EnergyCo

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Waste management and circular economy study

New England Regional Major Infrastructure Studies

December 2025

Acknowledgement of Country

The Energy Corporation of New South Wales acknowledges that it stands on Aboriginal land. We acknowledge the Traditional Custodians of the land and we show our respect for Elders past and present through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.

Published by Energy Corporation of New South Wales (EnergyCo).

energyco.nsw.gov.au

Document title: Waste management and circular economy study

First published: December 2025

Cover image: Armidale, NSW.

ISBN: 978-1-76058-942-4

Introduction

Renewable energy zones (REZs) are a critical part of our plan to provide affordable, clean and reliable energy for NSW.

Walcha

A secure energy future for everyone in NSW

Five REZs have been identified so far which will help keep the lights on as coal-fired power stations retire.

Regional communities play a vital role in hosting the power lines and renewables we need. We are committed to working with communities to minimise impacts and maximise the benefits of this investment in our regions. REZs will contribute to the growth, prosperity of regional communities through jobs, training, investment and funding for local projects.

Investigating priority areas for the New England REZ

EnergyCo is leading the delivery of the REZs to ensure long-term energy security for NSW. We are working closely with a range of stakeholders to coordinate investment and provide long-term benefits to communities who are hosting new energy projects.

EnergyCo has been investigating how potential impacts will be managed in the New England REZ. This work includes a program of engagement with local councils, government agencies and other key stakeholders to understand local issues.

In 2024, we commissioned a series of studies to understand the potential constraints and challenges caused by concurrent development in the region, as well opportunities that could be used to support renewable energy development. The studies aim to provide a point-in-time analysis of the potential impacts of REZ development along with other major infrastructure projects in the region.

We will use this information, along with local feedback, to develop the REZ in a way that supports growth and sustainable demand for skills, services and infrastructure across the region in the years to come.

Community, council and key stakeholder input will help us to focus efforts where they are needed.

Purpose of this document

This document provides the waste management and circular economy study developed by MRA Consulting Group. The study aims to identify existing baseline capacity for waste management and recycling in the New England REZ. It also identifies potential opportunities to support REZ delivery in a proportionate and appropriate way which also meets the needs of local councils and communities.

Study development and limitations

Information contained in the study is based on knowledge and understanding at the time of its development. For this reason, it may not accurately represent local conditions at the time of reading.

The study provides a point-in-time analysis based on available data, proposed developments and the delivery timeframes for the New England REZ as of November 2024. The study does not predict future developments or changes in policy and should not be interpreted as a predictive or exhaustive assessment of all cumulative impacts over time.

Information has been sourced from EnergyCo, councils, government agencies, industry stakeholders, related third parties and/or as available in the public domain at the time of writing, coupled with research and industry knowledge of the study consultants. The passage of time, manifestation of latent conditions or impacts of future events may require further examination and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed within the study.

The study should not be interpreted as specific advice or relied upon in lieu of appropriate professional advice.

Project lists

Inclusion of projects or infrastructure in the study does not imply endorsement, approval or funding commitment by any government agency or private entity. Decisions about development approvals and infrastructure investments will be subject to separate statutory and policy processes.

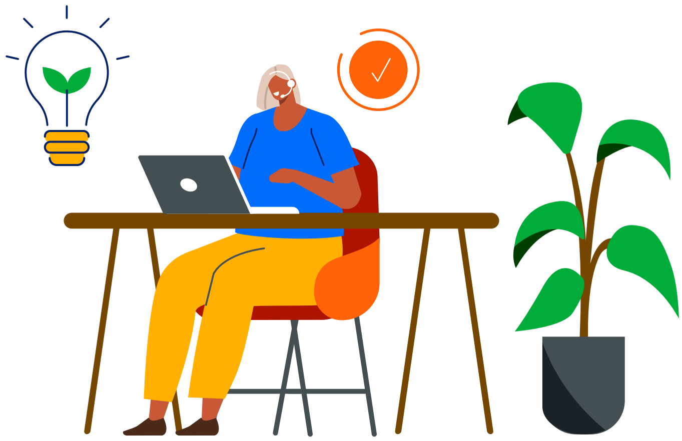
Scenarios outlined in the study include renewable energy projects and non-renewable energy projects at various stages of the project development lifecycle (pre-planning, planning, construction and operation). Major projects, state significant development, state significant infrastructure and critical state significant infrastructure have been considered.

The number and configuration of renewable energy projects within the New England REZ may change and will be influenced by factors such as generation availability and network connection capacity.

The modelling undertaken for this study is based on the proposed projects identified at the time of writing and may exceed what can feasibly be realised due to factors such as generation availability and transmission capacity within the REZ network infrastructure. The scenarios used are sufficient to support the study's key findings, addressing the challenges and opportunities associated with the REZ. Subsequent studies (if undertaken) may build on this as more information becomes available. This methodology was used so that the full extent of potential impacts was presented in the study, allowing NSW Government to plan for a higher impact to communities. Some sections of the study are redacted due to confidential information provided by renewable energy developers or other key stakeholders. While this data was used in modelling, its removal does not affect the overall findings.

Opportunities

The study has identified opportunities to address potential cumulative impacts. The study does not represent a list of commitments or set of guaranteed actions to be implemented. EnergyCo will share the studies with community, councils and key stakeholders for feedback to help us identify and prioritise a list of potential opportunities to investigate further. We will then work with councils, renewable energy developers, other government agencies and key stakeholders to develop the opportunities into initiatives which provide legacy benefits for the region.



New England REZ network infrastructure corridor changes

In October 2025, EnergyCo announced that the corridor of the New England network infrastructure project is to be changed between Bayswater Power Station near Muswellbrook and the energy hub near Walcha. More information on this change is available at: energyco.nsw.gov.au/nerez

What the corridor updates mean for the studies

The studies provide a baseline understanding of the region and consider a point-in-time analysis of the potential challenges and opportunities from major infrastructure development in the region. These insights, together with community feedback, will help develop the REZ as a whole to best support growth, meet the future demand for skills, services, and infrastructure across the region, and provide legacy outcomes. As no new council areas are impacted by the revised corridor and due to the regional nature of the studies, the baseline information provided by the studies is largely unaffected. There may be changes in the timing of peak construction periods which will be determined by changes to the New England REZ network infrastructure project, and any changes renewable energy projects make to their programs.

A key part of the next phase will be for EnergyCo to monitor the status of projects as they continue to develop and refine the understanding of the potential cumulative impacts from development in the region. Further investigations will be carried out as part of the development of the REZ to capture these changes and respond to the identified impacts.

We will continue to work closely with community and stakeholders, including councils, to understand the areas that matter most to local communities. We are also continuing to work closely with renewable energy developers to identify opportunities and strategies to manage potential impacts from development in the region over time.

What the corridor updates mean for the waste management and circular economy study

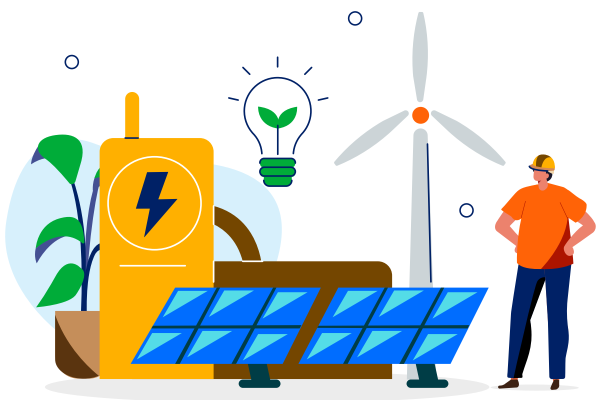
The New England REZ network infrastructure project forms one part of the expected waste generation, along with renewable energy and non-renewable projects. While the contribution of non-renewable and renewable energy projects to the waste volumes remains unchanged, the waste estimates from the revised corridor may be different. EnergyCo anticipates that the revised corridor will reduce waste generation from the New England REZ network infrastructure project due to flatter terrain and reduced vegetation clearing. Based on the regional nature of the modelling and the approaches used in the study, the key findings and opportunities identified are still relevant to the revised corridor.

Acknowledgements

The study has been developed with assistance from a range of key stakeholders providing their input, expertise and local insights. EnergyCo thanks all those individuals and organisations who have participated in the development of this Waste management and circular economy study.

For more information

If you have any questions about the contents of this document, please get in touch with our team on 1800 061 114 (toll free) or by emailing nerez@energyco.nsw.gov.au. For more information about the New England REZ visit our website at energyco.nsw.gov.au/nerez.



NSW GOVERNMENT

New England Renewable Energy Zone Waste Management and Circular Economy Study

A Study for EnergyCo NSW

21 July 2025

MRA Consulting Group

New England Renewable Energy Zone Waste Management and Circular Economy Study

A Study for the Energy Corporation of NSW (EnergyCo NSW)

ABN 13 495 767 706

Prepared by

Mike Ritchie & Associates Pty Ltd
trading as MRA Consulting Group
ABN 13 143 273 812

Suite 408 Henry Lawson Building
19 Roseby Street
Drummoyne NSW 2047

+61 2 8541 6169
info@mraconsulting.com.au
mraconsulting.com.au

Version History

Ver	Date	Status	Author	Approver	Signature
0.1	29/11/2024	Draft 1	MRA	[redacted]	[redacted]
0.2	21/02/2025	Draft 2	MRA	[redacted]	[redacted]
1	29/04/2025	Final	MRA	[redacted]	[redacted]
2	20/06/2025	Final	MRA	[redacted]	[redacted]
3	21/07/2025	Final	MRA	[redacted]	[redacted]

Disclaimer

In the spirit of reconciliation MRA Consulting Group acknowledges the Traditional Custodians of Country throughout Australia and their connection to land, sea and community. We pay our respects to Aboriginal and Torres Strait Islander peoples and to Elders past, present and emerging.

Executive Summary

This New England Renewable Energy Zone (NE REZ) Waste Management and Circular Economy Study was commissioned by the Energy Corporation of NSW (EnergyCo) to assess the cumulative impacts of concurrent renewable energy and other major infrastructure developments on waste management systems and circular economy outcomes within the NE REZ and associated transmission corridor.

The NE REZ, a key initiative under NSWs' renewable energy transition strategy, is projected to deliver up to 8 GW of new generation capacity by 2043. This will involve significant construction, operation, and eventual decommissioning of renewable energy assets including solar farms, wind farms, battery energy storage systems (BESS), pumped hydro energy storage (PHES), and transmission infrastructure.

To support informed planning and coordination, the study adopted a structured, evidence-based approach:

- **Project Identification:** Over 100 renewable and non-renewable infrastructure projects were identified and classified based on project type, size, delivery stage, and likelihood of proceeding.
- **Existing Infrastructure Mapping:** A spatial analysis of 60 existing waste facilities across 10 local government areas (LGAs) was conducted, assessing facility types, capacities, and geographic coverage relative to project locations.
- **Scenario and Sensitivity Modelling:** Waste generation was modelled across three development scenarios, accounting for baseline conditions, project progression uncertainties, and sensitivity factors.
- **Stakeholder Engagement:** Broad consultation was undertaken with councils, government agencies, renewable energy proponents (Generation Design Partners), and industry organisations, to refine assumptions, validate findings, and identify opportunities.

This comprehensive approach ensured the study reflects the practical realities of the region and the dynamic nature of REZ delivery.

Key findings of the study include:

- Total waste generation will increase significantly, driven primarily by general waste and construction and demolition (C&D) waste associated with site development, roadworks, infrastructure installation, and ancillary activities.
- Renewable energy-specific waste streams (such as solar panels, wind turbine blades, and batteries) will contribute a smaller proportion of total waste but present significant management challenges due to their complexity and recycling requirements.
- Existing waste management infrastructure is constrained, with many landfills nearing or exceeding their licensed capacity and limited facilities capable of managing specialised or hazardous waste streams.
- Spatial and logistical challenges are significant, with many renewable energy projects located far from suitable waste facilities, increasing haulage distances, transport costs, and operational inefficiencies.
- Capability gaps exist for managing emerging waste streams, including composite materials, electronic waste, large infrastructure components, and organics.
- Decommissioning of renewable energy assets will generate substantial volumes of bulky and complex waste, particularly from wind turbine blades, solar panels, and BESS units, requiring early planning for specialised recovery and disposal pathways.
- Local government capacity constraints, including staffing, funding, equipment, and expertise limitations, will restrict the ability to effectively manage increased waste volumes without strategic support and coordination.

- Circular economy practices are currently limited, but there is a strong opportunity to improve material reuse, remanufacturing, and resource recovery outcomes across construction, operation, and decommissioning phases.
- Without intervention, valuable materials risk being lost to landfill, undermining economic opportunities and environmental goals. Proactive circular economy initiatives, including reverse logistics and industry stewardship schemes, will be critical.

In response to these findings, the study identifies eleven strategic opportunities to enhance waste management and circular economy outcomes:

1. Waste Advisory Service - Establish a specialist service to support councils and proponents in navigating waste planning and compliance.
2. Standardised Waste Management Plans - Develop templates to ensure consistency in project waste management practices.
3. New England REZ Waste Management Framework - Create a framework to guide waste minimisation, resource recovery, and responsible disposal across projects.
4. Centralised Waste Facility Database - Develop a dynamic database to improve visibility of available waste infrastructure.
5. Pre-Approved Waste Service Agreements - Facilitate streamlined access to waste services through pre-arranged agreements.
6. Waste and Circular Economy Grants Advisory Service - Support stakeholders in identifying and applying for funding opportunities.
7. New England REZ Waste Working Group - Form a working group to coordinate planning, advocacy, and implementation across the region.
8. Streamlined Approvals for Waste Infrastructure - Advocate for faster planning approvals for critical waste facilities.
9. Circular Economy and Reverse Logistics Initiatives - Promote design for reuse, material recovery, and shared logistics networks.
10. Monitoring and Reporting Mechanisms - Establish systems to track waste generation, resource recovery, and circular economy performance.
11. Coordinated Decommissioning Plans - Plan for end-of-life management of renewable energy infrastructure, ensuring recovery and recycling pathways are maximised.

The study concludes that early, coordinated action is critical to ensure that the NE REZ delivers not only clean, reliable energy but also sustainable and resilient waste management outcomes.

Embedding circular economy principles from project inception, investing in infrastructure upgrades, supporting local government capacity, and fostering industry collaboration will be essential to mitigating risks, enhancing resource efficiency, and maximising long-term community and environmental benefits.

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Glossary

Terminology	Definition
Baseline	The reference point used to model existing waste generation and infrastructure capacity, prior to additional project development.
Battery Energy Storage System (BESS)	A system for storing and discharging energy, comprising buildings, containers, or other infrastructure connected to energy hubs.
Circular Economy	An economic model focused on designing out waste, keeping materials in use for as long as possible, and regenerating natural systems.
Co-mingled Recycling	As defined in Clause 49 of Schedule 1 of the *Protection of the Environment Operations Act 1997* (POEO Act) as “general solid waste (non-putrescible)”. It is generally a mix of different recyclable materials collected together in a single container. This typically includes: • Paper and cardboard (newspapers, magazines, office paper, junk mail) • Glass bottles and jars • Beverage cans and aluminium containers • Food cans and other steel or tin containers • Rigid plastic containers (bottles, tubs, containers marked with recycling symbols 1-7)
Construction and Demolition (C&D) Waste	Waste generated from the construction, renovation, and demolition of buildings and infrastructure, including concrete, timber, metal, and packaging materials.
Department of Planning, Housing and Industry (DPHI)	NSW Government agency responsible for assessing and approving State Significant Infrastructure projects.
Electricity Infrastructure Investment Act 2020 (EII Act)	Legislation governing the establishment and delivery of Renewable Energy Zones in NSW, including the role of EnergyCo.
Energy Hub	A substation or switching station where energy from renewable projects is aggregated and transmitted to the grid.
EnergyCo	Energy Corporation of New South Wales constituted by section 7 of the *Energy and Utilities Administration Act 1987* as the NSW Government statutory authority responsible for the delivery of NSW’s Renewable Energy Zones. EnergyCo, a NSW Government statutory authority established under the EII Act, is responsible for leading the delivery of the REZs as part of the NSW Government’s Electricity Infrastructure Roadmap (the Roadmap). As the Infrastructure Planner, EnergyCo is responsible for delivering the REZ’s, EnergyCo’s role is to lead the development, coordination and delivery of the REZs in a way that benefits consumers, investors, and regional communities.
Environmental Impact Statement (EIS)	A document assessing environmental, social, and economic impacts of major infrastructure projects, required for planning approval.
Extended Producer Responsibility (EPR)	A policy approach that holds manufacturers accountable for the end-of-life management of their products.
Food Organics Garden Organics (FOGO)	A combined organic waste stream including food waste and garden waste suitable for composting.

Terminology	Definition
Generation Design Partners (GDPs)	Proponents of renewable energy projects participating in design and planning processes, consulted as stakeholders for this study.
Gigawatt (GW)	A unit of power equal to one billion watts.
Kilovolt (kV)	A unit of electric potential equal to 1,000 volts.
Landfill	A site for the controlled disposal of waste by burial, licensed and regulated to manage environmental impacts such as leachate and emissions.
Local Government Area (LGA)	A defined administrative region governed by a local council.
Materials Recovery Facility (MRF)	A specialised facility where recyclable materials are sorted, processed, and prepared for resale and reuse in manufacturing.
Megawatt (MW)	A unit of power equal to one million watts.
MRA Consulting Group (MRA)	The author of this study.
Municipal Solid Waste (MSW)	General household waste, including putrescible (organic) and non-putrescible (dry) waste.
New England Renewable Energy Zone (NE REZ)	REZ declared in the New England region which is intended to group new renewable energy generation projects and network infrastructure to deliver 6 GW of network capacity by 2033 and an additional 2 GW by 2043. A geographic area of approximately 15,500 km^2 centred by Armidale and Guyra, extending west to Bendemeer, east between Walcha and Yarrowitch, to Nowendoc in the south and Deepwater in the north.
NSW	New South Wales
NSW Environment Protection Authority (EPA)	The primary environmental regulator for New South Wales, responsible for overseeing waste management, pollution control, and environmental protection under the POEO Act and other legislation.
Organics	Organic waste material, including food waste, garden waste, and other biodegradable materials suitable for composting or processing.
Organics Processing	The treatment of organic waste to create compost, mulch, or energy products.
POEO Act (Protection of the Environment Operations Act 1997)	Primary NSW legislation regulating environmental protection, including waste management operations.
Project Corridor	A corridor, generally 250 m wide and wider at energy hub locations, that encompasses the Project's transmission line and energy hub infrastructure. The EIS Project Design and all associated ground disturbance is located within the Project corridor. The Project corridor is used to assess the potential impact to environmental features and engagement with affected landowners during the EIS phase of works to arrive as an indicative construction / as the disturbance footprint is likely to evolve with design development.

Terminology	Definition
Pumped Hydro Energy Storage (PHES)	A type of renewable energy storage system that uses two water reservoirs at different elevations to store and generate electricity by moving water between the reservoirs, typically to provide grid stability and firming services.
Renewable Energy Zone (REZ)	A geographic area with high-quality variable renewable energy resources (such as wind and solar), suitable topography and land use designations for development, and demonstrated interest from project developers. Renewable Energy Zones are identified and declared by the NSW Government.
Resource Recovery	The process of extracting valuable materials or energy from waste streams through recycling, reuse, or other methods.
Reverse Logistics	The process of moving products and materials backward through the supply chain for reuse, remanufacturing, recycling, or disposal.
Scenario Analysis	A modelling approach that examines different potential futures based on varying assumptions about project delivery and waste generation.
Sensitivity Testing	An analysis technique used to understand how variations in key assumptions affect modelling outcomes.
The Project	The NE REZ Network Infrastructure Project consisting of new 500 kV and 330 kV transmission lines and related infrastructure, that would allow renewable energy generators and storage projects in the New England REZ to connect to the existing transmission network in the Upper Hunter region of NSW.
The Study	This *New England Renewable Energy Zone Waste Management and Circular Economy Study*
Transfer Station	A facility where waste is temporarily deposited and consolidated before being transported to a final disposal or recycling facility.
Upper Limit Estimate	A projection that represents the maximum plausible waste volumes under worst-case delivery and project assumptions.
Virgin Excavated Natural Material (VENM)	Natural material such as soil, clay, or rock excavated from the ground that is uncontaminated and suitable for reuse.
WARR Report	The NSW EPA's Local Government Waste and Resource Recovery Data Report, providing key waste generation and management data.

1 Introduction

1.1 Context

MRA Consulting Group (MRA) was engaged by EnergyCo to provide insights into the cumulative waste management and circular economy impacts and opportunities in the New England Renewable Energy Zone (NE REZ), and in the vicinity of the NE REZ Network Infrastructure Project corridor, stemming from concurrent development in the region. This Waste Management and Circular Economy Study (the study) aims to develop an overview of current and expected changes in waste generation, storage and management, reuse and recovery across the development and energisation stages of the NE REZ.

1.2 Background

1.2.1 NE REZ Project Description

The NE REZ is a key initiative under the NSW Government's renewable energy transition strategy, designed to replace the generation capacity of retiring coal-fired power stations. NSW currently relies on coal for approximately 75% of its electricity supply and two-thirds of its firming capacity. With four of the state's five coal-fired power stations scheduled for closure within the next 15 years, beginning with the Liddell Power Station in 2023, the NSW Government has prioritised investment in clean, reliable, and affordable renewable energy infrastructure.

The NE REZ was formally declared on 17 December 2021 under the *Electricity Infrastructure Investment Act, 2020* (EII Act), marking a critical step in securing long-term energy stability. EnergyCo, as the designated Infrastructure Planner under the EII Act, is responsible for overseeing the planning, design, and coordination of the NE REZ Network Infrastructure Project (the Project) which will provide the transmission infrastructure needed to support the NE REZ.

The NE REZ will integrate multiple renewable energy generation and storage projects developed by private investment with supporting transmission infrastructure, creating a modern, decentralised electricity network. The NE REZ benefits from NSW's strong solar and wind resources and aims to attract large-scale investment in solar farms, wind farms, battery energy storage systems (BESS), and pumped hydro energy storage (PHES).

1.2.2 NE REZ Network Infrastructure Project

To enable the efficient transmission and distribution of renewable energy, EnergyCo is developing a comprehensive network infrastructure plan, including the Project, which will deliver:

- High-voltage transmission lines and substations to connect renewable energy projects to the grid.
- New energy hubs (substations and switching stations) to support power distribution.
- Transmission network augmentations to increase capacity as demand grows.
- Road upgrades and supporting infrastructure to facilitate construction and long-term maintenance.

The network infrastructure will link the NE REZ to existing energy corridors, such as the Sydney Ring, enabling efficient transmission of renewable energy to key load centres across NSW.

At the time of writing this study, EnergyCo was in development phase of planning for the NE REZ.

The Project will be delivered in two stages as illustrated in Figure 1.

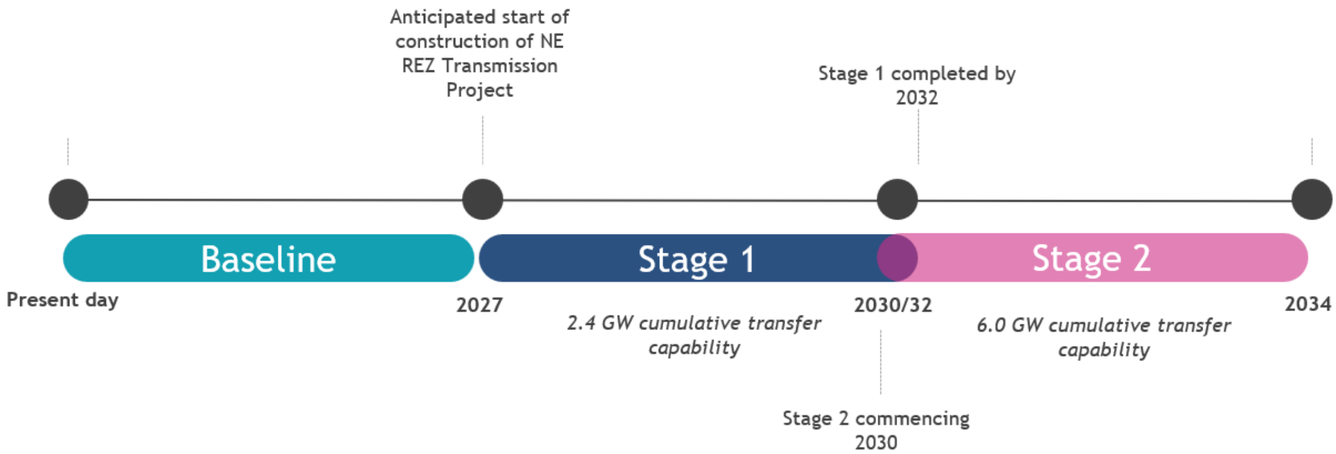


Figure 1: Project Delivery Stages (Source: AEMO ISP)

1.2.3 Overarching policies

The NE REZ is a cornerstone of NSW's transition to net-zero emissions, aligning with key government policies and commitments, including:

- *NSW Net Zero Plan*, *Stage 1 2020 – 2030* (Department of Planning, Industry and Environment, 2022), which aims to reduce emissions across all sectors.
- *National Waste Policy Action Plan* (Australian Government, 2019*),* which sets a target of reducing waste generation per capita by 10% and achieving an 80% recovery rate from all waste streams by 2030.
- *NSW Circular Economy Policy Statement* (EPA, 2019), which outlines circular economy initiatives, which promote the reuse and recovery of materials across infrastructure projects.

By addressing waste and circular economy challenges at the planning and development stages, this study supports long-term sustainability outcomes for the NE REZ and broader NSW electricity infrastructure.

1.3 Purpose of this study

The purpose of this study is to provide a **point-in-time analysis** based on the best available data to assess cumulative impacts of additional waste volumes on existing waste infrastructure arising from the construction, operation, and decommissioning of renewable energy and other major infrastructure projects within and immediately surrounding the NE REZ and in the vicinity of the Project corridor.

The analysis has the following primary objectives:

1. To assist in developing coordinated strategies for waste generation, avoidance, minimisation, management, and disposal during the construction and delivery of projects in the NE REZ. The study aims to identify strategic opportunities for risk reduction, long-term benefits, sustainable waste management and circular economy solutions with local industry and communities.
2. To outline the potential shift in waste generation, and the impacts on local communities and the environment caused by concurrent development of projects, identifying innovation priorities and opportunities for economic growth, circularity and transition to meet future market needs.
3. To provide a thorough understanding of the potential waste generation and management requirements associated with the renewable energy infrastructure in the REZ, identify opportunities to reduce resource risk and pressures on resilience, such as availability of resource and price volatility arising from concurrent development in the region.
4. To summarise challenges and opportunities in managing changes in waste demand and advancing circularity and sustainable development.

5. To identify and coordinate resource integration opportunities with local industries and communities, enhancing resilience and reducing pressures from concurrent development in the region.
6. To summarise the likely cumulative impacts of construction, operation, maintenance, and decommissioning of renewable energy projects and the Project with respect to waste management and circular economy, while identifying key challenges and opportunities.

This study is intended to support alignment among state and local governments and serve as a foundation for collaborative planning and risk mitigation. It aims to inform relevant state and local agencies on the opportunities to manage waste and circular economy impacts across the delivery phases, align planning for services, and identify areas requiring further analysis.

1.4 Key data inputs

The key data inputs for this study are:

- EnergyCo's NE REZ Data and Assumptions Book, version 2.1;
- Information provided by Stakeholders;
- Waste Chapters of a variety of relevant project Environmental Impact Statement (EIS) documents sourced from the *NSW Major Projects Planning Portal*;
- NSW Environment Protection Authority's (EPA) Local Government Waste and Resource Recovery Data Report 2022–23 (WARR report).

1.5 Stakeholder consultation

To inform the development of this study, consultation was carried out with key stakeholders, including:

- **Renewable energy generation projects** – MRA, in conjunction with EnergyCo, consulted with proponents for large renewable generation projects to gain an understanding of the type and quantities of waste likely to be generated through construction and operation (directly or through the workforce accommodation) and what recycling / waste minimisation efforts have been undertaken on previous projects.
- **Local Councils** – MRA, in conjunction with EnergyCo, consulted with relevant local councils within the study area to determine the key issues and opportunities for the region relating to the waste to be generated from the development of the NE REZ.
  - A total of ten Local Government Areas (LGAs) across the region are intercepted by the NE REZ boundary and/or NE REZ Network Infrastructure Project, with the nature and extent of impacts varying depending on whether they host renewable energy projects, transmission infrastructure, or both. Table 2 categorises the affected LGAs based on their role in hosting developments. Some LGAs will accommodate new renewable energy generation projects, others will primarily host key transmission infrastructure to support energy distribution (see Figure 2), and several will be affected by both, highlighting their significance in the broader energy transition. It is also noted that some renewable energy projects connecting into other networks may be located within these LGAs.
  - The Northern Councils are situated within the declared NE REZ boundary and are expected to be the primary hosts of renewable generation projects. Consequently, these councils will experience higher renewable project densities and greater waste management demands during construction, operation, and eventual decommissioning.
  - The Southern Councils, while located outside the formal NE REZ boundary, are positioned along the Project's transmission corridor. These councils will primarily be impacted by the construction of transmission infrastructure. Although hosting fewer NE REZ renewable projects directly, they will still face waste and resource management pressures associated with transmission line works, workforce accommodation, and associated infrastructure. Additionally, several Southern LGAs fall within the influence

area of the Hunter-Central Coast REZ and may experience cumulative impacts from multiple REZ developments, particularly in relation to waste transport, infrastructure demand, and service capacity.

- **NSW EPA –** MRA met with the EPA to discuss the risks and limitations of the key opportunities.
- **Smart Energy Council –** MRA met with the peak body for solar, storage and smart energy industries in Australia to discuss key topics that affect the industry, such as:
  - Solar Panel Lifecycle & Waste
  - Decline of Second-Hand Solar Panel Market
  - Challenges with Second-Hand Panel Testing & Oversupply
  - Early Retirement & Recycling Growth
  - Solar Panel Recycling in Australia
  - Future of Solar Panel Stewardship
  - Wind Turbines & Recycling Challenges
  - Battery Recycling
- **Regional Joint Organisations** – MRA met with the Hunter Joint Organisation and the Northern Inland Regional Waste groups which represent the waste management interests of groups of affected councils.

Further details of stakeholder consultation is provided in Section 5.

Table 1: LGAs affected by NE REZ and Project

LGA	LGA Group	Hosts NE REZ projects	Hosts Project	Overall Affected LGA
Armidale	Northern	✓	✓	✓
Glen Innes	Northern	✓	✗	✓
Inverell	Northern	✓	✗	✓
Liverpool Plains Shire	Southern	✗	✓	✓
Muswellbrook Shire	Southern	✗	✓	✓
Tamworth	Northern	✓	✓	✓
Tenterfield Shire	Northern	✓	✗	✓
Upper Hunter	Southern	✗	✓	✓
Uralla	Northern	✓	✓	✓
Walcha	Northern	✓	✓	✓

1.6 Study Area

The Study Area is graphically presented in Figure 2 and includes:

- The NE REZ boundary – covering all planned renewable energy generation projects.
- The NE REZ Project corridor – encompassing new and upgraded transmission infrastructure.
- The LGAs impacted by associated development, including road infrastructure, temporary workforce accommodation, and supporting industrial activities.

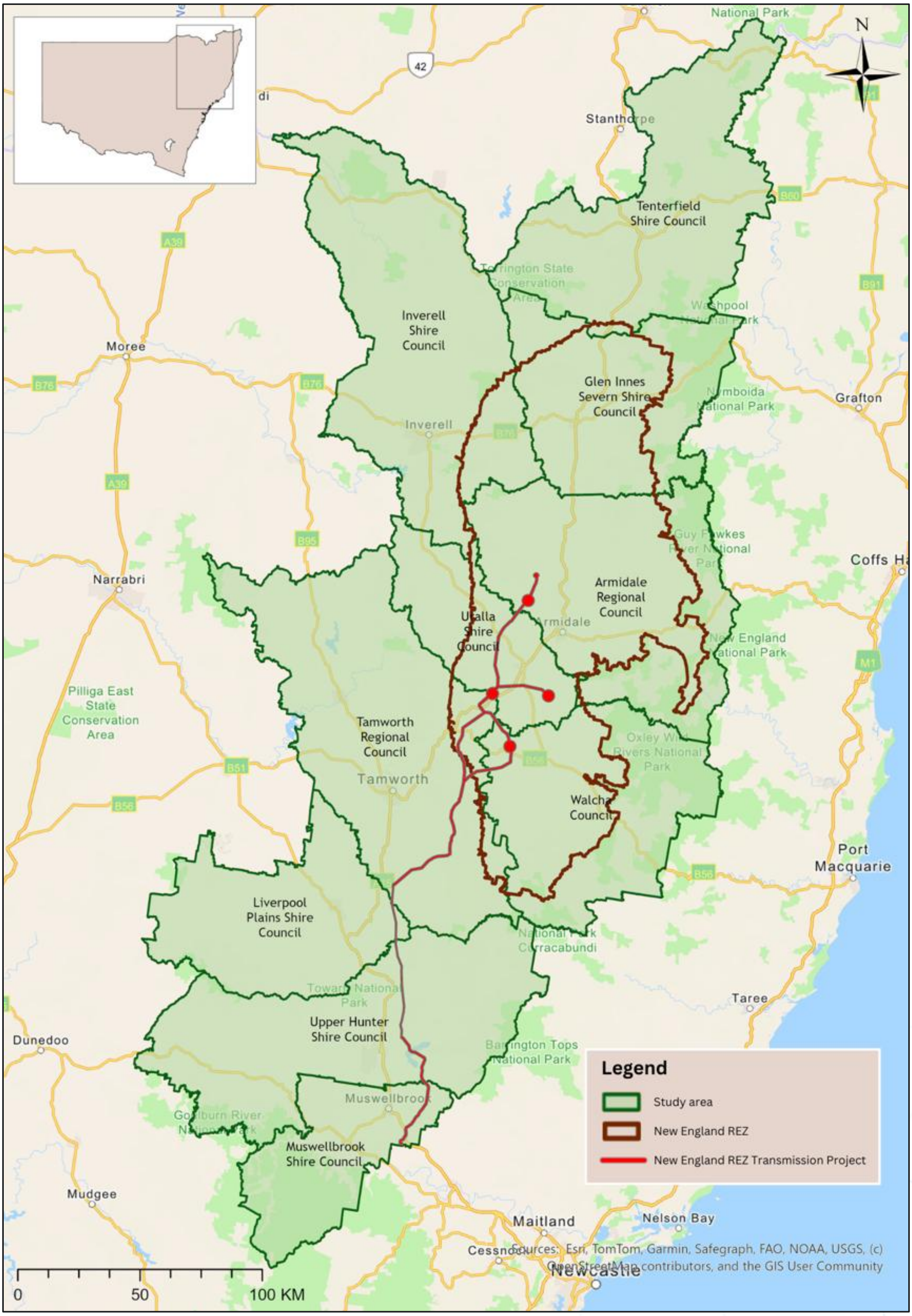


Figure 2: Map of Study Area

1.7 Study structure

The study has been structured as per Table 2 below.

Table 2: Study Structure

Study Section	Description
Section 1	Introduction
Section 2	Study Approach
Section 3	Project Classification and Scope
Section 4	Existing Waste Infrastructure Analysis
Section 5	Summary of Stakeholder Consultation
Section 6	Waste Generation
Section 7	Waste Quantity Projections
Section 8	Waste Management and Maintenance Plans
Section 9	Recycling and Waste Minimisation
Section 10	Planning Considerations
Section 11	Legislative and Policy Overview
Section 12	Funding Considerations
Section 13	Key Findings
Section 14	Opportunities
Section 15	Employment Opportunities and Legacy Outcomes
Section 16	References

1.8 Study reliance and limitations

This study has been prepared by MRA for EnergyCo. MRA does not accept responsibility for any use of, or reliance on, the contents of this document by any third party.

Information contained in this study is based on knowledge and understanding at the time of writing (April 2025) and is subject to change. The waste estimates presented are based on a 'point in time' and the delivery timeframes for the NE REZ Project as of November 2024 when the analytical framework was established for this study. MRA derived the data in this report from information sourced from EnergyCo, related third parties and/or available in the public domain at the time, coupled with MRA's research and industry knowledge. The passage of time, manifestation of latent conditions or impacts of future events may require further examination and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this study. The data in this study should not be construed as specific advice or relied upon in lieu of appropriate professional advice.

1.9 AEMO date change

The waste estimates presented in this study are based on the delivery timeframes for the Project as of November 2024 when the analytical framework was established for the study.

These timeframes are as follows:

- Stage 1 completion by July 2031, and
- Stage 2 by January 2033.

In December 2024, the Australian Energy Market Operator (AEMO) released revised delivery timeframes for the Project as follows:

- Stage 1 completion by July 2032, and
- Stage 2 by January 2034

The revised delivery timeframes differ from the timeframes used in this study by 12 months.

Assuming the whole portfolio of development included in the analysis presented in this study occurs 12 months later, the waste estimates presented herein would also likely occur 12 months later. However, this does not account for changes in timing of individual projects or sub-components of the portfolio.

Readers should also keep in mind that it is only the Project energisation delivery dates that have been revised. Non-renewable and other projects outside the scope of the Project may be delayed and / or brought forward independently. Such changes would have implications on the timing of waste volumes to be managed.

2 Study approach

To support effective planning, infrastructure development, and circular economy outcomes across the NE REZ and Project corridor, this study was developed using a structured, evidence-based approach. The methodology involved identifying project activities, assessing existing waste management capacity, projecting future waste volumes, and evaluating system-wide opportunities. Scenario analysis and stakeholder engagement were incorporated to ensure the projections reflect real-world conditions and to inform targeted waste and resource recovery strategies. This section outlines the overarching process undertaken to deliver the study and set the foundation for the findings presented in subsequent sections.

1. Project Identification
    a. Collated and verified the list of renewable and non-renewable infrastructure projects located within the Study Area, including their type, scale, delivery stages, and likelihood of proceeding.
    b. Categorised projects according to delivery stage (construction, operation, decommissioning) and waste generation characteristics.
2. Existing Waste Infrastructure Assessment
    a. Identified and mapped existing waste management facilities within the Study Area.
    b. Assessed facility attributes such as waste acceptance types, capacity, geographic coverage, and proximity to major project sites.
3. Waste Generation Forecasting
    a. Estimated the types and quantities of waste generated across the lifecycle stages of each project type (e.g., construction waste, operational waste, decommissioning waste).
    b. Conducted targeted stakeholder engagement and desktop research to refine assumptions around waste generation rates and material composition.
4. Spatial and Temporal Mapping of Waste Estimates
    a. Allocated projected waste volumes to specific LGAs based on project locations and anticipated project timelines.
    b. Partitioned data by waste stream, project type, and delivery stage to enable granular analysis.
5. Scenario Analysis
    a. Developed three distinct waste generation scenarios to reflect different project progressions and impacts:
    b. Applied sensitivity testing within Scenarios 2 and 3 to model likelihood and scale of project delivery.
    c. Incorporated a combined baseline, non-renewable, and renewable projection to illustrate cumulative impacts across the Study Area.
6. Analysis of Scenario Results
    a. Evaluated projected waste generation profiles across LGAs, time periods, and waste types.
7. Circular Economy and Waste Management Opportunities
    a. Analysed the results of the waste generation modelling to identify practical opportunities to enhance circularity, minimise waste generation, and improve resource recovery across the NE REZ and NE REZ Project corridor.
    b. Developed a set of specific, actionable opportunities for consideration.
8. Development of Supporting Guidance and Analysis

a. Developed additional supporting analysis and collateral to inform broader waste management and circular economy outcomes in the Study Area, including:
b. Planning Considerations
c. Funding Considerations
d. Employment Opportunities and Legacy Outcomes
e. Recycling and Waste Minimisation Strategies
f. Legislative and Policy Overview
g. Waste Management and Maintenance Plans

3 Project Classification and Scope

3.1 Development in the NE REZ

Development of the NE REZ will include wind, solar, BESS, PHES and transmission projects. The staged delivery of these renewable energy projects over the next decade has been determined and used as a basis to estimate volumes of wastes that will be generated.

While it is noted that the exact number and configuration of renewable energy projects within the NE REZ is subject to change, this study uses a point-in-time analysis to determine the potential volumes of waste that will be generated by the NE REZ development, along with population change and other concurrent development in the region.

3.2 Project identification

Details of the renewable energy and non-renewable projects anticipated to be developed within the NE REZ and Project corridor during each of the Project delivery stages was sourced from *EnergyCo's NE REZ Data and Assumptions Book*, version 2.1 (dated 21/11/2024) ("the Data and Assumptions Book").

The Data and Assumptions Book has been compiled using a number of data sources, including:

1. Proposed renewable generation and storage projects within the NE REZ planned to connect to the NE REZ network.
2. Proposed NE REZ or Priority Transmission Infrastructure Projects under development by EnergyCo.
3. Major energy projects (renewable and non-renewable) listed on the NSW Planning Portal (includes projects in planning, construction and operation).
4. Non-energy projects listed on the NSW Planning Portal (includes projects in planning, construction and operation).
5. Expressions of Interest (EOI) from the Hunter-Central Coast Renewable Energy Zone (HCC REZ GDP EOI).

To inform the development of this study, only projects classified as 'relevant' have been assessed. Whether a project was considered relevant was determined by the authors of the Data and Assumptions Book, and was based on the following criteria:

- Project type
- Project location
- Project status
- Project size and significance
- Project likelihood (based on objective criteria).

Projects classified as 'relevant' were then carried forward into the waste projection modelling stage conducted by MRA. In total, 100 projects were classified as relevant. Each project's construction duration, start/end dates, and operational timeline were sourced directly from the Data and Assumptions Book. The "likelihood to proceed" classification (low, medium, or high) was determined based on:

- Project approvals and planning pathway
- Secured or potential funding
- Development progress and proponent commitments. This classification helped refine waste generation forecasts across the Baseline, Stage 1, and Stage 2.

A high level list of the relevant projects is provided in Table 3, while the full list of relevant projects is provided in Appendix C. A map of the locations of the projects is provided in Figure 3.

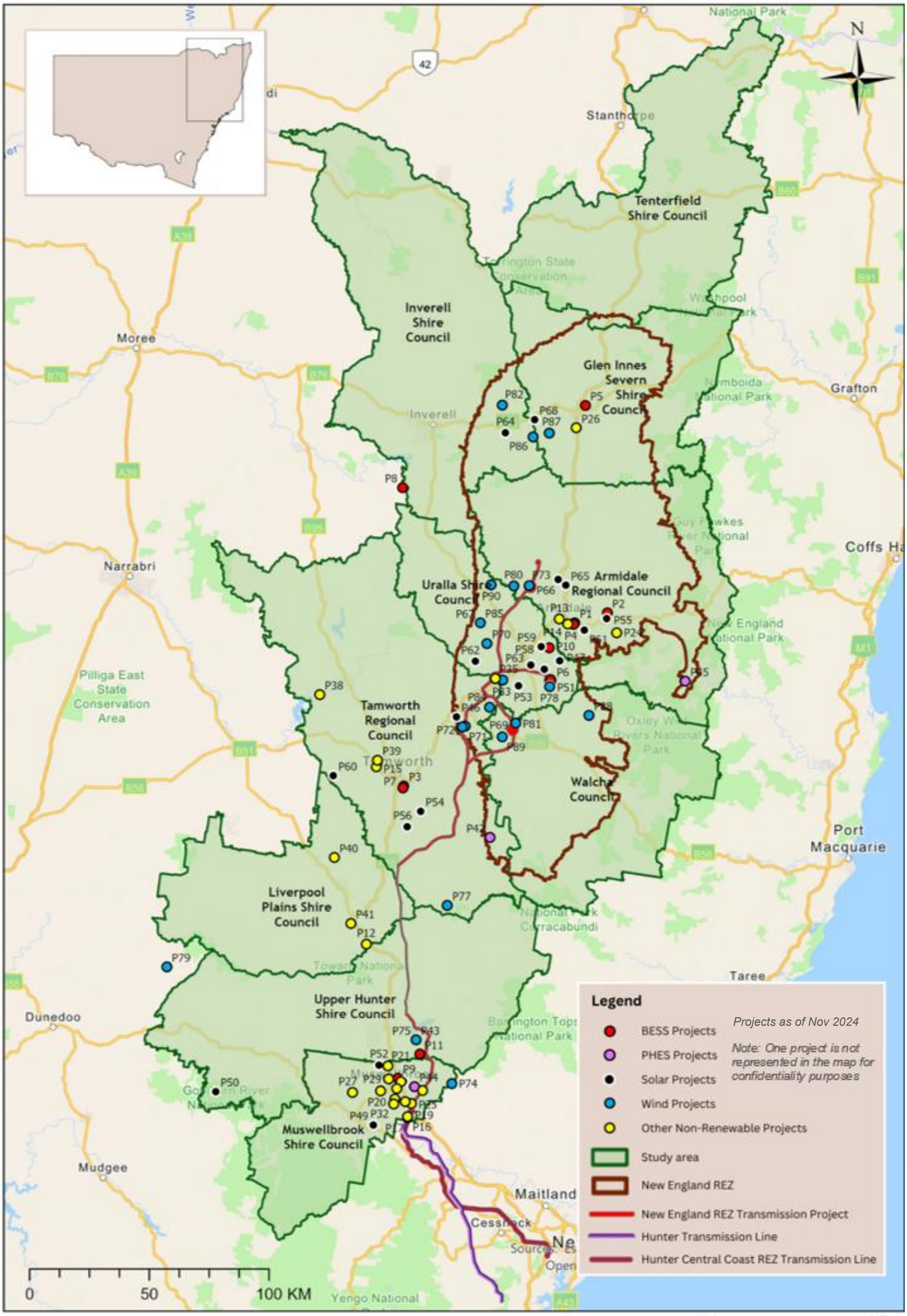


Figure 3: Map showing location of relevant projects within the Study Area

Table 3: Summary of anticipated projects within the NE REZ and Project boundary

Planning pathway	# prjs	Planning pathway	# prjs
Renewable		**State Significant Development**	
Solar	25	Coal & Coal Mining	18
Wind	23	Education	2
Pumped Hydro (PHES)	5	Electricity Generation – other	2
Battery (BESS)	11	Extractive industries	2
		Food, beverage, and tobacco manufacturing	3
		Gas pipeline	1
		Roads	3
		Waste collection, treatment and disposal	1
		Transmission	4

4 Existing Waste Infrastructure Analysis

4.1 LGA waste storage and processing infrastructure

The operational waste management facilities in each of the LGAs hosting the NE REZ or the Project are described in the following sections. This was determined through consultation with the relevant Councils, a desktop review of waste facilities in the Study Area, and a search of the NSW Environmental Protection Agency (NSW EPA) Environment Protection Licences (EPLs) database.

4.1.1 Armidale Regional Council

Armidale Regional Council (ARC) operates the Armidale Waste Management Facility (AWMF), a modern, co-located site that includes the Armidale Regional Landfill, Community Recycling Centre (CRC), recycling drop-off, second-hand goods shop, Container Deposit Scheme (CDS) facility, and organics processing. The landfill has a licensed capacity of 15,000 tonnes per annum (tpa) and a projected lifespan of 50 years (total void capacity of ~1 million tonnes). However, with population growth projections and discussions with neighbouring councils about diverting waste to Armidale, the facility is already nearing capacity. To address this, ARC is working through EPL and planning modifications to expand the landfill's capacity to 25,000 tpa.

The region is serviced by six waste transfer stations located in Armidale, Guyra, Ebor, Hillgrove, Wollomombi, and Lower Creek. These facilities support resource recovery by encouraging waste separation, with mixed or contaminated loads incurring higher fees. The Guyra Waste Transfer Station is a key facility, designed to maximise recycling and reuse. The Council's waste management strategy is also supported by the City to Soil program, which facilitates kerbside Food Organics Garden Organics (FOGO) collection and composting.

The commercial sector is serviced through a weekly waste collection program, with businesses able to access general waste, FOGO, and recycling services at scheduled fees. While ARC has prioritised waste diversion and resource recovery, hazardous waste disposal is limited, with asbestos requiring pre-booked disposal at AWMF and other hazardous materials transported to external processing facilities.

Key challenges for the region include landfill capacity constraints, a lack of a Material Recovery Facility (MRF), and limited hazardous waste processing. Without an increase in landfill capacity, future population growth and additional regional waste intake could accelerate landfill depletion. Further investment in waste sorting incentives, expanded organics processing, and a regional strategy for hazardous waste management could improve long-term waste sustainability in the LGA.

4.1.2 Glen Innes Severn Council

Glen Innes Severn Council operates four waste facilities located in Glen Innes, Emmaville, Deepwater, and Red Range. The Glen Innes Waste Facility serves as the primary waste management site for the LGA and is the only landfill that accepts tyres, mattresses, and asbestos. It also houses the area's MRF, which processes kerbside recyclables, and a CRC for household problem wastes such as gas bottles, paints, batteries, motor oils, smoke detectors, and fluorescent tubes.

The landfill has an EPL permitting a maximum of 4,000 tpa of waste disposal, including general solid waste (both putrescible and non-putrescible), asbestos, and waste tyres. However, the site currently receives approximately 3,000 tpa, with minimal to no available capacity to accommodate additional waste from external sources. The three smaller waste facilities at Emmaville, Deepwater, and Red Range operate as transfer stations, consolidating waste for disposal at Glen Innes, further constraining the landfill's long-term capacity.

Storage limits also apply to certain waste types. The facility may not store more than 50 tonnes or 5,000 waste tyres at any one time. Similarly, the total quantity of contaminated soil stored onsite is restricted to 1,000m^3 at any given time.

Council provides kerbside collection services for general waste and recycling, with recyclables transported to the MRF at the Glen Innes Waste Facility for sorting. Strict waste separation is enforced at all facilities, and a buy-back shop operates onsite, reselling reusable items recovered from the waste stream. No information is available on landfill expansion plans, meaning capacity constraints may become a pressing issue as waste volumes increase.

4.1.3 Inverell Shire Council

Inverell Shire Council operates a network of waste management facilities, with the Inverell Landfill serving as the principal waste disposal site. The landfill has been in operation since 1963 and is expected to continue serving the region until at least 2039. It is licensed to accept up to 40,000 tpa, including putrescible and non-putrescible waste, asbestos, garden waste, and waste tyres. Waste volumes are estimated at around 13,000 tpa. The landfill also provides designated areas for segregating green waste, concrete, scrap metal, timber, and various problem wastes, such as fluorescent tubes, printer cartridges, batteries, and waste oil.

Adjacent to the landfill is the Inverell MRF, which processes recyclables and operates as a social enterprise, providing employment and training for people with disabilities. The MRF is labour-intensive but has the capacity to process significantly more material than current volumes. The Inverell CRC, co-located at the landfill, serves as a drop-off point for hazardous and problem household wastes.

Beyond the main landfill, Inverell Shire operates several rural waste facilities, including transfer stations at Ashford, Delungra, Yetman, and Bonshaw, as well as a small landfill at Tingha. These facilities provide localised waste disposal and recycling options, with waste ultimately consolidated and transferred to the Inverell Landfill. Each transfer station operates on limited hours, and services vary by location.

Storage limits apply to specific waste types at the Inverell Landfill, including a maximum of 50 tonnes or 5,000 waste tyres and 1,000m^3 of contaminated soil at any given time. Given projected population growth and increasing waste volumes, future infrastructure upgrades may be required to ensure continued capacity and compliance with environmental regulations.

4.1.4 Liverpool Plains Shire Council

The Council operates seven landfills, one MRF, and two transfer stations. No additional waste or recycling infrastructure is planned for the Shire. The seven landfills are located at Quirindi, Werris Creek, Willow Tree, Pine Ridge, Caroona, Spring Ridge, and Premer, with the Willow Tree Landfill serving as the primary landfill for the Shire. A 2012 report projected that Quirindi Landfill would reach capacity by 2018. While this has not occurred, it highlights the impending closure of the site. The Werris Creek Landfill has a projected life of 11 years, while Willow Tree Landfill has an estimated lifespan of 36 years. The MRF is co-located at Quirindi, and the transfer stations are located at Blackville and Wallabadah.

The Council contracts out the collection of waste and the operation of several of its landfills to private contractors, while also managing the operation of some landfills internally. These facilities accept general waste, co-mingled recyclables, and various materials for long-term storage, including oil, soil, Virgin Excavated Natural Material (VENM), Construction and Demolition (C&D) waste, tyres, paint, scrap metal, household hazardous waste, and green waste. Materials are often stored long-term at each facility and transported for recycling once sufficient stockpiles have been accumulated to justify transportation and processing costs. Scrap metal and green waste are also stockpiled until they are ready for processing or recycling.

Quirindi Landfill currently accepts small amounts of asbestos (less than 15 tpa). None of the Council's landfills hold an EPL because they receive less than the threshold of 12,000 tpa, as stipulated by the *POEO Act*.

4.1.5 Muswellbrook Shire Council

Muswellbrook Shire Council (MSC) operates two waste management facilities: the Muswellbrook Waste & Recycling Facility (MWRF) and the Denman Waste Transfer Station (DWTS). The MWRF is the primary waste disposal site in the LGA, accepting a range of general, putrescible, and problem wastes. It also houses the CRC, which provides free drop-off services for household hazardous waste, including paints, oils, batteries, gas cylinders, e-waste, and fluorescent lamps. The End of the Road Reuse Shop, co-located at the site, promotes resource recovery by selling salvaged second-hand goods.

The MWRF has a landfill capacity of up to 50,000 tpa, covering general solid waste (putrescible and non-putrescible), asbestos, and tyres. The site also provides designated areas for the storage of hazardous and restricted solid waste, as well as limited liquid waste. Asbestos disposal is available by prior arrangement only.

The Denman Waste Transfer Station serves as a localised disposal point for small volumes of household waste, with restrictions on truckloads and commercial waste. The facility accepts mixed waste, green waste, recyclables, e-waste, scrap metal, whitegoods, and small quantities of tyres.

In 2024, MSC transitioned from a garden organics service to a full FOGO system, significantly increasing the diversion of organic waste from landfill. Initially, FOGO materials will be processed by an external contractor until a dedicated organics recycling facility is constructed at MWRF, ensuring long-term processing capacity for the LGA.

In 2025, MSC prohibited the disposal of solar panels at landfill, reinforcing a strong stance on responsible waste management for renewable energy infrastructure. This policy applies to both public and private landfill operators in the LGA, ensuring that solar panels are recycled, rehabilitated, or reused rather than landfilled.

While Muswellbrook currently has sufficient landfill and waste processing capacity, the transition to FOGO and evolving regulatory requirements may necessitate future investment in waste infrastructure to ensure long-term viability and compliance.

4.1.6 Tamworth Regional Council

Tamworth Regional Council (TRC) operates a network of 11 waste management facilities, including four landfills and seven waste transfer stations. The Forest Road Waste Management Centre (FRWMC) is the primary landfill for the region and has been in operation since 1973. It serves as the largest waste facility in the LGA, focusing on recycling and resource recovery, with approximately 50% of incoming waste diverted from landfill through recycling, reuse, and repurposing initiatives.

The Tamworth landfill, located at FRWMC, is licensed to accept up to 60,000 tpa of general solid waste (putrescible and non-putrescible), asbestos, waste tyres, and certain liquid waste. However, the storage of waste tyres is limited to 50 tonnes or 5,000 units at any one time. TRC also operates a CRC at FRWMC, offering free disposal of problem wastes, including gas bottles, fire extinguishers, vehicle batteries, household batteries, fluorescent tubes, e-waste, used motor oil, paint, smoke detectors, x-rays, and mobile phones.

Several landfills are being transitioned into transfer stations, with the Barraba and Manilla Landfills scheduled for closure and conversion in 2024/25. The waste transfer network includes facilities at Bendemeer, Dungowan, Duri, Kootingal, Niangala, Somerton, and Watsons Creek.

The Kootingal Transfer Station has specific licensing conditions, including

- Landfilling of general solid waste (putrescible and non-putrescible), asbestos waste, and waste tyres.
- The total quantity of waste disposed of at the premises must not exceed 5,000 tonnes per annum.

TRC currently operates a composting facility at FRWMC, processing 15,000 tpa of garden organics (GO) into mulch. However, food organics (FO) and commercial organic waste are currently being landfilled, as the existing facility has reached its maximum processing and storage capacity.

In 2024, TRC resolved to construct a new Organics Recycling Facility at Gidley Appleby Road, with an initial processing capacity of 35,000 tpa, capable of handling FOGO. The facility is designed to expand to 50,000 tpa as demand increases. Construction is scheduled to commence by September 2025, with operations expected to begin in early 2027.

TRC is also participating in the Curby Soft Plastics Recycling Trial, enabling residents to recycle soft plastics from home, reducing landfill reliance and establishing a long-term processing pathway for flexible plastics.

TRC provides metal recycling services through Matthews Metal Management, which operates a scrap metal depot in Tamworth. This ensures that metals such as steel, aluminium, and copper are recovered and diverted from landfill.

TRC also participates in the DrumMUSTER program, providing a drop-off service for triple-rinsed rural chemical containers. This service is available year-round at the following sites:

- Tamworth Landfill
- Barraba Landfill
- Manilla Landfill
- Nundle Landfill.

While Tamworth has significant landfill and processing capacity, continued investment will be required to expand organic waste processing, improve recycling rates, and manage future waste volumes driven by population and industry growth. The planned Organics Recycling Facility will play a critical role in reducing landfill reliance and increasing diversion rates, supporting the region's long-term waste management strategy.

4.1.7 Tenterfield Shire Council

Tenterfield Shire Council (TSC) operates a network of waste facilities, including one operational landfill at Boonoo Boonoo and multiple Waste Transfer Stations (WTSs) across the LGA. Waste management services include weekly kerbside collection for Tenterfield, Urbenville, and Jennings, weekly commercial waste collection, and trade waste skip bin services. The Boonoo Boonoo Landfill is the only active landfill in the Shire, accepting general solid waste (putrescible and non-putrescible), asbestos waste, and tyres. It has a licensed capacity of 20,000 tpa but is closed to the public, requiring prior approval from Council for access. Due to its limited lifespan, Council is planning for its closure and are investigating the feasibility of reopening the Sunnyside Loop Road Transfer Station as a long-term alternative to landfill disposal.

TSC operates six transfer stations, which only accept household waste. Commercial waste, construction waste, and timber must be transported to Boonoo Boonoo Landfill by appointment only. The main WTS at Tenterfield accepts recyclables, household hazardous waste and general household waste. Other WTSs at Drake, Urbenville, Legume, Liston, and Torrington provide waste consolidation services. Waste from these sites is transported to Boonoo Boonoo for disposal, highlighting the limited waste processing capacity within the Shire.

TSC is actively seeking alternatives to landfill expansion, focusing on transfer-based waste management. The planned reopening of Sunnyside Loop Road WTS will extend the lifespan of existing waste infrastructure by consolidating disposal at regional facilities. While short-term landfill extensions at Boonoo Boonoo will maintain disposal capacity, long-term planning for regional waste transport and processing solutions is critical to ensuring sustainable waste management in the Shire.

4.1.8 Upper Hunter Shire Council

The Council operates a network of waste facilities, including the Scone Waste Management Facility (WMF), the Murrurundi Transfer Station, the Aberdeen Resource Recovery Facility, the Merriwa Transfer Station, and the Cassilis Transfer Station. The Scone WMF, which includes a landfill and a CRC, accepts a variety of waste types and serves as the primary waste management site within the Shire.

Asbestos disposal is available exclusively at the Aberdeen Resource Recovery Facility and is not accepted at Scone, Merriwa, Murrurundi, or Cassilis.

The Merriwa and Murrurundi landfills have reached capacity and have been closed, with both sites now operating as transfer stations. Landfill closure plans for these sites are currently in development. Preliminary plans have been prepared to improve the Scone WMF, and a feasibility study is underway to evaluate the potential expansion of the Aberdeen Resource Recovery Facility.

All facilities within the Shire hold EPLs and accept general solid waste. A wide range of waste types are consolidated and bulked for recycling, including scrap metal, lead-acid batteries, garden organics, tyres, e-waste, gas bottles, fluorescent lights, motor oil, paint, mattresses, cardboard, and paper. Recycling shops operate at each landfill, supporting resource recovery and reuse initiatives.

4.1.9 Uralla Shire Council

Uralla Shire Council (USC) operates four waste management facilities across the LGA, located in Uralla, Bundarra, Kingstown, and Kentucky. The Uralla Waste Management Facility (UWMF) serves as the primary waste disposal site, accepting general solid waste (putrescible and non-putrescible), asbestos, and waste tyres, with a licensed capacity of 3,000 tpa. However, the landfill has reached its capacity limit, with less than three years of remaining operational life. USC is actively exploring disposal options with neighbouring councils to address long-term waste management needs.

Asbestos disposal is available by prior booking, and the facility holds EPA approval for emergency waste disposal. The UWMF also operates a CRC, providing free drop-off for household hazardous waste, including paints, oils, gas bottles, chemicals, e-waste, white goods, and batteries. A dedicated green waste collection area is available, with residents able to opt into a kerbside green waste service within Uralla township.

The Bundarra, Kingstown, and Kentucky Waste Management Facilities function primarily as transfer stations, consolidating waste for transport to Uralla. Bundarra accepts general household waste, green waste, metals, glass, cardboard, waste oil, and batteries. Kingstown processes recyclables and general waste. The Kentucky facility is primarily a recycling station, accepting paper, cardboard, glass, hard plastics, and metals.

USC provides a kerbside recycling service via yellow-lid bins, complementing drop-off recycling services at waste facilities. With the Uralla landfill nearing capacity, the council’s waste management strategy will require a shift towards expanded transfer-based solutions or regional partnerships to ensure ongoing disposal capacity and sustainable waste management across the LGA.

4.1.10 Walcha Council

Walcha Council operates a waste management network comprising a landfill and two waste transfer facilities located at Woolbrook and Nowendoc. Access to the transfer facilities is restricted to residents and only household waste is accepted. Commercial waste must be transported to a registered waste facility.

The Walcha Waste Depot serves as the primary waste disposal site for the LGA. This landfill is gated, with certain waste types incurring disposal fees. The site also hosts a CRC, offering free drop-off for household problem waste such as paints, gas bottles, motor oils, batteries, smoke detectors, and fluorescent tubes. Walcha provides a weekly kerbside collection service for both general waste and recyclables.

While the landfill has an estimated 40 years of remaining capacity based on current domestic usage, it does not have the capacity to accept significant volumes of commercial and industrial (C&I) or construction and demolition (C&D) waste from the NE REZ. Future planning may require regional waste partnerships or transfer-based solutions to manage increasing waste demands beyond household waste.

4.2 Analysis of existing waste storage and processing infrastructure

Effective waste management across the Study Area depends not only on the availability of infrastructure, but also on its accessibility, capability, and alignment with the types and volumes of waste generated by NE REZ projects. A combination of licensed and unlicensed facilities currently service predominantly municipal and limited commercial waste streams, with varying suitability for large-scale infrastructure project waste.

A total of 60 facilities were identified in the Study Area, comprising:

- **12 standalone licensed landfills**, accepting general solid waste (putrescible and non-putrescible), asbestos, tyres, and in some cases, contaminated soils;
- **6 licensed multi-facility sites**, combining landfill, organics processing, and/or MRF;
- **1 organics-only processing facility** (under development);
- **41 transfer stations**, which are primarily geared toward domestic waste and generally unsuitable for REZ-related commercial waste volumes or types.

The distribution of these facilities is shown in Figure 4, with project locations overlaid in Figure 5 to demonstrate spatial alignment.

While some landfills and processing centres are well positioned relative to the anticipated project locations, many are already operating at or near capacity. Others are restricted to domestic inputs, lack weighbridges or vehicle access for large trucks, or require pre-arranged commercial agreements. These constraints limit the ability of existing infrastructure to absorb significant volumes of construction, operation, or decommissioning waste without upgrades or coordination.

A high-level summary of these facilities is provided in Table 4, outlining their type and LGA. More detailed facility data, including capacity limitations, accessibility constraints, and utilisation rates are included in Appendix D.

Table 4: Summary of existing waste storage and processing infrastructure within the Study Area

Ref #	Facility Name	Type	LGA
W1	Armidale Waste Management Facility	Mutli facility	Armidale Regional
W2	Ebor Waste Transfer Station	Transfer station	Armidale Regional
W3	Guyra Recycling & Transfer Station	Transfer station	Armidale Regional
W4	Wollomombi Waste Transfer Station	Transfer station	Armidale Regional
W5	Deepwater Landfill	Transfer station	Glen Innes Severn
W6	Emmaville Landfill	Transfer station	Glen Innes Severn
W7	Glen Innes Waste Facility	Multi facility	Glen Innes Severn
W8	Red Range Landfill	Transfer station	Glen Innes Severn
W9	Ashford Rural Transfer Station	Transfer station	Inverell
W10	Bonshaw Rural Transfer Station	Transfer station	Inverell
W11	Inverell Waste Depot	Multi facility	Inverell
W12	Tingha Landfill	Landfill	Inverell
W13	Yetman Rural Transfer Station	Transfer station	Inverell
W14	Delungra Rural Transfer Station	Transfer station	Inverell
W15	Pine Ridge Landfill	Landfill	Liverpool Plains
W16	Quirindi Landfill	Multi facility	Liverpool Plains
W17	Caroona Transfer Station	Transfer station	Liverpool Plains
W18	Spring Ridge Transfer Station	Transfer station	Liverpool Plains
W19	Premer Trabsfer Station	Transfer station	Liverpool Plains
W20	Werris Creek Landfill	Landfill	Liverpool Plains
W21	Willow Tree Landfill	Landfill	Liverpool Plains
W22	Blackville Transfer Station	Transfer station	Liverpool Plains
W23	Wallabadah Transfer Station	Transfer station	Liverpool Plains
W24	Denman Transfer Station	Transfer station	Muswellbrook
W25	Muswellbrook Waste Management Facility	Multi facility	Muswellbrook
W26	Sims Muswellbrook	Transfer station	Muswellbrook
W27	Bendemeer Transfer Station	Transfer station	Tamworth Regional
W28	Barraba Transfer Station	Transfer station	Tamworth Regional
W29	Dungowan Transfer Station	Transfer station	Tamworth Regional
W30	Duri Transfer Station	Transfer station	Tamworth Regional
W31	Forest Road Waste Management Facility	Multi facility	Tamworth Regional
W32	Kootingal Transfer Station	Landfill	Tamworth Regional
W33	Manilla Landfill	Landfill	Tamworth Regional
W34	Niangala Transfer Station	Transfer station	Tamworth Regional
W35	Nundle Landfill	Landfill	Tamworth Regional
W36	Somerton Transfer Station	Transfer station	Tamworth Regional
W37	Watsons Creek Transfer Station	Transfer station	Tamworth Regional
W38	Organics Recycling Facility	Organics	Tamworth Regional
W39	Matthews Metal Management	Transfer station	Tamworth Regional
W40	Boonoo Boonoo Landfill	Landfill	Tenterfield
W41	Drake Transfer Station	Transfer station	Tenterfield

Ref #	Facility Name	Type	LGA
W42	Legume Transfer Station	Multi facility	Tenterfield
W43	Urbenville Transfer Station	Transfer station	Tenterfield
W44	Liston Transfer Station	Transfer station	Tenterfield
W45	Tenterfield Waste Transfer Station	Transfer station	Tenterfield
W46	Torrington Waste Transfer Station	Transfer station	Tenterfield
W47	Aberdeen Resource Recovery Facility	Landfill	Muswellbrook
W48	Cassilis Transfer Station	Transfer station	Upper Hunter Shire
W49	Merriwa Transfer Station	Transfer station	Upper Hunter Shire
W50	Murrurundi Transfer Station	Transfer station	Upper Hunter Shire
W51	Scone Waste Management Facility	Landfill	Upper Hunter Shire
W52	Kingstown Transfer Station	Transfer station	Uralla
W53	Kentucky Transfer Station	Transfer station	Uralla
W54	Bundarra Transfer Station	Transfer station	Uralla
W55	Uralla Waste Management Facility	Landfill	Uralla
W56	Nowendoc Waste Transfer Station	Transfer station	Walcha
W57	Walcha Community Recycling Centre	Landfill	Walcha
W58	Woolbrook Waste Transfer Station	Transfer station	Walcha

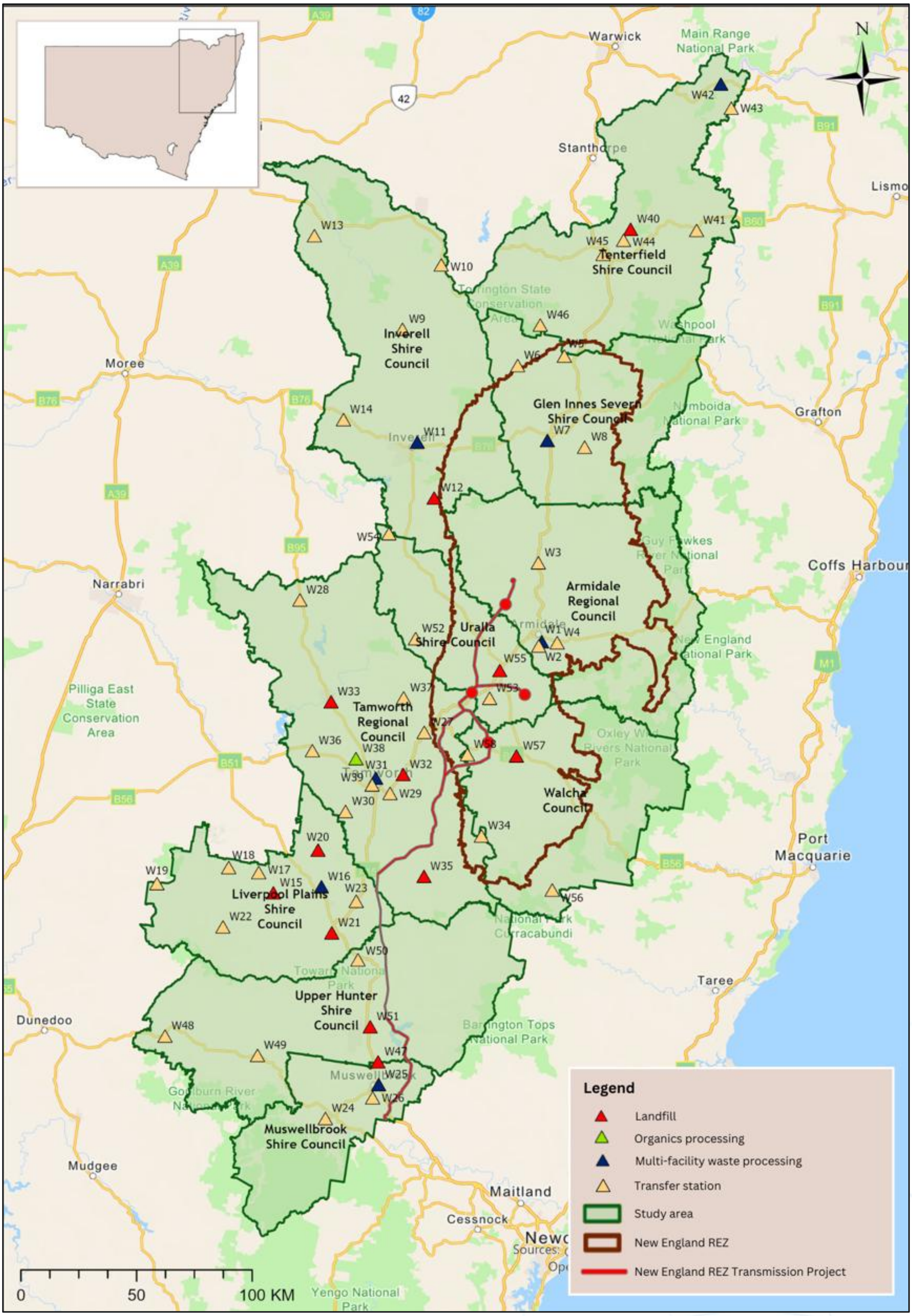


Figure 4: Distribution of all waste facilities within the Study Area

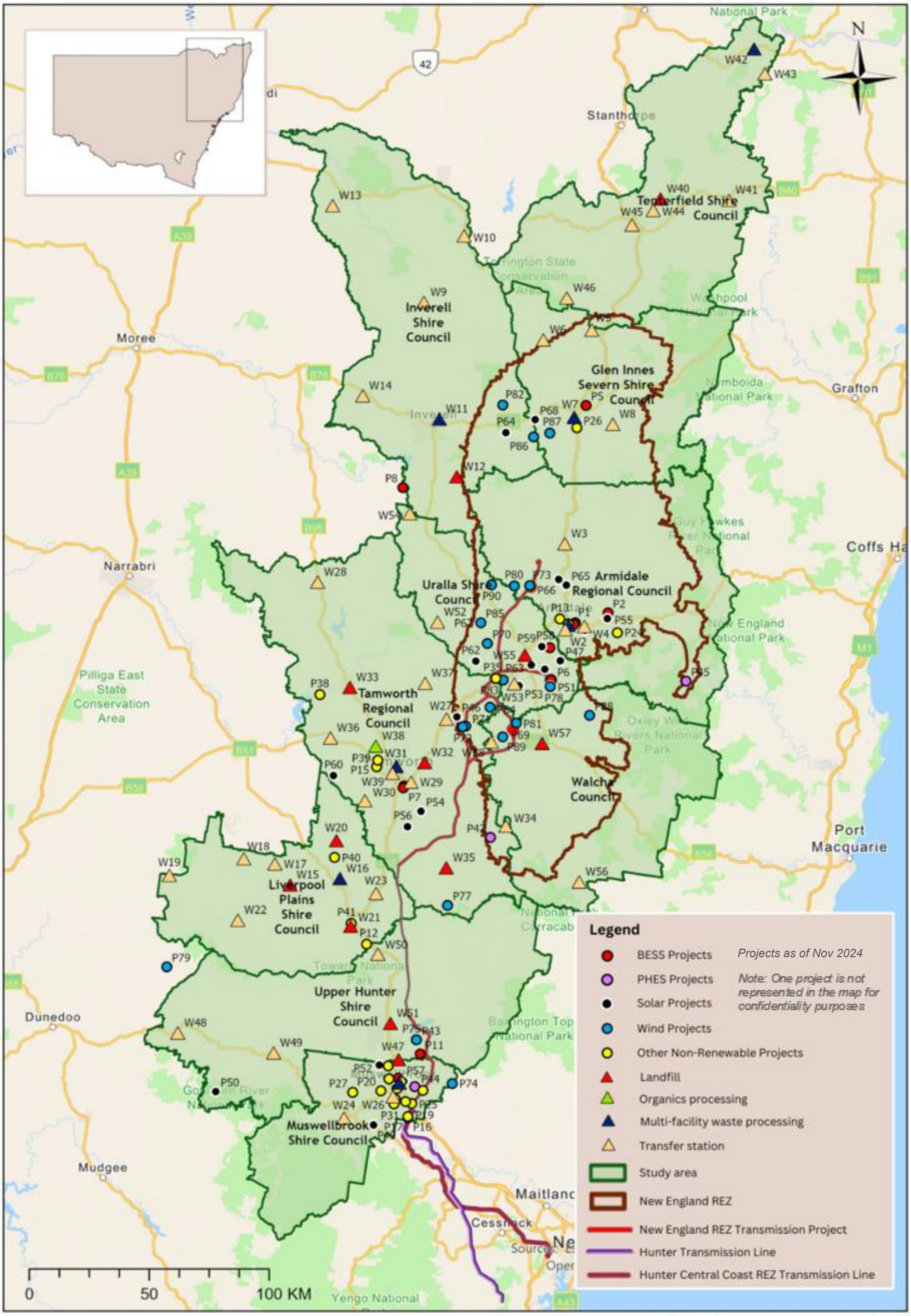


Figure 5: Distribution of all waste facilities and projects within the Study Area

4.2.1 Spatial Distribution and Access to Waste Infrastructure

To better understand proximity and potential access, a 35 km straight-line buffer was applied around each **relevant** facility in three sub-regional maps (north, central, and south). These are shown in Figure 6, Figure 7, and Figure 8. The buffer indicates areas likely to fall within feasible transport distance for waste haulage.

Relevant vs Non-Relevant Infrastructure

Facilities have been categorised based on their ability to receive commercial-scale project waste.

Relevant facilities include:

- Licensed landfills, which can accept general solid waste (putrescible and non-putrescible) and, in some cases, asbestos or other special waste streams.
- Multi-facility waste processing sites, which combine landfill functions with other services such as MRFs and organics processing.

Non-relevant facilities include:

- Transfer stations, which primarily serve residential users and typically lack the capacity, licensing, or vehicle access to manage REZ construction or operational waste.

While transfer stations are the most numerous facility type (41 of 60), they are not viable disposal options for REZ proponents without significant upgrades or reclassification.

Spatial Gaps and Coverage

The spatial analysis shows that many project sites do fall within 35 km of a relevant facility. However, coverage is uneven:

- The central corridor of the Study Area is better served by landfills and processing sites.
- The northern, eastern, and southern zones have fewer relevant facilities, creating spatial gaps.
- Relevant infrastructure is often clustered near population centres, whereas REZ projects tend to be located in remote areas.

This mismatch increases haulage distances and limits redundancy, affecting both cost and logistical efficiency. While buffer-based proximity provides a useful indicator of potential access, it does not account for capacity, licensing limitations, or other constraints explored in Section 4.2.3.

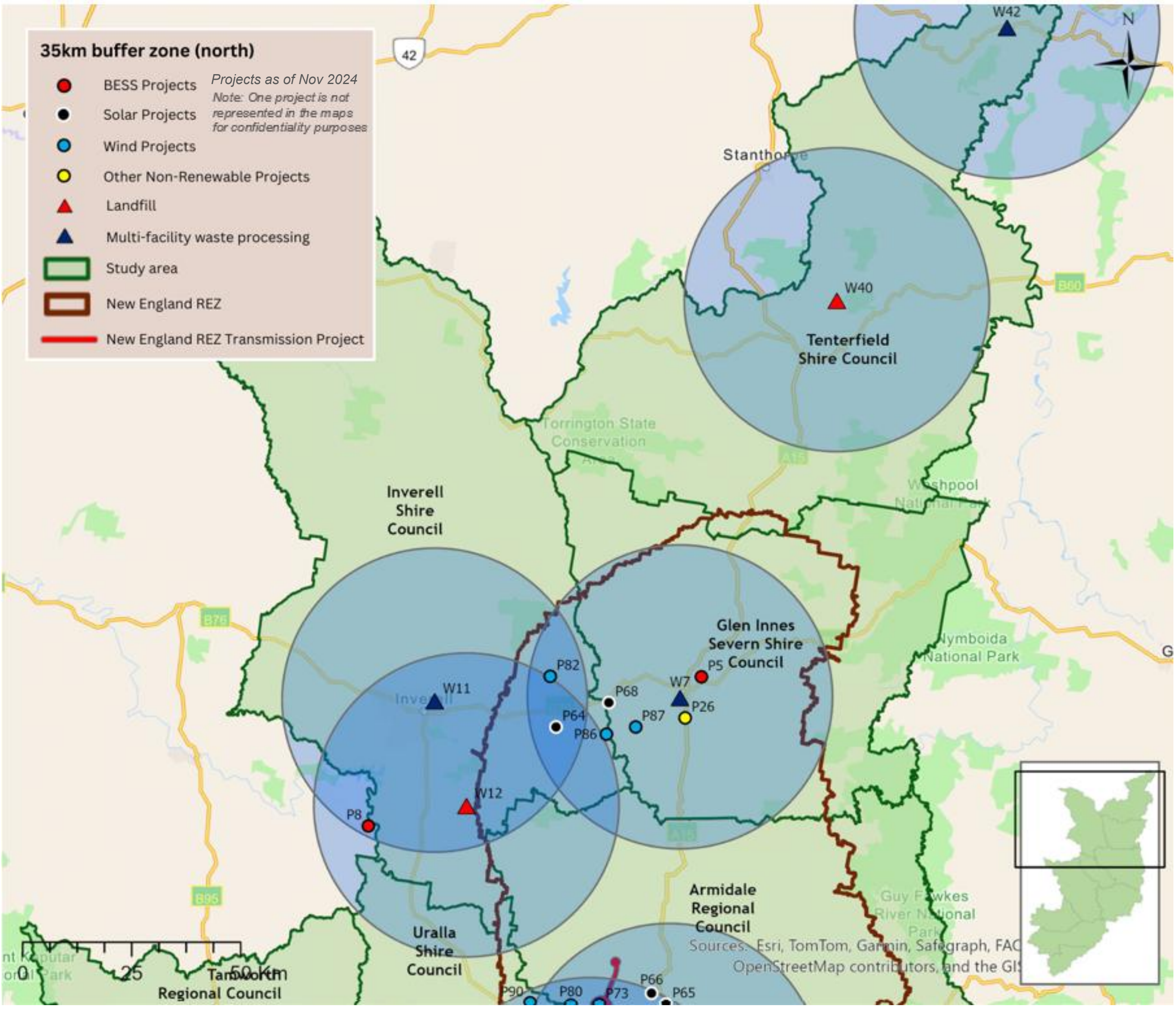


Figure 6: Northern Study Area – Waste Facility Coverage (35 km Buffer) and Project Locations

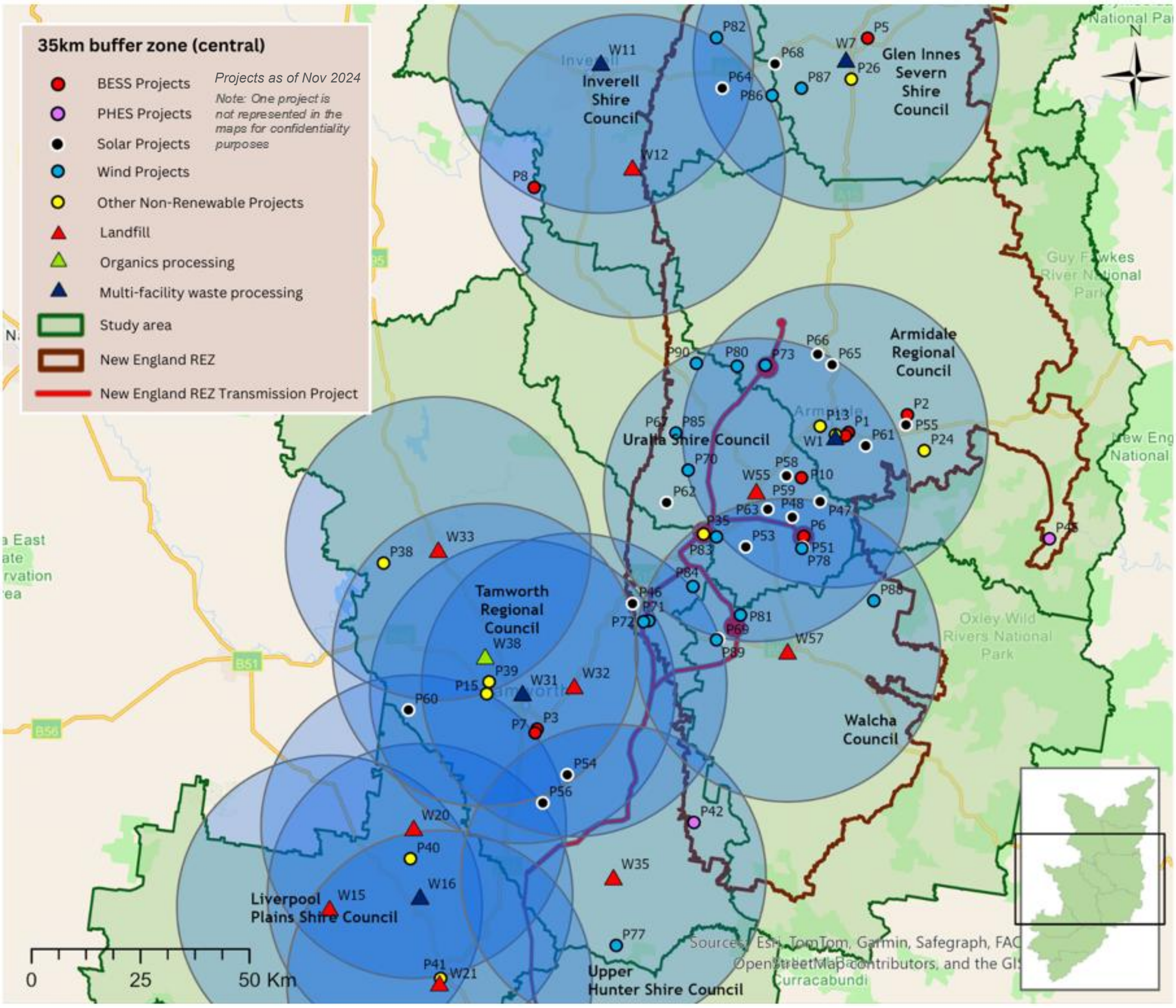


Figure 7: Central Study Area – Waste Facility Coverage (35 km Buffer) and Project Locations

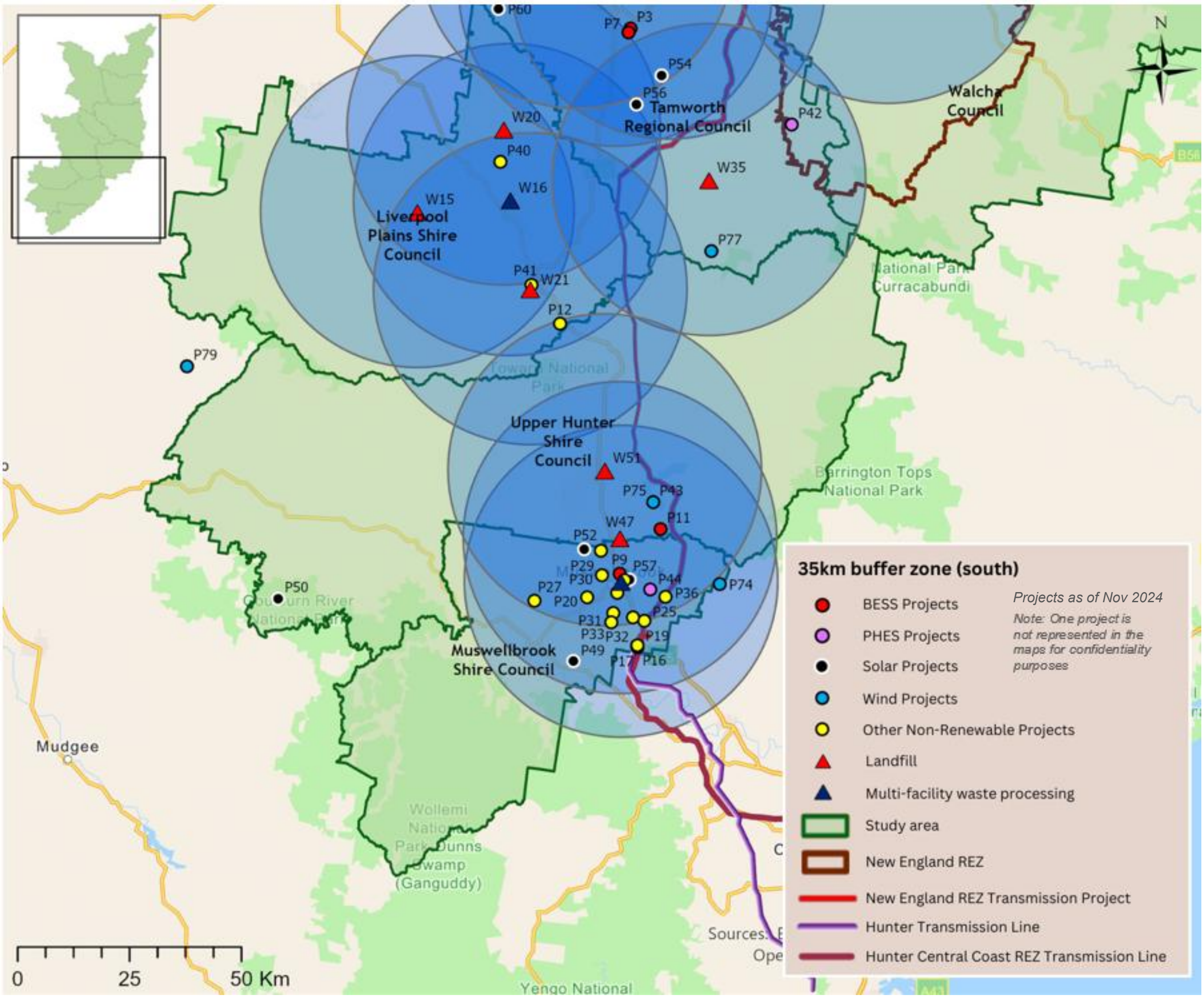


Figure 8: Southern Study Area – Waste Facility Coverage (35 km Buffer) and Project Locations

4.2.2 Spatial Challenges in Waste Management

Most existing waste infrastructure was designed to service households and businesses in regional towns and villages. In contrast, NE REZ projects are often located in isolated, sparsely populated areas, far from these established facilities.

This geographic disconnect presents a challenge for planning and delivering effective waste solutions. Waste transport logistics are particularly complex and costly. Under Section 143 of the *POEO Act*, both the waste owner and transporter must demonstrate that disposal occurred at an authorised facility.

Transporting waste over long distances significantly increases costs. The cost of operating a waste collection truck is estimated around $200 per hour, inclusive of all associated expenses (fuel, labour, maintenance, insurance, etc.). For a truck with a 30-tonne payload, this equates to $6.67 per tonne per hour of operation. Economic considerations drive waste generators to transport materials to facilities with lower gate fees. For example, if two disposal facilities have a $20 per tonne difference in gate fees, waste transporters may travel up to three additional hours to reach the cheaper site. This dynamic, illustrated in Figure 9, highlights how transport costs, combined with gate fee variations, influence waste management decisions.

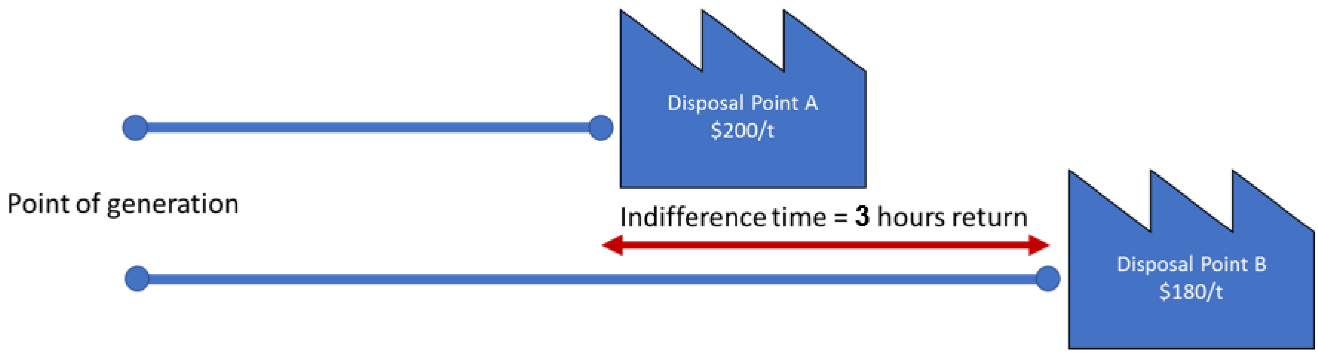


Figure 9: Illustration of Indifference Time

This geographical disconnect compounds the challenges of transporting waste and underscores the need for strategic planning to bridge the gap between remote development sites and waste infrastructure.

4.2.3 Capacity, capability and access limitations

While mapping shows moderate geographic alignment between projects and facilities, actual capacity and suitability vary considerably.

Capacity Constraints

Among the 18 relevant facilities (12 standalone landfills + 6 multi-facilities), many are already at or near their licensed throughput or physical capacity:

- **Northern region (Figure 6):**
    - Inverell Shire's landfill is the largest facility and is reportedly operating at just 32% of its licensed annual capacity. It is the region's primary facility and is expected to remain operational until 2039.
    - Tenterfield Shire's Boonoo Boonoo landfill is nearing the end of its life, and Council is actively investigating alternatives, primarily the transfer of waste out of the LGA.
    - Glen Innes Shire's landfill is relatively small and currently operating at around 75% of its licensed capacity, making it unlikely to accept significant additional volumes of waste.
- **Central region (Figure 7):**
    - Armidale Regional's landfill is operating at full capacity and currently services neighbouring LGAs. Plans are underway to increase its annual capacity by an additional 10,000 tpa.
    - Tamworth Regional operates four landfills, although two are slated for closure. Forest Road Landfill is the most significant in the central region, offering extensive infrastructure and processing capability. However, it will require strategic planning to manage efficiently. Tamworth also operates one of the region's only organics processing facilities and is currently constructing a new regional-scale facility.
    - Uralla Shire's only landfill is small and has reached its annual licensed capacity. The site is expected to close within three years.
    - Walcha Shire operates the smallest landfill in the central region. It has no remaining capacity to accept additional waste.
- **Southern region (Figure 8):**
    - Liverpool Plains Shire's primary landfill is located at Willow Tree. The six other landfills in the LGA are operating at or near capacity, with some expected to close in the near future.

- Muswellbrook Shire's landfill is one of the larger facilities in the southern region, offering greater capacity relative to neighbouring sites.
- Upper Hunter Shire operates two landfills, both of which are small and currently at capacity. Plans are underway to upgrade the Scone landfill to accommodate future demand.

These limitations reduce the system's resilience to peak waste loads during construction and decommissioning phases.

Capability Gaps

While most licensed landfills can accept general waste, few are equipped to manage:

- Hazardous or contaminated wastes from civil works and equipment.
- Organics in high volumes.
- Composite or electronic waste, such as solar panels, turbine blades, and batteries, which require specialist processing.

The Study Area lacks operational facilities for processing these more complex streams, and only one organics facility is currently being developed.

Accessibility and Commercial Viability

Many landfills require prior commercial agreements with councils to accept project waste. Others lack weighbridges, are restricted to small vehicles, or have limited hours and staffing. As a result, even proximate facilities may not be functionally accessible, requiring longer haulage distances and raising project costs.

5 Summary of Stakeholder Consultation

MRA engaged with key stakeholder groups (Table 5) with the following main objectives:

- To understand baseline conditions, as well as local and regional issues, opportunities, and constraints, to inform the development of this study.
- To identify strategic opportunities arising from the Project and concurrent activities, focusing on coordination, risk reduction, long-term benefits, and sustainable waste management and circular economy solutions with local industry and the community.

This study includes only the information directly relevant to the study. The full Stakeholder Consultation Plan is available in Appendix A.

Table 5: Key Stakeholder Groups

Key Stakeholders
1. EnergyCo (including NE REZ Integrated Project Team)
2. EnergyCo NE REZ Network Infrastructure Project Consultants
3. Third Party Stakeholders
a. Councils
b. Other third-party stakeholders
i. Regional Joint Organisations
ii. Government Authorities
iii. Key industry suppliers/service providers
iv. Generation Design Partners (GDPs)
v. Relevant industry groups

5.1 Generation Design Partners

Engagement with GDPs was undertaken to improve the accuracy of existing estimates and obtain new data on the types and quantities of waste and materials likely to be generated across the construction, operation, and decommissioning phases of solar farms (SF), wind farms (WF), pumped hydro energy storage systems (PHES), battery energy storage systems (BESS), and transmission networks, including workforce accommodation.

Six GDPs were identified for interview based on their proposed developments within the Study Area and their experience in planning and delivering renewable energy projects. The rationale for inclusion and participation of each GDP is summarised in Table 6.

Table 6: Rational for GDP Interviews Conducted

Generator	Rationale for Selection
ACE Power	Team with projects across Australia, with a focus on batteries and renewable energy in NSW.
ACEN Australia	Developer of the recently completed New England Solar Farm, with experience in renewable energy projects.
EDF (Hydro)	International company with experience in delivering PHES projects overseas.
Neoen	Known for expertise in batteries and international renewable energy projects.
Origin	Company with experience across a wide range of renewable energy projects.
Squadron Energy	Developer with a history of delivering renewable energy projects.

Interviews were conducted in October 2024 with four of the six selected GDPs. The two remaining GDPs, Neoen and Squadron Energy, were unavailable for interviews. The four interviewed GDPs represent a cross-section of the renewable energy sector, covering solar, wind, hydro, and battery storage projects.

The GDPs interviewed (ACE Power, ACEN Australia, EDF (Hydro), and Origin) provided valuable insights into waste management challenges and opportunities specific to their projects. The discussions focused on waste management practices, challenges, and circular economy initiatives, providing critical data for the study.

The key takeaways from these interviews are summarised in Table 7.

Table 7: Generation Design Partners Key Takeaways

Phase	Key Insights
Waste Management Plans (WMPs)	WMPs were generally not available as most projects were in early planning stages. Some generators were not required to make WMPs publicly available through consent conditions.
Construction Phase Wastes	Responsibility for management of these wastes is largely placed with construction contractors / development partners. Typical waste types identified included packaging materials (e.g., treated/untreated crates, plastics, cardboard, metals) and general construction wastes (e.g., concrete, bricks, wood, glass). Excavated materials (VENM/ENM) and vegetation from land clearing would be mostly reused on-site; surplus required off-site management. Damaged solar PV units and wind blades would be sent to landfill.
Operational Phase Wastes	Solar farms: Damaged front panels from hailstorms and regular mowing generate the most waste; failed PV units would be either sent to manufacturers or recyclers, or landfilled. PHES: Wastewater from equipment cooling/cleaning and periodic removal of sediment/debris from reservoirs. Maintenance wastes: Oils, lubricants, paints, wastewater, electronic waste, and packaging.

Phase	Key Insights
Decommissioning Phase Wastes	Metal recyclers and landfills were identified as the main disposal methods. Wind farms: Steel, aluminium, and copper would be recycled; plastic components and wind blades (comprising of fibre-reinforced plastics) would be sent to landfill, electronic waste would be separated for recycling, concrete foundations would either be left in place or demolished and recycling options sought for the concrete rubble. Solar farms: Limited commercial-scale recycling; aluminium frames could be recycled; toxic/hazardous components pose challenges. BESS: Batteries likely to require overseas recycling, given limited onshore options. PHES: Predominantly recyclable steel components; unlikely to be decommissioned.
Recycling Initiatives	Solar PV recycling at utility scale being explored. Cardboard size reduction for shipment to recycling facilities. Larger equipment components (e.g., steel and metals) deemed recyclable. Cost-efficiency and regulation significantly impact recycling decisions.
Circular Economy Initiatives	Potential reduction of plastic packaging (e.g., plastic film) for shipped equipment. Use of untreated/heat-treated crates to improve recycling/reuse options where uncontaminated with nails/metal from other timber/wood waste. On-site reuse of excavated materials and vegetation.
Lifespan and Equipment Replacement	Wind farms: 20–35 years, with modern warranties up to 30 years. Solar farms: 25–30 years. BESS: ~20 years, with batteries replaced below 60% charge capacity. PHES: Unlikely to be decommissioned; transformers may need replacement after 40 years.

A detailed summary of the interviews is provided in Appendix A.

5.2 Local Government Area

To understand the key issues and opportunities for LGAs related to managing waste generated by these projects, two workshops were conducted in collaboration with EnergyCo:

- 15 October 2024: Northern councils.
- 16 October 2024: Southern councils.

In addition to the workshops, individual engagements were conducted via email and phone calls to gather further insights and ensure all LGAs had the opportunity to contribute.

This included online meetings with:

- Tamworth Regional Council on 12 December 2024; and
- Uralla Shire Council on 13 March 2025.

The councils raised several significant challenges, including:

1. Limited time, data, and resources to adequately plan for and manage changes in waste types and generation.
2. Limited time and budget constraints to implement any new waste infrastructure projects.

3. Insufficient staff capacity, contractor skills, trucks, and equipment to address emerging waste management needs.
4. Constraints in storage and processing capacity.
5. Restricted funding for necessary infrastructure upgrades (including access roads, security, weighbridges, data recording technology, trucks, containers, equipment).
6. Limited capability to process all material types (including batteries, hazardous wastes, large and long inert wastes, large volumes of waste).
7. Concerns about legacy waste if comprehensive, standardised, and reliable waste management processes, and agreements are not implemented during and after the commissioning of the NE REZ.

A detailed summary of the issues raised during the engagement activities is provided in Appendix A Table 31.

The councils also identified key opportunities to enhance the region's resilience and economy, including:

1. Attracting investment and partnerships to support economic growth.
2. Strengthening the local workforce by providing opportunities for upskilling and job creation.
3. Supporting economies of scale and circularity through regional collaboration.
4. Developing regional waste and resource recovery infrastructure.
5. Positioning the region as a waste and resource recovery hub for surrounding areas.
6. Exploring the repurposing of infrastructure from mine and power station closures to expand capacity for REZ waste management and circular economy initiatives.

A detailed summary of the opportunities raised during the engagement activities is provided in Appendix A, Table 32.

5.3 Government authorities

An online meeting was held with the NSW EPA on 6 March 2025. The meeting was attended by representatives from Environment Protection Planning and the Manager for Regional Operations (Armidale).

An overview of the study and stakeholder consultation outcomes was presented. MRA's identified key intervention areas for EnergyCo were also presented for feedback by the NSW EPA.

Key outcomes of this consultation included support in principle for the majority of interventions where the NSW EPA could see value in the presented options, and also discussion of the potential risks and limitations of several interventions including measures that could address these areas of concern.

5.4 Key industry suppliers/service providers

An online meeting was held with the Smart Energy Council (SEC) on 22 January 2025 and on 11 March 2025. The SEC is the peak body for the solar, storage, and smart energy industries in Australia. It is a not-for-profit membership organisation committed to promoting clean, efficient, cheap, and smart energy solutions. SEC consults with state and territory governments, and recyclers regularly. National stewardship and policy is a large focus of the organisation.

A summary of the key takeaways from the interview is summarised in Table 8.

Table 8: Smart Energy Council Key Takeaways

Phase	Key Insights
Solar Panel Lifecycle & Waste	Damage Rates: • 1% damaged during construction (e.g. damage sustained during storage and transport). • 0.5% damaged during operations (e.g. due to mowing and objects hitting panels). • 100% decommissioned at end-of-life. • 5% to 10% lost annually due to repowering (based on the overseas situation and a few plants in Australia, likely to become the adopted practice in Australia). • Damage sustained due to floods, hailstorms and other inclement weather conditions. Trackers on panels mitigate amount of damage in hailstorms but are not regulated or standard practice in Australia. Packaging Waste: • There are typically 20 modules per pallet, generating thousands of pallets during solar farm installations. Commercial quantities and types of renewable energy wastes generated sit outside the responsibility of councils. • Discussed the benefits of rolling out biodiversity with large-scale solar farms in decreasing ambient temperature and decreasing dust.
Decline of Second-Hand Solar Panel Market	Historically, in Europe, more than 80% of decommissioned panels were exported for reuse. Market shrinking due to falling new panel prices, driven by: • China doubling production to 1.2 terawatts per year. 50% used domestically, the rest exported internationally. Price trends: Prices will fall but may stabilise, depending on U.S. policy under the Trump administration. Impact: Second-hand market decline may lead to illegal dumping. Example: Used panels once sold for $30 each; now, solar farms must pay $30 per panel for disposal.
Challenges with Second-Hand Panel Testing & Oversupply	No international standard for testing second-hand panels (development ongoing). No available tools to test panel efficiency. Market cannot absorb millions of retired panels annually. Some companies use second-hand panels for 5 MW solar farms, but these are localised projects.
Early Retirement & Recycling Growth	Solar panel warranties are typically for 10 to 15 years, and up to 25 years under extended product warranties. Solar panel performance warranties of 25 years are standard. Average panel retirement age: 8 - 10 years (far below 25-30 year lifespan) is becoming the trend in Australia. Reason: Repowering – replacing older panels with new, efficient, and cheaper ones. Solar panel recycling is a growing industry, attracting investment.

Phase	Key Insights
Solar Panel Recycling in Australia	A materials recovery ecosystem is necessary to ensure we have the materials required to make renewables. Technology employed makes the difference between high and low rates of separation (silver silicon copper) / quality outputs. Best recycler is located in Queensland – produces high-quality recovered materials (metals in particular have less contaminants). NSW is behind, but has two recyclers: Sircle & PCB. New recyclers starting up: One in Hunter Valley, one on NSW-QLD border. Recycling Approaches: 1. Mega recycling plant – centrally located, well-connected by road & rail. 2. Decentralized small plants – closer to solar farms. 3. Mobile processing units – strip and pre-process panels on-site, reducing logistics costs.
Future of Solar Panel Stewardship	Existing solar farms will be excluded from any future stewardship scheme. Unclear if scheme will be state or federal level. Federal coordination makes most sense so that regulations and strategies are harmonised. Federal elections will delay implementation as no ministerial support exists. If a scheme is started, potential revenue collection from July 2026, but depends on election outcome.
Wind Turbines & Recycling Challenges	Wind turbine blades can be damaged during transport and in storms. Wind turbine blades are low-value resin, materially inert, heavy, and costly to transport and recycle with a low market demand for the recycled outputs. • Best option: Leave them in place. Wind turbines (excluding blades) contain rare earth metals and are valuable as these materials are in short supply globally. • Recycling is complex due to metals being in alloys which makes them difficult to separate out. Research on refurbishment & reuse is ongoing at Sydney & Perth universities.
Battery Recycling	Under development in Australia (including Envirostream, Renewable Metals, Ecobatt facilities). A 10-year product warranty often offered reflecting the average life of the battery.

5.5 Regional Joint Organisations

5.5.1 Hunter Joint Organisation

MRA met with the Hunter Joint Organisation (HJO) on 2 December 2024 where HJO raised the following key issues and opportunities:

1. Pressure on Waste Infrastructure: Large, bulky wastes from decommissioning (e.g., wind turbine blades, power poles) require dedicated storage and specialised recovery equipment. Without proactive planning, significant materials may be lost to landfill.
2. Transport and Levy Challenges: Waste transport through the region will increase, compounded by upcoming waste levy changes in 2026 that could impact the economics of disposal.

3. Circular Economy Potential: The industrial transition underway in the Hunter creates a strong opportunity for the NE REZ to drive investment in circular economy initiatives, particularly through early-stage procurement decisions that prioritise recyclability and reuse.
4. Need for Regional Coordination: Platforms like HJO's Material Exchange Hub and Hunter Circular Digital Hub are helping track waste flows and enable collaboration, but broader coordination across precincts, ports, and waste facilities is needed to capture material value at scale.
5. Repair and Reuse Opportunities: Developing repair and refurbishment businesses for operational waste streams could unlock long-term regional economic benefits, but will require strategic support and market signalling from government and project proponents.
6. Lessons from Other REZs: Experience from the Central-West Orana REZ indicates that investment in long-term circular economy infrastructure, rather than short-term grants, is key to ensuring sustained regional benefits.

A detailed summary of the opportunities raised during the engagement activities is provided in Appendix A, Table 33.

5.5.2 Northern Inland Regional Waste

MRA met with the Northern Inland Regional Waste (NIRW) on 18 November 2024 where NIRW revealed systemic gaps in early-stage planning for REZ waste impacts. Councils are often left scrambling without sufficient data on waste volumes or composition at project inception. Oversized and contaminated waste streams, such as wind turbine blades and treated timber, create significant challenges for local processing and landfill operations.

NIRW highlighted the critical need for:

1. Early provision of waste volume forecasts to councils,
2. Mandatory size reduction and sorting of REZ waste at source,
3. Regional coordination for shared infrastructure like bulking centres or future C&I MRFs,
4. Proactive disaster waste planning to manage capacity risks from extreme weather and disease events,
5. Aligning waste fees across councils to discourage "price shopping" by generators.

The findings underscore the urgency of structured planning and investment to build resilience into the region's waste management system before major NE REZ delivery stages commence. A detailed summary of the opportunities raised during the engagement activities is provided in Appendix A, Table 34.

6 Waste Generation

This section presents the modelled waste generation projections for the NE REZ and NE REZ Project across a nine-year period from 2025 to 2033. It includes projected volumes from four key waste-generating activities:

- Baseline waste from existing residents and commercial operations;
- Construction waste from both renewable and non-renewable energy projects;
- Operational waste; and
- Workforce accommodation waste during both construction and operation.

The modelling is based on a combination of data from GDPs, project EISs, and publicly available reports. Where possible, project-specific data has been prioritised; however, due to inconsistencies in the availability and detail of data, assumptions have been used to ensure a balanced and practical projection. Waste generation estimates are expressed in total tonnes and, where relevant, normalised units (e.g. tonnes per megawatt (MW) for energy generation or tonnes per kilometre (km) for transmission infrastructure).

6.1 Modelling Approach and Assumptions

Three scenarios were modelled to capture a range of future waste generation outcomes, as detailed in Table 9.

Table 9: Scenario Descriptions and Data Sources

Scenario	Description	Source
Scenario 1: Baseline	Status quo waste generation by residents and current commercial activities within the LGAs.	NSW Population Projections NSW EPA WARR Reports
Scenario 2: Baseline + Projected change (excluding NE REZ development)	Baseline waste plus waste from non-renewable projects such as housing, utilities, health, agriculture, mining, road upgrades and transmission.	NSW Population Projections NSW EPA WARR Reports Project EIS Reports NE REZ Data and Assumptions Book, Revision 2.1
Scenario 3: Baseline + Projected change (excluding NE REZ development) + NE REZ development	Includes Scenarios 1 and 2 plus NE REZ renewable projects: solar, wind, BESS, PHES, and temporary workforce accommodation. This was based on two tiers of sensitivity analysis based on the likelihood that a project would proceed (see Section 3.2).	All above sources plus GDPs

The conceptual structure of these scenarios is illustrated in Figure 10 (for illustrative purposes only).

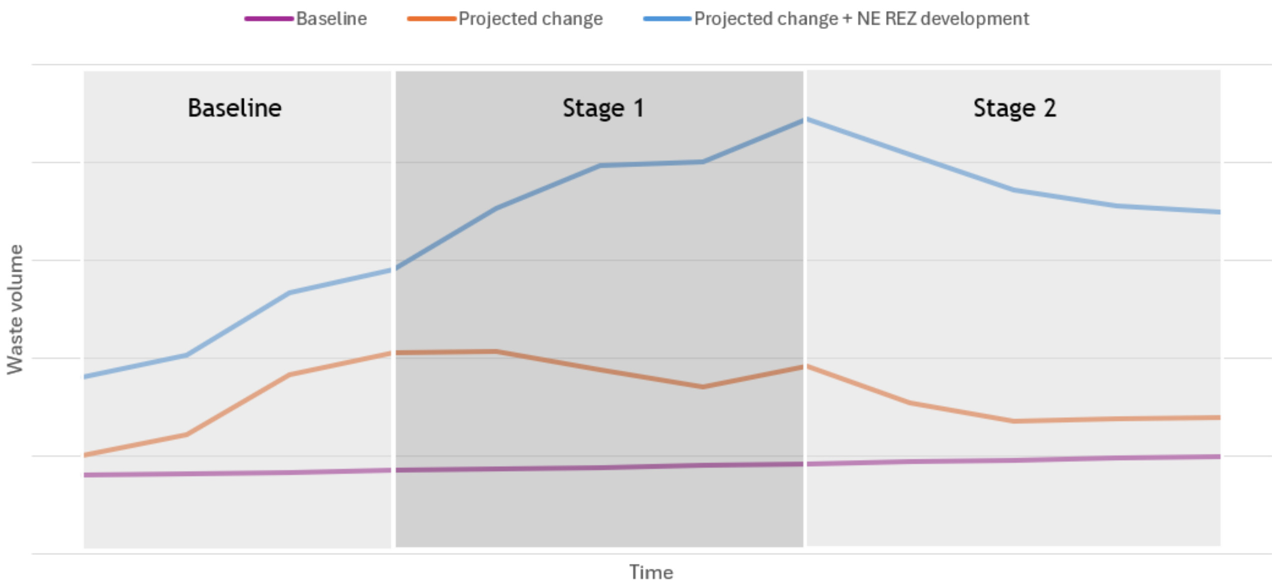


Figure 10: Example Histogram Illustrating Typical Waste Volumes and Scenarios across Delivery Stages*

(This figure is for illustrative purposes only and does not represent real data)*

Data Sources and Estimation Methods

Figures for waste types and volumes were obtained from a variety of sources with varying levels of granularity. Where detailed data was provided (e.g., in EISs), those values were used. Where data was inconsistent or incomplete, professional judgement and previous project experience were used to determine average or median estimates. In cases where a range was given, median values were adopted to minimise skew.

Sensitivity Analysis

To account for uncertainty in the delivery of NE REZ projects, a sensitivity analysis was conducted based on the likelihood of each project progressing from planning to delivery. Projects were categorised into three tiers:

- High-Probability Projects:
    - Currently under construction or operational.
    - Approved in 2023-24.
    - Assumed to contribute 100% of projected waste outputs.
- Medium-Probability Projects:
    - In pre-planning that intend to connect to the NE REZ or HCC REZ.
    - Approved in 2021-22.
    - Assumed to contribute 75% of projected waste outputs.
- Low-Probability Projects:
    - Approved before 2020 or with limited progress.
    - In planning for an extended period with no approval progress.
    - Assumed to contribute 0% of projected waste outputs.

Two waste generation scenarios were developed:

1. **Baseline Estimate**: Includes only high-probability projects.
2. **Upper Limit Estimate**: Includes both high- and medium-probability projects.

This approach enables scalable, realistic projections that account for differing levels of project certainty and development timelines. It is important to note, however, that the number of projects included in the Data and Assumptions Book exceeds the capacity of the transmission infrastructure to connect them all. As such, the upper limit scenario represents a worst-case estimate of potential waste volumes and is likely to overstate actual future outcomes.

The following subsections provide detail on the types and volumes of waste anticipated from each of the four activity areas: baseline, construction, operation, and workforce accommodation.

6.2 Baseline waste generation

The baseline waste generated by the existing residents and normal commercial activities within each LGA ranges from 0.26 to 1.28 tonnes per capita per annum. The estimated volumes per LGA is detailed in Table 10. The waste types are Municipal Solid Waste (MSW), co-mingled recycling waste, and Garden Organic Waste, and Food Organic Garden Organics (FOGO). Each LGA has a different combination of bin collection services for the collection of these wastes.

The bin systems are represented by colours in the table below:
Red=MSW, Yellow=Co-mingled Recycling, Green= Garden Organics, Purple=FOGO.

Table 10: Baseline Waste Generation Rate per Capita per LGA (Source: NSW EPA WARR Reports)

LGA	tonne/ capita/ year	Bin system				LGA	tonne/ capita/ year	Bin system			
Armidale	0.64	Red	Yellow		Purple	Tamworth	0.76	Red	Yellow	Green	
Glen Innes	1.28	Red	Yellow			Tenterfield Shire	0.56	Red	Yellow		
Inverell	0.63	Red	Yellow			Upper Hunter	0.31	Red			
Liverpool Plains Shire	0.36	Red	Yellow			Uralla	1.03	Red	Yellow	Green	
Muswellbrook Shire	0.64	Red	Yellow	Green		Walcha	0.26	Red	Yellow	Green	
Singleton	0.59	Red	Yellow	Green							

6.3 Construction waste generation

The construction of renewable and other project assets generates a variety of waste streams due to the scale and complexity of activities involved. A significant portion of this waste comes from packaging materials used for project components, including timber, cardboard, plastic film, strapping, polystyrene, hard plastic, aluminium, and steel. Additionally, substantial quantities of general construction waste, such as spoil, concrete, and metal off-cuts, are expected.

Waste will also be generated by the operation and maintenance of construction vehicles and equipment, contributing to hazardous wastes like fuels, lubricants, and chemicals. General waste from construction offices and workforce activities, including co-mingled recyclables such as paper, cardboard, plastic, glass, and mixed metals, will add to the total. A substantial workforce is required to undertake construction works, generating additional waste streams such as food waste, sewerage, and residual non-putrescible materials.

Many of these waste materials can be reused onsite, such as green waste being mulched for landscaping or spoil being used for cut-and-fill balancing. Recyclable materials, including metals and plastics, can be diverted for resource recovery where feasible. While the majority of waste generated is expected to be General Solid Waste (non-putrescible), a smaller proportion will be putrescible and hazardous. These materials require careful management to ensure compliance with environmental regulations and to minimise environmental and community impacts.

6.3.1 Renewable Energy

Estimates of waste types and quantities from renewable energy projects were primarily sourced through engagement with GDPs. Where GDP input was not available, data was drawn from publicly available EISs for projects within the NE REZ. In cases where NE REZ-specific EISs were unavailable, comparable project types were identified and reviewed via the *NSW Major Projects Planning Portal*. The level of detail provided in these documents varied considerably, from comprehensive waste breakdowns to minimal references, reflecting inconsistencies in reporting. Additionally, differences in project scope, such as the inclusion of BESS, access roads, and electrical infrastructure, contribute to the broad range of estimated waste quantities.

6.3.1.1 Solar

The amount and types of waste generated from large-scale solar projects were calculated using average reported values from four representative solar project EISs. These waste projections account not only for the solar panel arrays themselves but also for all ancillary infrastructure, including substations, switching stations, power conversion units, local transmission infrastructure (both overhead and underground), BESS, access roads, security fencing, and both permanent operations and maintenance facilities, as well as temporary facilities used during construction.

Estimated waste generation ranges from 6 to 21 tonnes per MW, with a median value of 18 tonnes per MW. Approximately 49% of this is sewerage waste from construction workers, reducing the median solid waste fraction to around 9 tonnes per MW. The compositional breakdown of median waste per MW is provided in Table 11.

The variation in waste volumes is influenced by several factors, including topography, vegetation cover, and project design. The presence of a BESS, the distance of transmission connections, and the layout of supporting infrastructure such as substations, roads, and fencing further influence waste generation.

Key waste streams include:

- Vegetation Waste: Green waste generated from site clearing is expected to be mulched and reused onsite for rehabilitation where feasible.
- Excavation & Spoil: While cut-and-fill balance is prioritised, excess spoil may still require offsite disposal.
- Cabling & Electrical Waste: Includes excess cabling, off-cuts, damaged wiring, and electronic components from installation.
- Packaging Waste: This includes plastics, strapping, and rigid packing materials from equipment delivery, wooden pallets and crates (which can be reused or processed into wood chips if untreated), and metals from packaging and structural components.
- General Waste: Includes food and office waste from the workforce, as well as co-mingled recyclables such as paper, cardboard, glass, and mixed metals.
- Hazardous Waste: Lubricants, oils, and maintenance fluids from plant, machinery, and construction equipment.

Table 11: Solar Construction Waste Composition

Waste type	Estimated t/MW	% of whole	Waste type	Estimated t/MW	% of whole
Wood	4.18	23.3%	Co-mingled recycling	0.09	0.5%
Cardboard	0.53	3.0%	Cable Cuts	0.57	3.2%
Metal	1.02	5.7%	Plastic Wrap	0.13	0.7%
Liquid Waste (sewerage)	8.77	49.0%	Rigid Packing Plastics	0.07	0.4%
Haz Liquid Waste	0.01	0.0%	Polystyrene	0.12	0.6%
General Waste	1.64	9.2%	C&D (soil + concrete)	0.77	4.3%
		Total (ex. Sewerage)	***9.12 t/MW***		
		Grand total	**17.89 t/MW**		

6.3.1.2 Wind

The amount and types of waste generated from large-scale wind projects were calculated using average reported values from three representative wind project EISs. These projections account for all major project components, including wind turbines of varying heights, hardstand areas, substations, switchyards, overhead and underground transmission lines, fibre optic cabling, BESS, permanent operations and maintenance facilities, weather stations, access roads, and temporary construction facilities.

Estimated waste generation ranges from 1.7 to 2.9 tonnes per MW, with a median value of 2.8 tonnes per MW. Approximately 35% of this is sewerage waste generated by construction workers, reducing the median solid waste fraction to around 1.8 tonnes per MW. The compositional breakdown of median waste per MW is provided in Table 12.

Variation in waste volumes can be attributed to topography, number of turbines, vegetation cover, proximity to existing infrastructure, and distance to the grid.

Key waste streams include:

- Wood Waste: Generated from pallets and cable drums, commonly used for transporting wind turbine components.
- Packaging Materials: Includes strapping, protective coverings, and component packaging, which vary depending on turbine size and supplier specifications.
- Green Waste: Vegetation cleared for turbine foundations, access roads, and laydown areas are mulched and reused onsite where feasible.
- Excavation & Spoil: Excess spoil from foundation works and hardstand areas is expected, with cut-and-fill balancing prioritised to minimise offsite disposal.
- Concrete Waste: Arises from turbine foundations, laydown areas, and access road construction.
- Cabling & Electrical Waste: Includes excess cabling, off-cuts, and damaged wiring from transmission infrastructure and fibre optic cabling.
- General Waste: Consists of office and workforce-generated waste, including co-mingled recyclables such as paper, cardboard, plastics, and metals.
- Hazardous Waste: Primarily includes oils, lubricants, and maintenance fluids from workshops and machinery servicing.

Table 12: Wind Construction Waste Composition

Waste type	Estimated t/MW	% of whole	Waste type	Estimated t/MW	% of whole
Wood	0.04	1.59%	Co-mingled recycling	0.01	0.18%
Cardboard	0.16	5.58%	Glass	0.00	0.02%
Metal	0.26	9.14%	Rigid Packing Plastics	0.00	0.01%
Liquid Waste (sewerage)	1.00	35.34%	C&D (soil + concrete)	0.05	1.62%
Haz Liquid Waste	0.02	0.86%	Dangerous goods	0.01	0.37%
General Waste	1.28	45.29%	Co-mingled recycling	0.01	0.18%
Total (ex. Sewerage)			***1.82 t/MW***		
Grand total			**2.82 t/MW**		

6.3.1.3 BESS

The amount and types of waste generated from large-scale battery projects were calculated using average reported values from three representative BESS project EISs. These projections account for all major project components and supporting infrastructure, including stormwater and drainage works, battery modules, power inverters, cabling (overhead and underground), transformers, switchgear, operations and maintenance facilities, car parking, security fencing and CCTV, internal roads, temporary construction facilities, and grid connection infrastructure.

Estimated waste generation ranges from 1 to 52.7 tonnes per MW, with a median value of 25.4 tonnes per MW. Approximately 35% of this is sewerage waste from construction workers, reducing the median solid waste fraction to around 16 tonnes per MW. The compositional breakdown of median waste per MW is detailed in Table 13.

Variation in waste generation rates depends on topography, facility size, vegetation cover, proximity to existing infrastructure, and distance to the grid. Sites with steep terrain or significant vegetation require more extensive earthworks and clearing, increasing waste volumes. Larger facilities with more battery modules, inverters, and supporting infrastructure will also contribute higher quantities of construction waste.

Key waste streams include:

- Excavation & Spoil: Earthworks generate significant spoil, including clean fill and potentially contaminated soils. While cut-and-fill balancing is prioritised to maximise onsite reuse, excess spoil may still require offsite disposal.
- Wood Waste: Generated from cable drums and pallets used for transporting battery modules and associated equipment.
- Concrete Waste: Produced from foundation construction, stormwater and drainage works, and hardstand areas.
- Cabling & Electrical Waste: Includes excess cabling, off-cuts, and damaged components from installation.
- Packaging Waste: Consists of plastics, wrapping materials, pallets, crates, and cartons associated with delivered items.
- General Waste: Includes workforce-generated waste, such as office waste, food scraps, and co-mingled recyclables like paper, cardboard, glass, and mixed metals.

- Vegetation Waste: Green waste generated from site clearing will be mulched and reused onsite where feasible.
- Hazardous Waste: Includes fuels, lubricants, and chemicals from vehicle maintenance and construction equipment servicing.
- Sewage: Generated from portable toilets used onsite, which will be disposed of at licensed processing facilities.

Table 13: Battery Construction Waste Composition

Waste type	Estimated t/MW	% of whole	Waste type	Estimated t/MW	% of whole
Liquid Waste (sewerage)	9.05	35.59%	Garden/Food Organics	0.10	0.41%
Haz Liquid Waste	0.00	0.00%	C&D (soil + concrete)	16.20	63.72%
General Waste	0.04	0.16%	Dangerous goods	0.03	0.12%
		Total (ex. Sewerage)	***16.38 t/MW***		
		Grand total	**25.43 t/MW**		

6.3.1.4 PHES

Due to the relatively small number of PHES projects in Australia, there is limited available data on construction waste volumes. The amount and types of waste generated from PHES projects were calculated using average values from two representative project EISs. These estimates indicate that large-scale pumped hydro projects can generate between 249 to 2,612 tonnes of waste per MW, with a median estimate of 1,431 tonnes per MW. They include all major infrastructure components such as reservoirs, water transfer pipelines, canals, penstocks, surge tanks, transformers, reversible motor generators, pump turbines, transmission lines, administrative buildings, water treatment facilities, ventilation systems, access roads, and both permanent and temporary construction facilities.

A significant proportion of this reported waste (up to 99%) consists of sewerage generated by the workforce. This high proportion reflects the large workforce and extended construction timeframes typical of PHES projects, which exceed those of other renewable energy types. In contrast, solid waste fraction is relatively low, with a median estimate of just 4 tonnes per MW. This is primarily because most solid waste materials, such as excavated spoil and cleared vegetation, are reused onsite in dam embankments, roadworks, and rehabilitation. However, due to the small sample size and variation in EIS reporting methodologies, these figures should be interpreted with caution.

Each PHES project is highly site-specific, with waste volumes influenced by topography, hydrology, and design parameters. Factors such as the number of reservoirs, connection to river systems or isolated sites (e.g., repurposed mines or quarries), tunnel distances between reservoirs, and the number of turbines all impact waste generation. While exact waste volumes remain uncertain, the types of waste expected are well understood and largely consistent across projects.

The key waste streams include:

- Spoil & Excavated Material: PHES projects generate significant volumes of spoil due to extensive tunnelling, reservoir construction, and underground power station development. Where possible, excavated material is reused onsite for dam embankments, road construction, and earthworks, or repurposed for other civil engineering projects. If no beneficial reuse is available, material is stored in designated spoil emplacement areas.

- Vegetation Waste: Substantial clearing is required for reservoirs, penstocks, and supporting infrastructure. Cleared vegetation is typically mulched and reused onsite for rehabilitation.
- Sewerage Waste: Due to the large workforce required for PHES construction, significant sewerage waste is generated. High-occupancy worker camps typically have onsite water treatment plants, while lower-occupancy camps rely on storage and pump-out systems for offsite treatment.
- Concrete Waste: Generated from power station, dam, and tunnel construction, with reuse or recycling prioritised where feasible.
- General Construction Waste: Includes timber, metals, rubble, and non-recyclable materials from various site activities.
- Cabling & Electrical Waste: Includes off-cuts and damaged components from electrical installations, transformers, and grid connection infrastructure.
- Packaging Waste: Generated from machine parts, structural components, and construction materials.
- Hazardous Waste: Includes fuels, lubricants, and maintenance fluids from plant, machinery, and construction vehicles.
- General Waste & Office Waste: Includes food waste from worker camps, site office waste such as paper and cardboard, and co-mingled recyclables. On some sites, food waste may be composted, while other sites will dispose of it through standard waste management channels.

6.3.2 Non-renewable energy projects

Figures for expected waste types and quantities from non-renewable energy projects were primarily sourced from proponents' planning documents, particularly the waste chapters of the EIS. Where these were unavailable or lacked sufficient detail, data was supplemented with EIS documents from similar projects. The level of detail across these sources varied significantly, ranging from comprehensive datasets to minimal or no information. Additionally, differences in project scale and components contributed to the broad range of reported waste quantities.

6.3.2.1 Coal & Coal Mining

Waste generation from coal and coal mining projects within the study area includes 18 projects. The coal projects consist of turbine upgrades at the Bayswater and Liddell power stations, while the coal mining projects involve extensions to existing mining operations.

Power stations and mines are highly self-sufficient in waste management, often operating onsite waste disposal facilities. As a result, most waste generated is managed internally, with only general waste from workers typically leaving the site.

Construction waste generation is expected to be minimal. The power station upgrades are limited to turbine improvements, while the mining projects involve expanding mining footprints, modifying tailings emplacement areas, upgrading internal roads and rail infrastructure, and installing additional water pipelines. These projects do not include major processing facility expansions, meaning construction-related waste will be minimal and largely managed onsite.

Operational waste streams from these projects are addressed in other sections of this study.

6.3.2.2 Education

Both education projects are operational, and as such, no construction waste is expected to be generated.

6.3.2.3 Electricity Generation – other

Of the two projects classified under electricity generation, one involved modifications to the Bayswater power station's pump station, which has already been completed. The other project relates to enabling works for the demolition of the Liddell power station.

Before demolition, the Liddell site will undergo decommissioning, a process designed to recover and repurpose materials, minimising the volume of waste generated. The majority of demolition materials, particularly asbestos-contaminated waste, are expected to be disposed of in a purpose-built landfill at the Liddell site. The project's EIS provides estimated waste types and quantities, as outlined in Table 14.

Table 14: Electricity Generation Construction Waste Composition

Waste type	Estimated volume (t)
Metal (ferrous and non-ferrous)	72,800
C&D (soil + concrete)	720
Liquid Waste (sewerage)	15 Kl/day
Haz Liquid Waste	Minimal
Garden/Food Organics	Minimal
General Waste	Minimal

6.3.2.4 Extractive industries

Waste generation from the two quarry projects is expected to be minimal, as both involve extensions of existing operations rather than new developments.

The Ardglen Quarry extension will allow operations to continue for another 30 years at the existing extraction rate, with no changes to waste streams. All associated waste types and volumes are already accounted for in the baseline modelling.

The Willow Tree Gravel Quarry extension will extend operations for 25 years and includes the development of a waste management facility. Any new waste generated will be managed onsite, preventing additional waste from leaving the premises. Waste volumes for this project have also been incorporated into baseline modelling, with no new or unexpected waste streams anticipated.

As these projects involve operational extensions rather than new construction, no additional construction waste is expected. Any increase in waste volumes will result from ongoing quarry operations rather than development activities.

6.3.2.5 Food, beverage, and tobacco manufacturing

There is no publicly available information on the types or quantities of waste expected to be generated during the construction of the two poultry facilities and the poultry feed facility—the three relevant projects being developed in the study area. Existing data focuses only on operational waste therefore, no quantities have been modelled for this section.

Waste will be generated throughout construction, including during site establishment, excavation, building construction, plant and equipment installation, access road development, stormwater management infrastructure installation, and associated utility works.

Typical waste streams include:

- Excavated Material & Spoil: Excavation is expected to generate spoil, which will be reused onsite where feasible.
- Vegetation Waste: Green waste from tree and shrub removal, as well as landscaping activities, will be mulched and reused onsite where practical.
- Steel Waste: Offcuts from galvanised steel structures, including frames, supports, silos, conveyors, and cladding from wall and roof sheeting.
- Concrete Waste: Surplus concrete from slabs, foundations, pavements, and structural elements.
- Packaging Waste: Includes pallets, plastic wrap, cardboard, and protective coverings from construction materials and equipment deliveries.
- Fuel, Lubricants & Oils: Diesel, petrol, LPG residues, and minor spills from construction machinery and equipment maintenance.
- Chemical Waste: Includes quarantine facility chemicals, sanitizers for vehicle wash-down areas, and water treatment chemicals.
- Electrical & Solar Panel Waste: Includes cabling and wiring offcuts, as well as minor electronic waste from generator and backup power installations.

6.3.2.6 Gas pipeline

Waste generation from gas pipeline construction is estimated to be 72 tonnes per kilometre, with approximately 76% consisting of sewerage from workforce activities, reducing the solid waste fraction to 17 tonnes per kilometre. A compositional breakdown per kilometre is detailed in Table 15.

The Hunter–Queensland Gas Pipeline is the only relevant gas infrastructure project, and traverses the southern LGAs. Waste generation from construction is expected to be moderate, with most materials managed onsite.

Waste volumes vary depending on pipeline length, terrain, and construction techniques. Spoil from trenching operations will be reused along the pipeline corridor, while vegetation waste, including grasses, trees, and shrubs, will be mulched and respread during site reinstatement, rather than transported offsite.

Key waste streams include:

- Excavated Material & Spoil: Primarily reused onsite.
- Vegetation Waste: Cleared vegetation, including trees, shrubs, and grasses, will be mulched and used for rehabilitation.
- General Industrial & Packaging Waste: Includes packaging materials, ropes, and rope spacers.
- Steel Waste: Scrap metal from pipe offcuts, welding rods, and fittings.
- Hazardous Waste: Includes used chemicals, gasket adhesives, cutting lubricants, and water treatment chemicals.
- Liquid Waste: Includes drilling muds, concrete slurries, sewage from workforce camps, and fuels/lubricants from vehicle and equipment maintenance.
- Construction & Demolition Waste: Includes co-mingled recyclables, garnet grit from blasting welded joints, and minor timber waste.
- Paper & Cardboard: Generated from temporary site offices and worker accommodations.

The waste projections account for all project activities, including the construction of high-pressure gas pipelines, compressor stations, scraper stations, mainline valves, temporary construction compounds, workforce accommodation facilities, and road crossings.

Table 15: Gas Pipeline Construction Waste Composition

Waste type	Estimated t/km	% of whole	Waste type	Estimated t/km	% of whole
Wood	1.05	1.46%	Haz Liquid Waste	0.08	0.11%
Cardboard	0.09	0.13%	General Waste	9.99	13.95%
Metal	1.57	2.19%	C&D (soil + concrete)	4.62	6.46%
Liquid Waste (sewerage)	54.18	75.70%			
		Total (ex. Sewerage)	***17.39 t/km***		
		Grand total	**71.57 t/km**		

6.3.2.7 Roads

Waste generation from road projects is influenced by several factors, including road layout, topography, number of lanes, interchanges, bridges, viaducts, road classification, design speed, vegetative cover (grassland or forest), geology (rock, acid sulfate soils, potential acid sulfate soils, or contaminated soils), and whether the project is a greenfield or brownfield development.

Of the three road projects, one affects only Singleton LGA, which falls outside the study area, and another is still in pre-planning, with no available documentation to quantify its impact. Only one project, located in Muswellbrook, falls within the study area and has relevant waste projections.

The majority of waste generated by road projects consists of spoil and vegetation from ground clearing. Where possible, cut-and-fill balance is prioritised to minimise spoil volumes, but some materials, including contaminated soils, may still require offsite disposal. Waste arises primarily from site establishment, excavation, clearing, stripping, demolition of existing structures, earthworks, and construction of roads, retaining walls, bridges, and drainage infrastructure.

Typical waste streams include:

- Excavated Material & Spoil: The largest waste stream, including both clean and potentially contaminated soils.
- Vegetation Waste: Cleared trees, shrubs, and grasses, with potential for mulching and reuse onsite.
- General Construction Waste: Includes timber formwork, scrap metal, steel, concrete, plasterboard, and packaging materials.
- Surplus Construction Materials: Fencing, sediment, gravel, crushed rock, asphalt, concrete, steel, aggregate, formwork, landscaping materials, and sandbags.
- Hazardous Waste: Adhesives, lubricants, waste fuels, batteries, hoses, and tyres from plant and equipment maintenance.
- Liquid Waste: Wastewater from facilities, vehicle washdowns, and dust suppression. Piling, grouting, and rock drilling activities may generate wastewater containing alkaline residues and residual chemicals.
- General Waste: Site waste, litter, and food waste from workforce facilities.

6.3.2.8 Waste collection, treatment and disposal

The Armidale Regional Solid Waste Landfill Facility project is not expected to generate any construction waste, as it involves modifications to operational conditions rather than new infrastructure development.

6.3.2.9 Transmission

The amount and types of waste generated from high-voltage transmission line projects were calculated using average reported values from two representative project EISs. These projections account for all project activities, including the construction of single- and double-circuit high-voltage transmission lines, as well as supporting infrastructure such as substations (new or upgraded), optical telecommunication cables, access roads, construction and worker compounds, utility connections, brake and winch sites, helicopter support facilities, laydown areas, and concrete batch plants.

Estimated waste generation ranges from 73 to 2,445 tonnes per kilometre, with a median value of 1,279 tonnes per kilometre. The majority of waste consists of cleared vegetation and excess spoil, both of which have high reuse potential, either onsite or for other applications. Minor quantities of surplus construction materials, wastewater, and operational waste from plant and equipment are also expected. The estimated median compositional breakdown of waste per kilometre is detailed in Table 16.

Waste volumes vary significantly depending on terrain, vegetation cover, and project design. Transmission corridors that traverse forested areas will generate substantial vegetation waste, while projects in hilly terrain may require extensive cut-and-fill earthworks, increasing spoil volumes.

Key waste streams include:

- Vegetation Waste: Generated from clearing easements, access roads, and energy hub sites, typically mulched and reused for rehabilitation where feasible.
- Excess Spoil: Excavated material from access track works and substation construction. Cut-and-fill balancing is prioritised, but excess spoil may require offsite disposal.
- Surplus Construction Materials: Includes steel, concrete, rebar offcuts, broken porcelain or glass insulators, and conductor and cable offcuts (copper and aluminium).
- Packaging Waste: Consists of wooden pallets, cable drums, metal strapping, plastic wrapping, and protective packaging materials.
- Hazardous Waste: Includes disused paints, protective coatings, fire retardants, discarded fire extinguishers, and waste oils, greases, and lubricants from plant and equipment operation.
- General Waste: Produced by construction and maintenance personnel, including food waste, co-mingled recyclables, and site office waste such as paper and cardboard.
- Wastewater & Sewage: Generated at construction compounds and workforce accommodation camps, requiring onsite treatment or offsite disposal.
- Electronic Waste: Faulty or broken electrical and electronic equipment, including discarded control panels, sensors, and monitoring devices.

Table 16: Transmission Construction Waste Composition

Waste type	Estimated t/km	% of whole	Waste type	Estimated t/km	% of whole
Wood	0.17	0.01%	General Waste	3.20	0.25%
Cardboard	0.04	0.00%	Garden/Food Organics	467.06	36.51%
Metal	3.28	0.26%	Plastic Wrap	0.01	0.00%
Liquid Waste (sewerage)	36.99	2.89%	Rigid Packing Plastics	0.00	0.00%
Haz Liquid Waste	0.03	0.00%	C&D (soil + concrete)	768.47	60.07%
		Total (ex. Sewerage)	***1,242.27 t/km***		
		Grand total	**1,279.26 t/km**		

6.4 Operational waste generation

The ongoing operation and maintenance of renewable energy and other project assets generate a variety of waste streams that reflect the daily activities and unexpected events associated with these facilities. Waste from routine operations typically arises from administrative tasks performed at site offices, workshop-based maintenance activities, and regular servicing of equipment. Maintenance staff, living and working in the region, contribute to general domestic waste as part of their day-to-day activities.

In addition to regular maintenance-related waste, operational waste also includes materials resulting from asset failures. Such failures may occur due to manufacturing defects, wear and tear, or external factors such as natural disasters, including storms, fires, or extreme weather events. These incidents can produce unique waste streams, such as damaged equipment, hazardous materials, and non-recyclable components, requiring careful management to ensure compliance with environmental standards and safe disposal practices.

The operational lifespans of each type of renewable energy project are listed in Table 17.

Table 17: Operational Lifespan of Renewable Energy Assets

Project Types	Lifespan	End of life decommissioning likely (Y/N)	Warranty
Solar farm	25-30 years	Y	10 - 15 years, up to 25 years under extended warranties (product), 25 years (performance)
Wind farm	20-35 years	Y	30 years
BESS	20 years	Y	Typically 10 years - replace batteries/cells once they fall below 60% of charge.
PHES	NA	N	May need to replace transformer after 40 years

To model component failure rates over time, a Weibull distribution was applied, a statistical method commonly used to predict the likelihood of equipment failures. This approach captures early-life failures (infant mortality), steady operational performance, and end-of-life degradation, reflecting the real-world wear and tear of infrastructure. While some waste is generated throughout the operational life of these assets due to periodic failures and replacements, the majority of waste will arise at decommissioning, when all components reach the end of their functional life and require removal, recycling, or disposal.

6.4.1 Renewable energy

Figures for expected waste types and quantities from renewable energy projects were sourced directly from GDPs. Where GDP data was unavailable, information was drawn from proponents' planning documents, particularly the waste chapters of EISs. The level of detail in these documents varied significantly, ranging from comprehensive data to minimal or no information. Additionally, project variations in scale and components (such as included BESS, roads, and electrical connections) contribute to the broad range of reported waste quantities.

6.4.1.1 Solar

During the ongoing operation of large-scale solar projects, waste generation is estimated to range from 0.5 to 6 tonnes per MW per annum, with a median value of 3 tonnes per MW per annum. This excludes waste from failed photovoltaic (PV) panels, focusing solely on day-to-day operations and maintenance.

The majority of this waste arises from maintenance activities, with sewerage (27%) and dangerous goods (49%), such as damaged lithium-ion batteries from onsite BESS, being the most significant contributors. It is assumed that operational staff reside permanently within the region, and their per capita waste generation is incorporated into the workforce calculation in Section 6.5. The estimated median compositional breakdown of operational waste per MW per annum is shown in Table 18.

Table 18: Solar Operational Waste Composition

Waste type	Estimated tpa/MW	% of whole	Waste type	Estimated tpa/MW	% of whole
Metal	0.50	16.6%	General Waste	0.07	2.4%
Liquid Waste (sewerage)	0.80	26.7%	Co-mingled recycling	0.14	4.8%
Haz Liquid Waste	0.00	0.1%	Dangerous goods	1.48	49.4%
		Total (ex. Sewerage)	***2.20 tpa/MW***		
		Grand total	**3.00 tpa/MW**		

Solar Panel Failure Assumptions

Solar panels degrade over time due to environmental stress, material degradation, and manufacturing defects. Factors such as ultraviolet radiation, extreme temperatures, hail, and internal structural issues (e.g., micro-cracks, corrosion) contribute to their failure. Failure rates increase with age, particularly beyond 25–30 years, when performance typically declines below acceptable efficiency thresholds.

For this study, it is assumed that all panels will reach the end of their life in Year 30, providing a base-case scenario for modelling end-of-life waste generation. The panel failure rate over time has been modelled using a Weibull failure distribution with a shape parameter of k = 2.4928[1], reflecting the expected failure trends of solar panels under operational conditions. This modelling accounts for:

[1] : IRENA and IEA-PVPS (2016), "End-of-Life Management: Solar Photovoltaic Panels," International Renewable Energy Agency and International Energy Agency Photovoltaic Power Systems

- Damage during transport and installation.
- Failures within two years due to poor installation.
- Failures after 10 years due to technical defects.
- Failures after 15 years due to material degradation and operational wear.

The modelled panel failure rates over time are shown in Figure 11, which illustrates an initial period of minimal failures, followed by a steady increase, peaking around Years 22–26, before gradually declining towards Year 30 as fewer original panels remain operational. This reflects the compounding effects of long-term degradation, where the highest percentage of failures occur as panels approach the latter stages of their lifecycle.

However, this modelling does not account for several real-world variables, including:

- Extreme weather events (e.g., hailstorms, cyclones, bushfires) that may cause mass panel failures at irregular intervals.
- Farm repowering or re-energisation, where sections of a solar farm may be upgraded, repurposed, or retired before reaching 30 years (as raised by the Smart Energy Council in Section 5.4).
- Panels operating beyond their 30-year lifespan, as some PV modules may continue functioning at reduced efficiency beyond this timeframe.

The composition of solar panels, including materials that can be recovered or recycled, is outlined in Table 19.

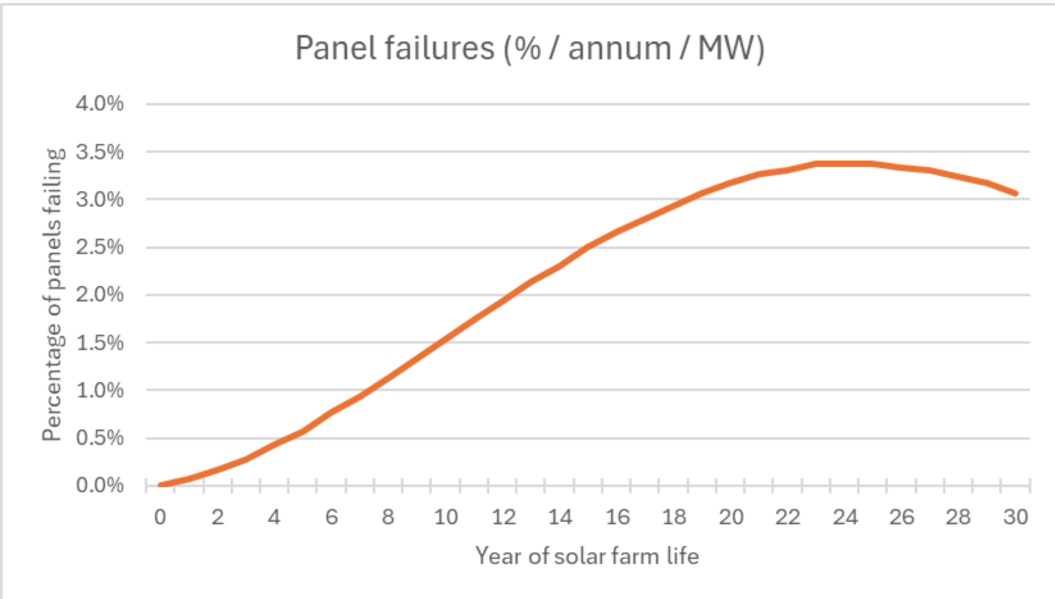


Figure 11: Solar Panel Failure Rate over time

Table 19: Typical Composition of a 22kg Solar Panel

Component	%	kg per panel	Component	%	kg per panel
Glass	70.00%	15.40	Copper connector	1.00%	0.22
Aluminium Frame	18.00%	3.96	Aluminium, internal conductor	0.53%	0.12
Polymer-based adhesive (EVA) encapsulation layer	5.10%	1.12	Copper, internal conductor	0.11%	0.03
Silicon metal solar cell	3.65%	0.80	Silver	0.05%	0.01
Back-sheet layer (based on polyvinyl fluoride)	1.50%	0.33	Various metal (tin, lead)	0.05%	0.01

6.4.1.2 Wind

During the ongoing operation of large-scale wind projects, waste generation is estimated at a median value of 1 tonne per MW per annum. Sewerage accounts for 83% of this waste, reducing the solid waste fraction to 0.17 tonnes per MW per annum. The main waste streams consist of sewerage, general waste generated by workers, and minor amounts of cardboard from maintenance parts. Additionally, oils and lubricants used during maintenance activities contribute to the waste profile.

This excludes waste from failed components, such as blades or generators, focusing solely on the normal day-to-day operations. It is assumed that operational staff reside permanently within the region, and their per capita waste generation is included the workforce calculation in Section 6.5. The estimated median compositional breakdown of operational waste per MW per annum is detailed in Table 20.

Table 20: Wind Operational Waste Composition

Waste type	Estimated tpa/MW	% of whole	Waste type	Estimated tpa/MW	% of whole
Cardboard	0.071	6.93%	Dangerous goods	0.001	0.07%
Liquid Waste (sewerage)	0.857	83.17%	General Waste	0.097	9.38%
Haz Liquid Waste	0.002	0.15%	Co-mingled recycling	0.003	0.28%
		Total (ex. Sewerage)	***0.173 tpa/MW***		
		Grand total	**1.031 tpa/MW**		

Wind Turbine Failure Assumptions

Wind turbine components such as blades, gearboxes, and generators degrade over time due to environmental stress, material fatigue, and mechanical or electrical failures. Factors such as extreme temperatures, humidity, hail, lightning strikes, and internal issues like delamination, corrosion, and electrical faults contribute to their failure. Failure rates are highest in the early years of operation due to infant mortality failures, then gradually decrease over time as defective components are replaced, and more durable components remain in operation longer.

For this study, a Weibull distribution with a shape parameter of k = 0.8468 was applied to model failure rates over time. This reflects a decreasing failure trend, where the initial years see a higher proportion of component failures, followed by a steady decline in annual failure rates as turbines mature.

The modelled failure rate over time is illustrated in Figure 12, showing a rapid decline in failures during the first five years as weaker components fail early. After this initial period, failure rates stabilise and continue to decline gradually over the lifespan of the wind farm, reaching a lower but persistent failure rate beyond 30 years.

However, this modelling does not account for several real-world variables, including:

- Damage to wind turbines sustained during transportation.
- Extreme weather events (e.g., cyclones, hailstorms, bushfires) that may cause mass turbine failures at irregular intervals.
- Repowering or re-energisation, where sections of a wind farm may be upgraded, repurposed, or replaced before reaching 35 years.
- Turbines exceeding their modelled lifespan, as some wind farms may operate beyond 35 years with retrofits and repairs.

Replaced parts have been incorporated into the waste modelling, with typical failure rates per MW over the lifespan of wind farm projects illustrated in Figure 12. The material composition of wind turbines, including recoverable and recyclable materials, is detailed in Table 21.

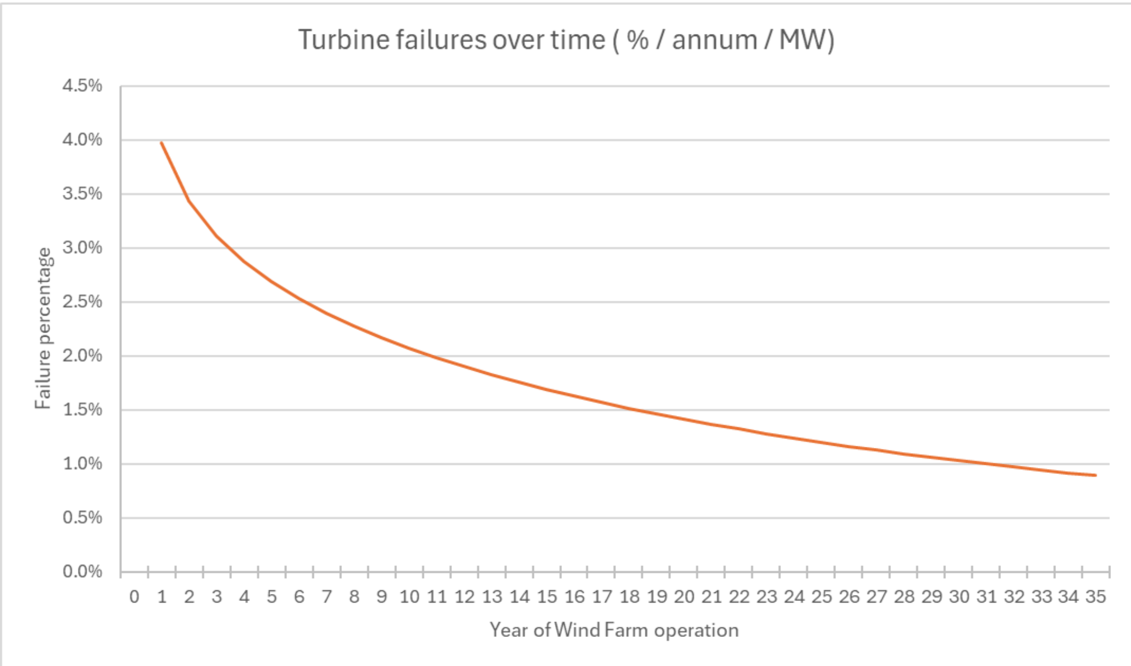


Figure 12: Wind Turbine component Failure Rate over time

Table 21: Typical Composition of Wind Turbines

Component	%	Component	%	Component	%
Blades		**Gearbox**		**Generator**	
Composite of fibre glass, plastics (PUR, PE, PVC), wood (sometimes), and carbon fibre	100.0%	Steel	54.2%	Steel	51.9%
		Iron	44.2%	Iron	42.3%
		Aluminium	1.1%	Aluminium	1.0%
		Other	0.5%	Copper	4.2%
				Electrical components	0.6%

6.4.1.3 BESS

The operation of large-scale BESS generates limited waste from daily activities. Operational staff are expected to produce up to 0.03 tonnes of sewerage per MW annually, alongside minor volumes of general waste. It is assumed that BESS personnel reside permanently within the region, and their per capita waste generation is already accounted for in the workforce waste calculation (see Section 6.5).

Beyond routine operations, waste generation occurs primarily from component failures within the battery modules, electrical systems, and supporting infrastructure. Failures can result from manufacturing defects, wear and tear, or external factors (e.g., thermal runaway, power surges, or extreme weather events). Given that BESS batteries are classified as dangerous goods, they must be handled appropriately, often being reused in less critical secondary applications, extending their functional lifespan before eventual recycling or disposal.

The failure rate of BESS components has been modelled using a Weibull distribution with a shape parameter of k = 0.3197, reflecting a high initial failure rate that declines over time. This aligns with industry observations that early-life failures occur due to defective units, poor manufacturing quality, or installation errors[2]. As systems stabilise, the failure rate decreases until end-of-life decommissioning, when all remaining components must be removed, recycled, or disposed of.

Figure 13 illustrates the failure rate distribution over the 20-year operational lifespan of a BESS battery. The steep drop in early years reflects initial defects and installation failures, followed by a gradual stabilisation. Figure 14 provides a breakdown of failures by component type, showing that battery modules contribute only 11% of total failures, while electrical components (46%) and support infrastructure (43%) account for the majority of waste over the BESS lifecycle.

Key assumptions and limitations of the modelling include:

- Only the weight of the battery components within the BESS has been accounted for in waste projections.
- Supporting infrastructure, such as power conversion systems, cooling units, and enclosures, has not been included due to unknown material compositions.
- The model does not factor in extreme failure scenarios caused by catastrophic weather events or safety-related shutdowns.

[2] EPRI (2024), Insights from EPRI's Battery Energy Storage Systems (BESS) Failure Incident Database Analysis of Failure Root Cause

- The majority of BESS-related waste will be generated during the decommissioning phase when all components reach the end of their functional life.

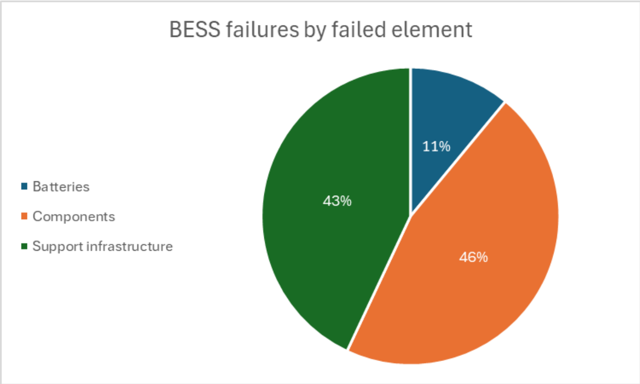


Figure 13: BESS failures by failed element

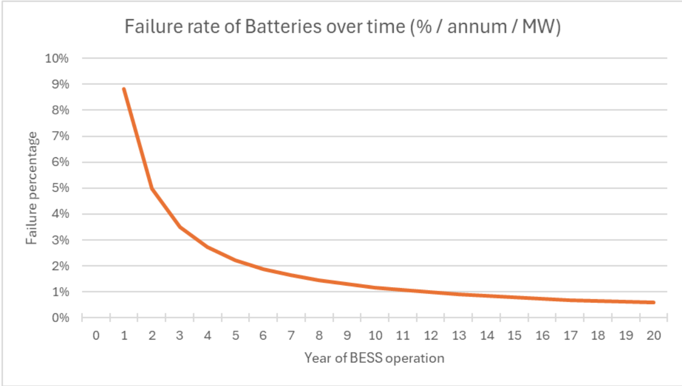


Figure 14: Battery Failure Rate over time

6.4.1.4 PHES

The operational phase of PHES projects will generate significantly less waste than the construction phase due to the sharp decrease in workforce presence and the absence of large-scale construction activities. Given the long operational lifespan of PHES plants, often exceeding 100 years, waste generation will be largely limited to routine maintenance, vegetation management, and periodic component replacements.

The primary types of waste expected during operations include:

- General waste: Office and workshop waste, packaging materials, and litter from maintenance personnel.
- Wastewater & sewage: Generated from site personnel, typically managed through onsite treatment or removal by a licensed contractor.
- Vegetation waste: Resulting from land and reservoir management, such as clearing of overgrown areas or aquatic vegetation control.
- Mechanical & electrical waste: Components replaced during routine servicing or major overhauls, including worn-out turbines, generators, transformers, electrical cables, and control system components.
- Hazardous waste: Used lubricants, solvents, hydraulic fluids, fire suppression chemicals, spent batteries, and contaminated materials from drainage system cleaning or sump maintenance.
- Sediment & sludge: Accumulation from water intake structures and reservoirs, requiring periodic removal and proper disposal.

Waste volumes are currently unknown, but they are expected to fluctuate depending on maintenance schedules, with periodic spikes during major overhauls or component replacements. Given the extended lifespan of PHES facilities, asset renewal programs will be essential in defining long-term waste projections and infrastructure needs.

Waste generated by operational personnel is accounted for separately in Section 6.5.

6.4.2 Non-renewable energy

Figures for expected waste types and quantities from non-renewable energy projects were primarily sourced from proponents' planning documents, particularly the waste chapters of the EIS. Where these were unavailable or lacked sufficient detail, data was supplemented with EIS documents from similar projects. The level of detail across these sources varied significantly, ranging from comprehensive datasets to minimal or no information. Additionally, differences in project scale and components contributed to the broad range of reported waste quantities.

6.4.2.1 Coal & Coal Mining

Coal-related projects, particularly those associated with power stations, are expected to generate minimal operational waste, primarily from routine maintenance activities. This waste has already been accounted for in the baseline modelling, while waste from workers is covered in Section 6.2.

For coal mining projects, operational waste is also anticipated to be low, as most waste streams are managed internally within existing waste handling systems. The primary waste streams include lubricants and waste oils, scrap metal, and worker-generated waste (which has been accounted for in Section 6.5).

Given the established waste management systems in coal operations, these waste streams are well-regulated and unlikely to contribute significantly to regional waste generation beyond what has already been modelled.

6.4.2.2 Education

Both educational projects within the study area are already operational, and their waste types and volumes are incorporated into the baseline waste generation rates in Section 6.2.

6.4.2.3 Electricity Generation – other

The Liddell Power Station project is focused on demolition and decommissioning, with no confirmed plans for a replacement facility at this stage. As a result, no operational waste volumes have been identified.

6.4.2.4 Extractive industries

Operational waste is expected to be minimal, with the majority of waste retained and managed onsite. The primary waste stream arises from workers, primarily in the form of sewerage, which is managed through onsite treatment systems or disposal pathways. Waste generated by operational staff has been addressed in Section 6.4

Additional waste streams include general waste, minor quantities of metals, lubricants and oils from plant and machinery, and co-mingled recyclables. Operational waste is estimated at 20.7 tpa per 500,000 tpa processing capacity.

6.4.2.5 Food, beverage, and tobacco manufacturing

The primary waste generated by poultry and poultry feed facilities consists of general waste from farm managers' residences, while the majority of operational waste is managed on-site or recovered through supplier take-back programs.

The waste generation rate is estimated at 5.9 tonnes per 1 million chickens per annum. Given the high degree of waste recovery and reuse within poultry operations, residual waste requiring off-site disposal is expected to be minimal.

6.4.2.6 Gas pipeline

The operation of gas pipelines generates minimal waste, primarily associated with routine maintenance and equipment servicing. The estimated waste generation rate is 0.03 tonnes per kilometre per annum, with key waste streams including filters, packaging waste, oils and greases, and sludge (pigging waste). Given the linear nature of gas pipeline infrastructure, waste is expected to be generated at distributed locations, primarily at metering stations, compressor stations, and maintenance access points.

6.4.2.7 Roads

The operational phase of road infrastructure projects will generate low but continuous volumes of waste, primarily from routine maintenance, repair works, and roadside litter collection. Waste quantities will vary depending on traffic volumes, weather conditions, and maintenance frequency, making it difficult to establish definitive waste generation rates. Typical wastes include roadside litter, green waste, oils and lubricants, road materials, and contaminated waste.

6.4.2.8 Waste collection, treatment and disposal

Operational waste is expected to be minimal, with all the waste retained and managed onsite. The primary waste stream arises from workers, primarily in the form of sewerage, which is managed through onsite treatment systems or disposal pathways. Waste generated by operational staff has been addressed in Section 6.4

6.4.2.9 Transmission

The operation of transmission lines is expected to generate limited waste, primarily from ongoing maintenance activities, including:

- Green Waste: Vegetation trimming within the transmission line easement.
- Maintenance Waste: Small quantities of waste materials from the replacement of fittings and equipment.
- General Domestic Waste: Produced by operation and maintenance personnel.

It is assumed that operational staff reside permanently within the region, and their per capita waste generation is included the workforce calculation in Section 6.5.

6.5 Workforce waste generation during construction and operation

The construction workforce will generate a range of general waste streams throughout the delivery of a project, including:

- Food waste
- Sewerage
- Co-mingled recyclables (paper, cardboard, plastic, glass, mixed metals)
- Residual non-putrescible material

To estimate the volume of waste generated by the temporary construction workforce and operational workforce, an LGA-based proxy approach was applied. Given that accommodation camps are dispersed across multiple LGAs, and that waste generation rates show little variation between these LGAs, the average per capita waste generation rate was deemed an appropriate benchmark.

Accordingly, the estimated waste volume per worker is 0.64 tpa, consistent with average residential waste generation rates across the LGAs. Workforce numbers and project timelines were sourced from the Data and Assumptions Book.

7 Waste Quantity Projections

This section presents the projected quantities of solid waste likely to be generated across the NE REZ and NE REZ Project corridor between 2025 and 2033. The results are based on the modelling approach detailed in Section 6.1 and illustrate cumulative impacts under three scenarios, with Scenarios 2 and 3 each modelled using two sensitivities: a Baseline Estimate and an Upper Limit Estimate.

Important Notes:

- Sewerage volumes have been excluded from the figures to avoid skewing results, given their disproportionately high volumes and separate treatment pathway. Sewerage management is addressed in the parallel Water and Wastewater Security Study being undertaken by Jacobs.
- Upper Limit projections reflect a worst-case scenario, based on high- and medium-probability projects. These estimates likely exceed actual future volumes, as the total capacity of proposed projects surpasses current transmission infrastructure limits and some projects may not proceed.
- Revisions to AEMO's delivery timelines may delay these projections by up to 12 months.

Key findings from the projections are discussed in the subsections below.

7.1 Scenario 1

This baseline represents the 'do-nothing' scenario, with no impact from NE REZ developments. It reflects the status quo of waste generated by residents and typical commercial activities within the ten affected LGAs of the Study Area. As such, it provides the reference case against which Scenarios 2 and 3 are compared. Any increases in waste under those scenarios can be interpreted as attributable to non-renewable and renewable energy developments, respectively.

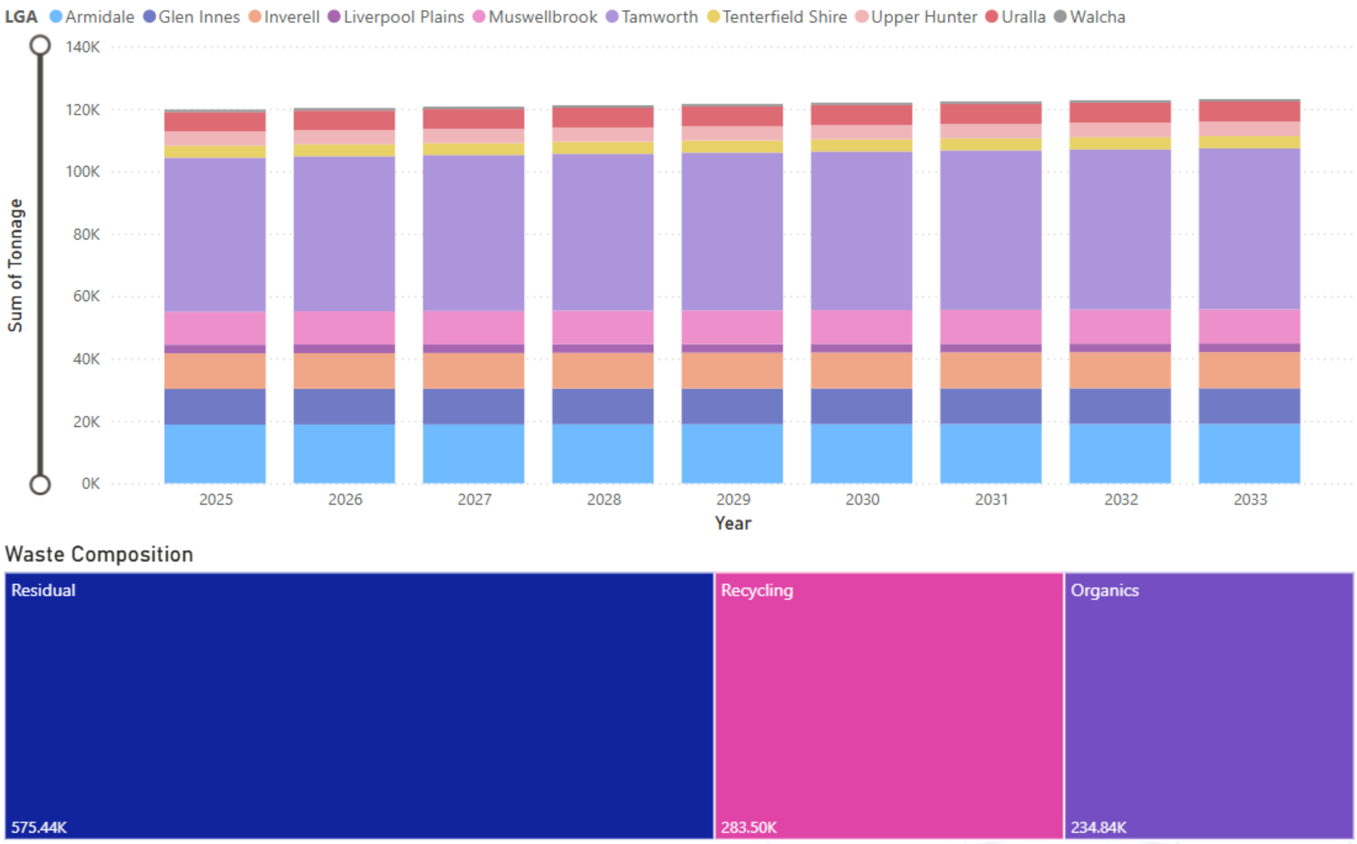


Figure 15: Scenario 1 – Baseline Waste Projections

Key findings

1. Total baseline waste generation remains relatively stable from 2025 to 2033, averaging around 120K tpa. This reflects the assumption that, in the absence of major new developments (i.e. no NE REZ projects), population and commercial growth is incremental and steady.
2. Tamworth Regional Council is the dominant contributor throughout the projection period followed by Armidale. This is consistent with their larger population base and urban profile. Inverell, Glen Innes, and Muswellbrook also contribute substantial baseline volumes. The remaining smaller LGAs contribute relatively minor volumes, which is expected given their smaller populations and lower commercial activity.
3. Waste Composition
    a. Across the period, cumulative waste volumes is composed of:
        i. Residual waste: ~575K tonnes (largest component)
        ii. Recycling: ~283K tonnes
        iii. Organics: ~234K tonnes
    b. The high proportion of residual waste indicates continued reliance on landfill, with scope to increase diversion through recycling and organics processing.
4. Diversion Opportunities
    a. Combined, recycling and organics represent 47% of the total baseline waste stream, highlighting a strong foundation for further diversion efforts if infrastructure and programs are enhanced.
    b. Residual waste still comprises over 50%, signalling that landfill reliance remains high in the absence of stronger circular economy policies or initiatives.

7.2 Scenario 2

7.2.1 Baseline estimate

Scenario 2 builds on the baseline by incorporating projected waste from non-renewable infrastructure and development projects. These include utilities, extractive industries, food, beverages and tobacco manufacturing and other conventional infrastructure. The Baseline Estimate within this scenario includes only high-probability projects (Figure 16) and excludes all renewable energy developments. As such, it isolates the impact of ongoing and imminent non-renewable developments within the Study Area.

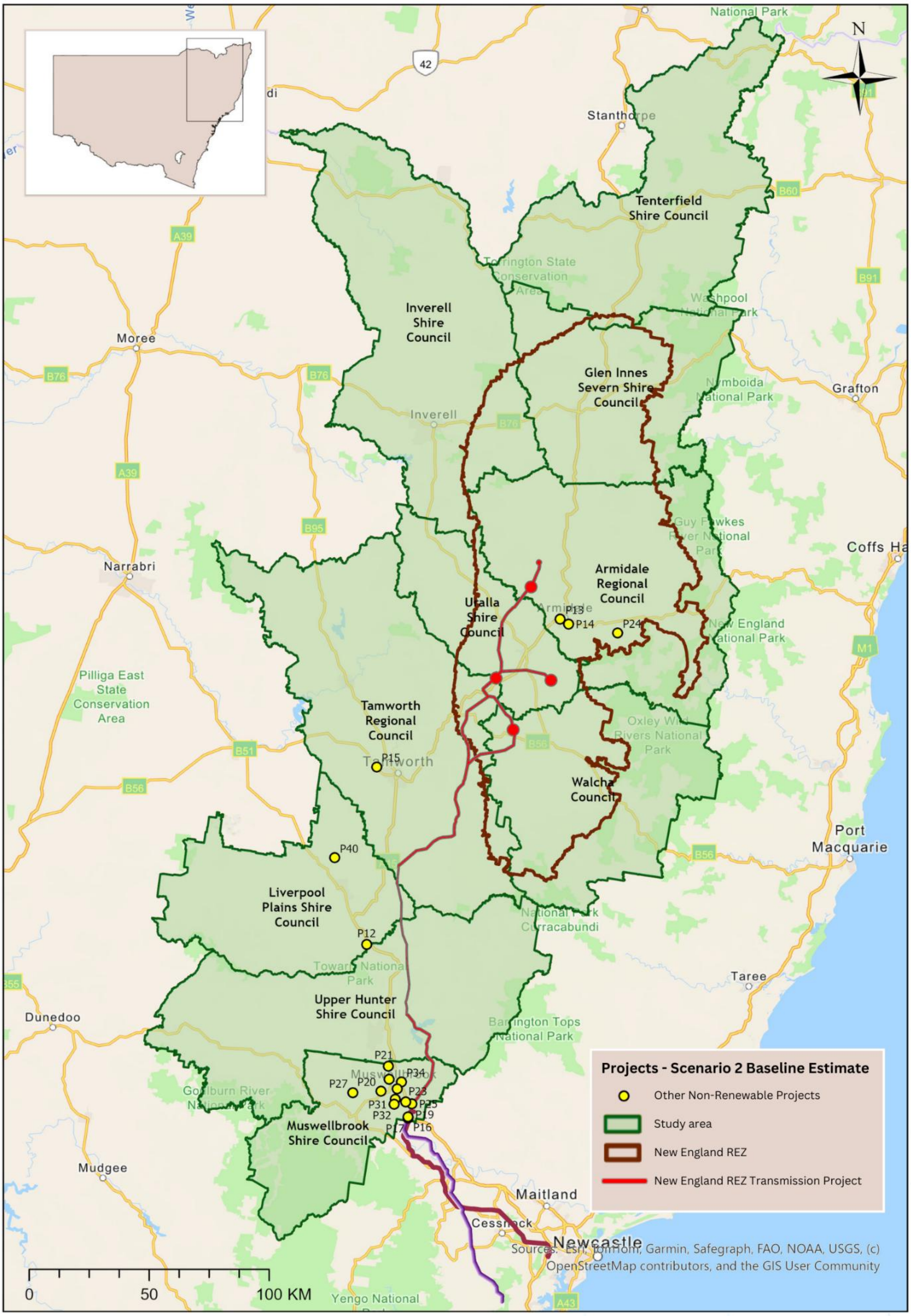


Figure 16: Scenario 2 Baseline Estimate, Map of Projects

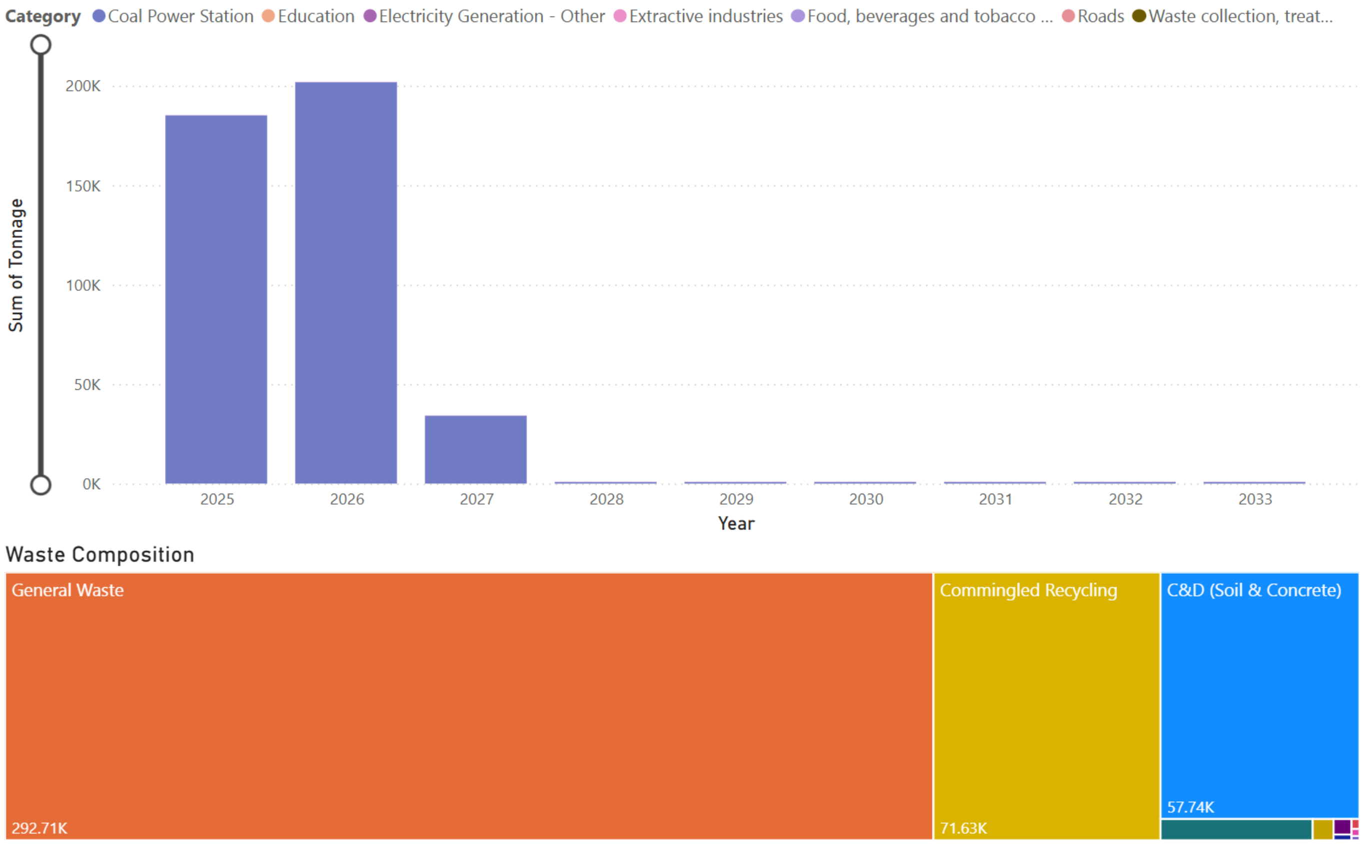


Figure 17: Scenario 2 Baseline Estimate Waste Projections excluding Scenario 1

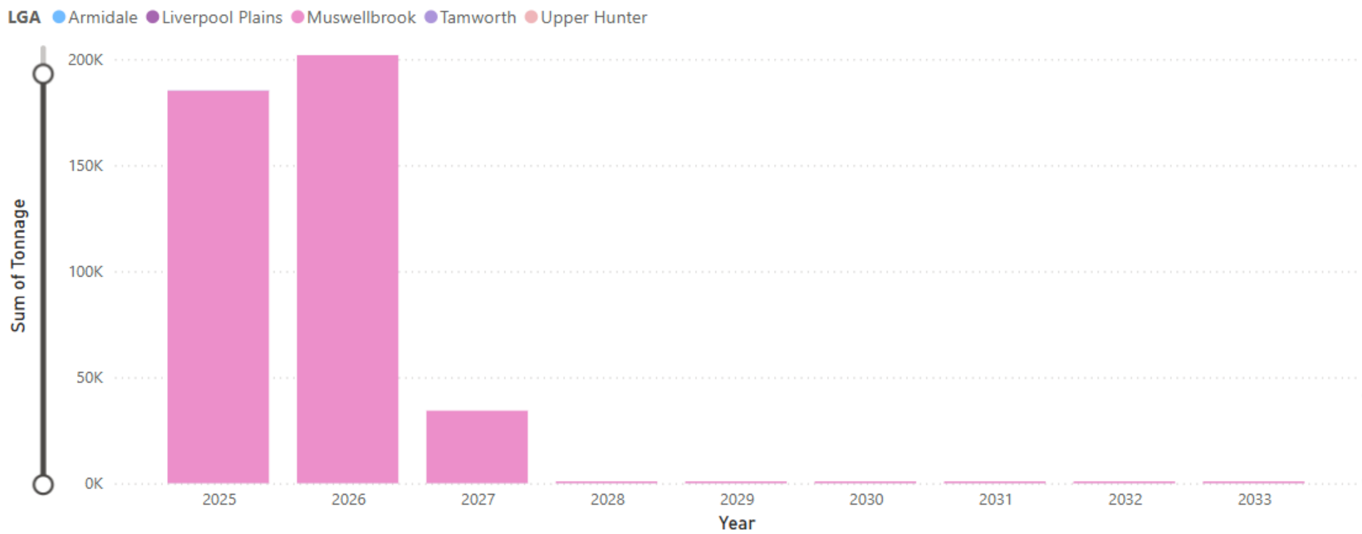


Figure 18: Scenario 2 Baseline Estimate Waste Projections excluding Scenario 1 (by LGA)

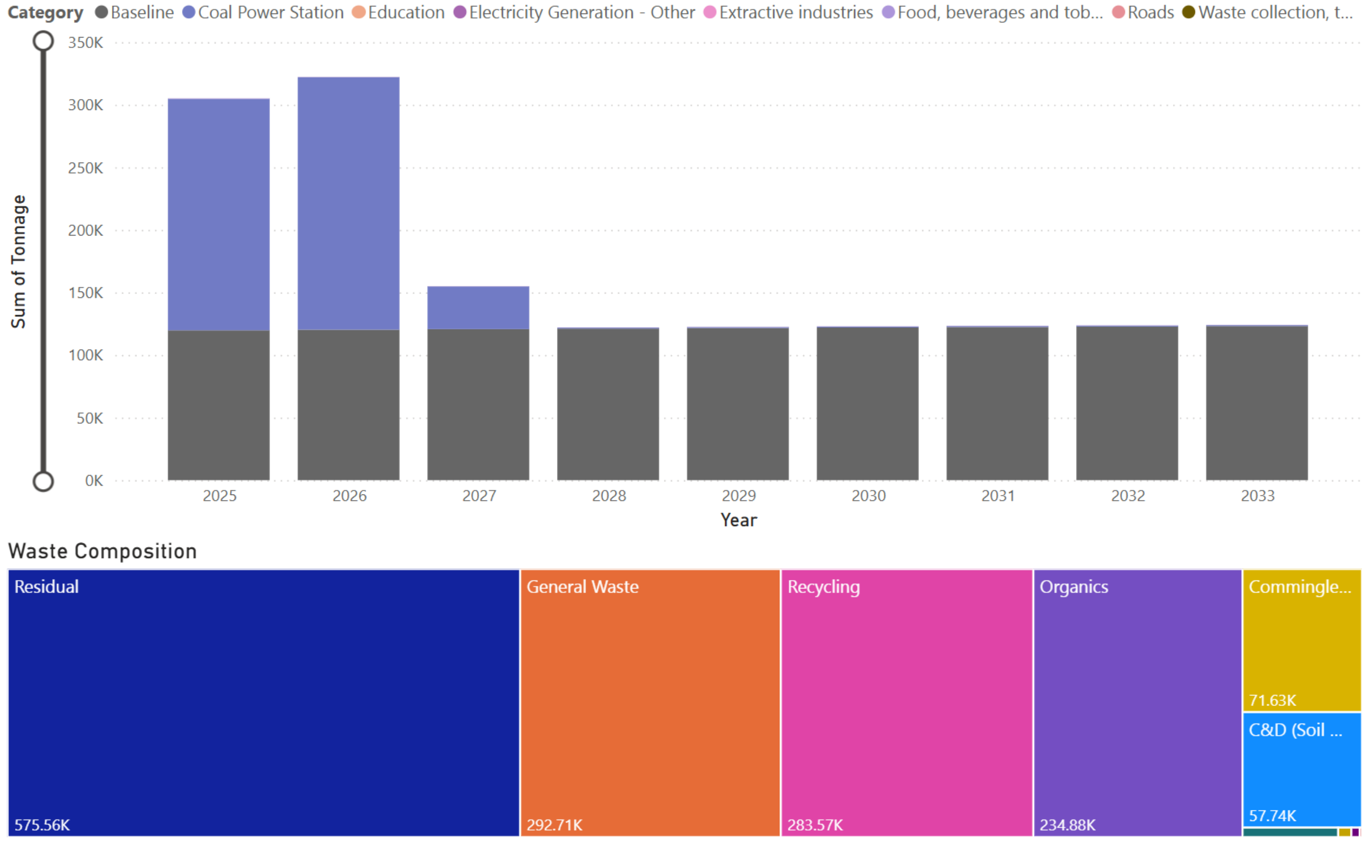


Figure 19: Scenario 2 Baseline Estimate Waste Projections

Key Findings

1. Projected waste volumes peak sharply between 2025 and 2027, after which they drop off significantly (Figure 17). This spike corresponds to major early-stage construction and infrastructure works. Beyond 2027, volumes return to baseline levels, reflecting the temporary nature of these development activities. These projections reflect current knowledge of committed and proposed developments, with future projects potentially altering waste volumes beyond 2027.
2. Muswellbrook Shire is the largest single contributor across the scenario (Figure 18), driven predominantly by coal power station-related activities.
3. Sectoral Waste Drivers
    a. Coal Power Station projects account for the bulk of the waste, contributing ~425K tonnes of waste (Figure 17).
    b. Extractive industries contribute around a baseline of 105 tpa throughout the modelling period. This includes metal, hazardous liquids, and recyclables.
    c. Food, Beverage and Tobacco Manufacturing projects contribute once off in 2025. This includes residual waste and recycling.
4. Waste Composition
    a. General Waste dominates the scenario, accounting for ~293K tonnes (more than 60% of total).
    b. Commingled Recycling contributes ~72K tonnes.
    c. C&D Waste contributes ~58K tonnes.
    d. Minor streams include metal, liquid hazardous waste, and dangerous goods from industrial sectors.

5. The waste profile offers limited but meaningful opportunities for diversion, particularly for commingled and C&D materials, however, the overwhelming proportion of general waste, highlights the continued reliance on landfill.

This scenario underscores the transient yet high-impact nature of non-renewable developments on the regional waste profile, particularly in Muswellbrook which is expected to experience the heaviest short-term demand.

7.2.2 Upper limit estimate

The Upper Limit Estimate for Scenario 2 includes both high- and medium-probability non-renewable development projects (Figure 20), providing a conservative, worst-case projection of future waste volumes. This scenario assumes a greater number of developments proceed, and the staged rollout of large-scale transmission infrastructure. This broader pipeline of development results in a more sustained and regionally distributed waste impact profile across the Study Area.

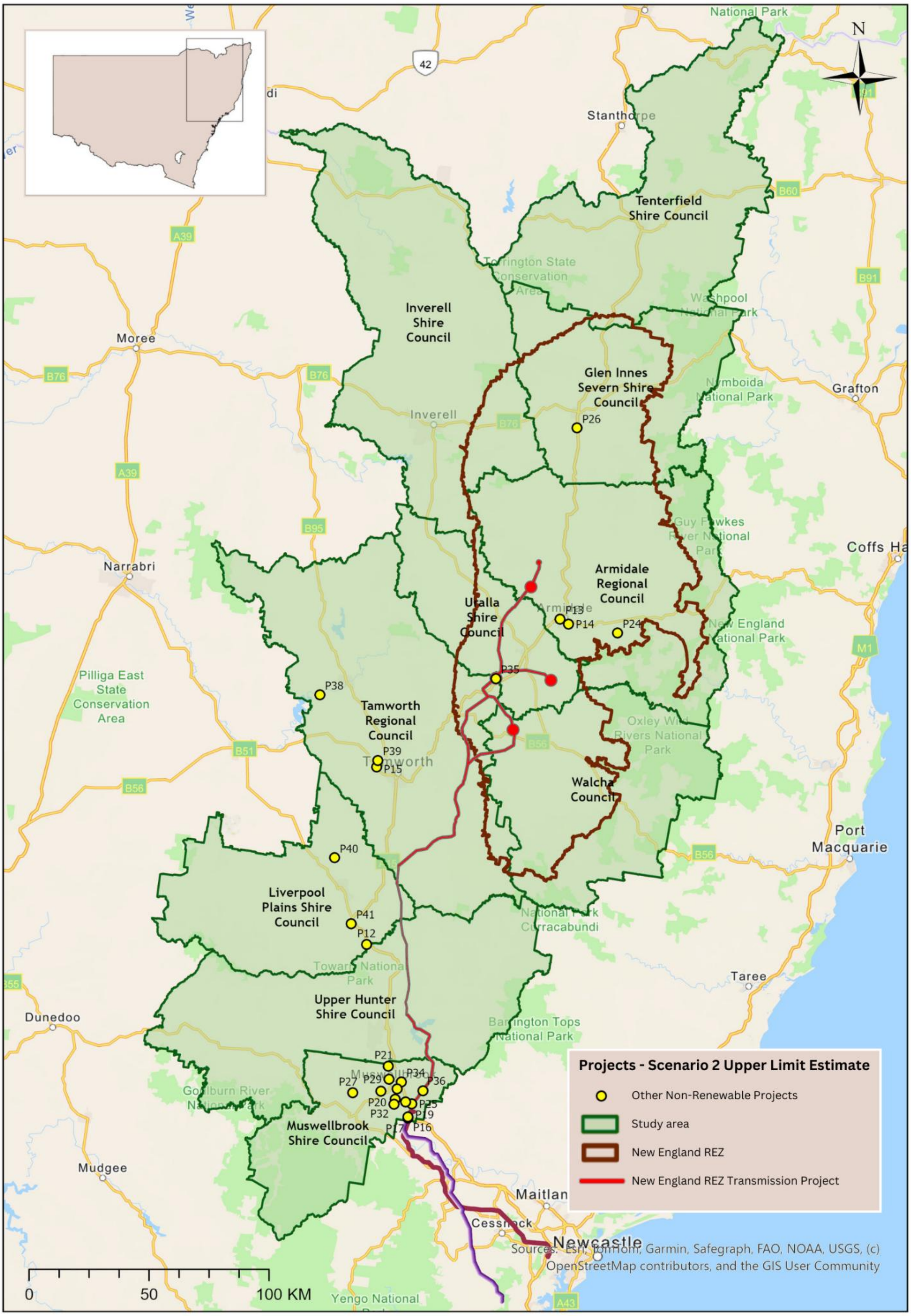
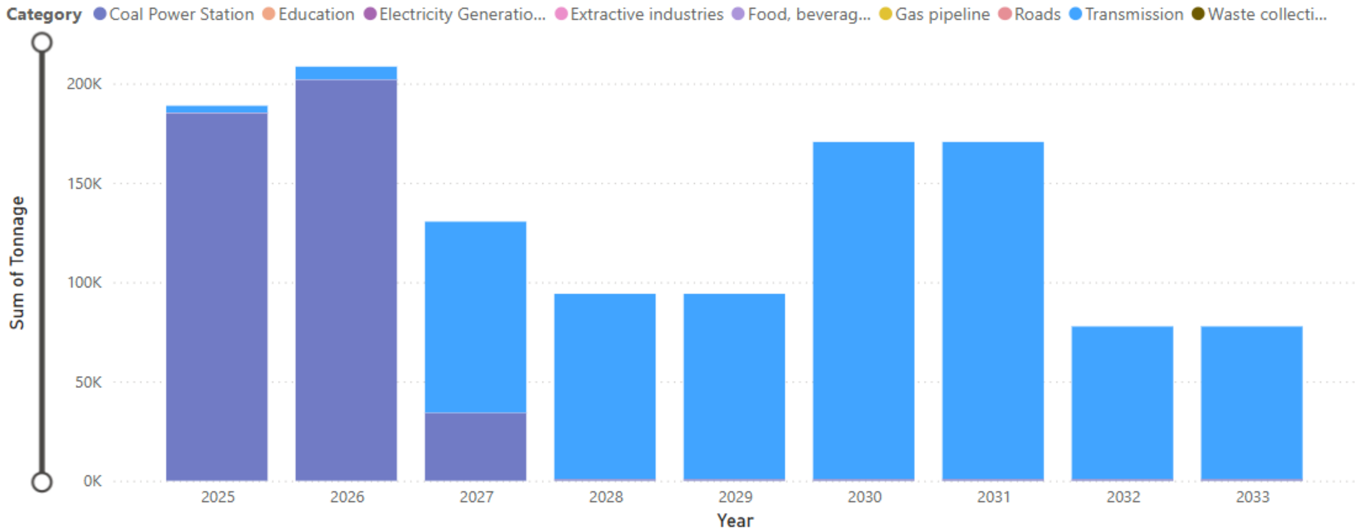


Figure 20: Scenario 2 Upper Limit Estimate, Map of Projects



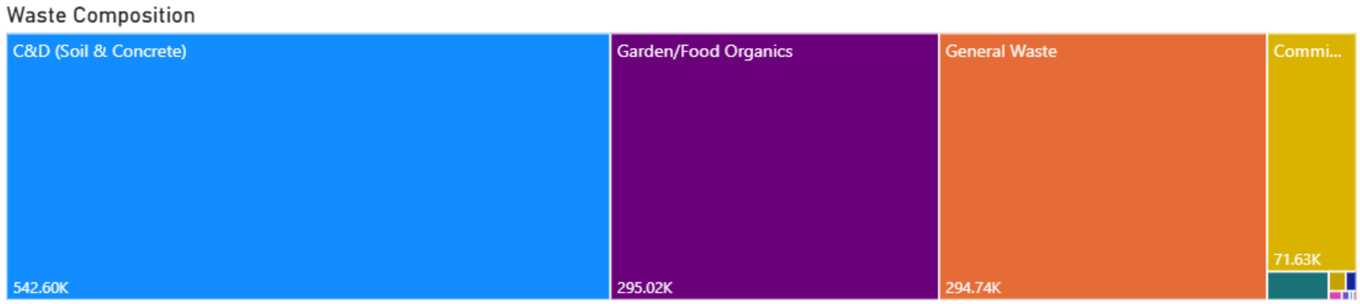


Figure 21: Scenario 2 Upper Limit Estimate Waste Projections excluding Scenario 1

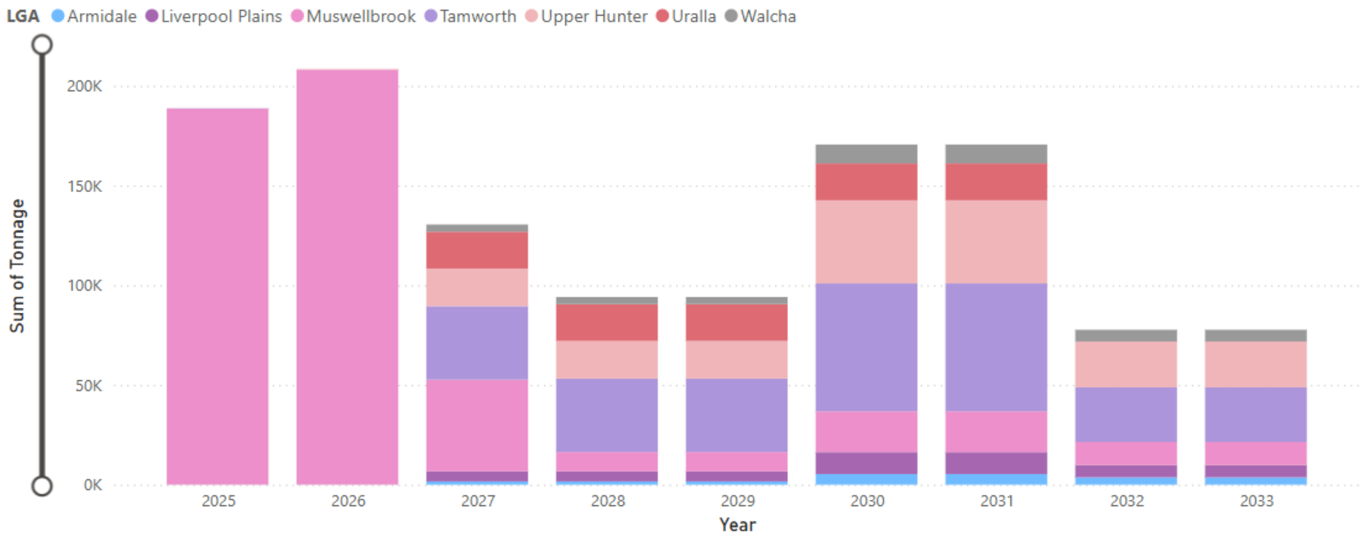


Figure 22: Scenario 2 Upper Limit Estimate Waste Projections excluding Scenario 1 (by LGA)

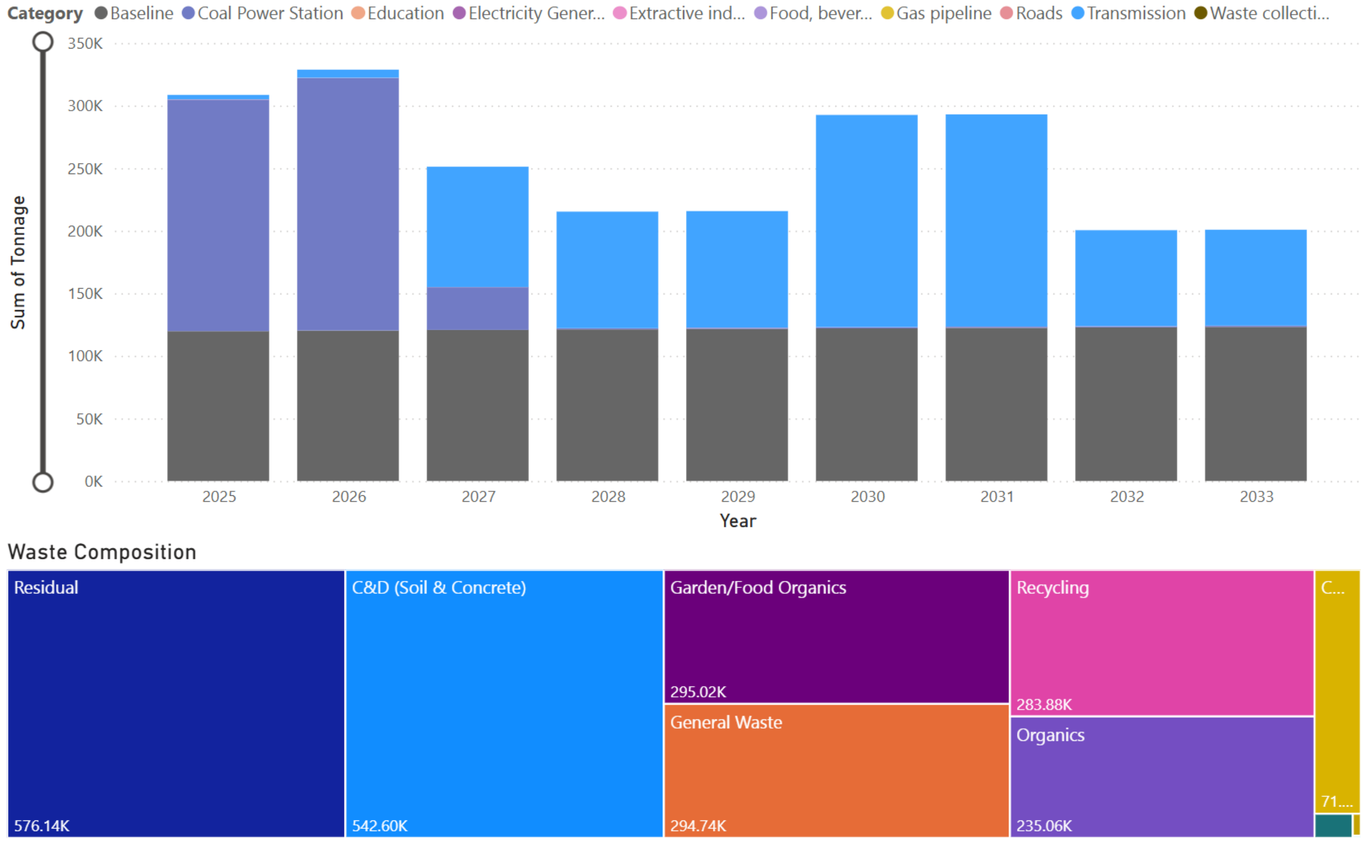


Figure 23: Scenario 2 Upper Limit Estimate Waste Projections

Key Findings

1. Unlike the Baseline Estimate, which showed a short, early spike, the Upper Limit projection exhibits sustained waste generation from 2025 to 2033. This reflects the inclusion of a larger number of medium-probability projects and a prolonged infrastructure delivery period (Figure 21).
2. Transmission line construction is the primary driver of waste under this scenario. These projects span multiple LGAs and extend throughout the study period, resulting in a more even spatial and temporal waste distribution. The largest contributions occur between 2027 and 2031.
3. Construction-related activities remain the overwhelming source of waste generation across the study period, with limited operational or workforce-related waste.
4. Broader LGA Impact
    a. Muswellbrook continues to dominate early-year volumes due to Coal Power Station projects.
    b. From 2027 onward, LGAs such as Tamworth, Upper Hunter, Uralla, and Walcha see elevated waste volumes due to their role in hosting transmission infrastructure (Figure 21).
5. Waste Composition
    a. C&D Waste (Soil & Concrete): Becomes the largest waste stream at ~543K tonnes, reflecting major civil construction works.
    b. Garden/Food Organics: Increase significantly to ~295K tonnes, indicating land disturbance and vegetation clearing.
    c. General Waste: Remains high at ~295K tonnes, a mix of operational, workforce and industrial inputs.
    d. Commingled Recycling: Steady at ~72K tonnes, with minor additional streams.

6. Implications for Resource Recovery and Infrastructure Capacity
    a. The sustained and geographically dispersed waste profile places increased pressure on existing waste infrastructure across the Study Area, particularly in smaller LGAs.
    b. The dominance of construction waste (C&D and organic materials) presents a substantial opportunity for recovery if temporary or mobile infrastructure can be deployed or upgraded facilities are brought online in time.
    c. Without adequate recovery options, a significant proportion of this waste is likely to be landfilled, increasing the risk of premature capacity exhaustion at key sites and escalating transport costs for project proponents.

This scenario highlights the compounded impact of including medium-probability non-renewable projects, particularly linear infrastructure like transmission, and underscores the critical need for early coordination between project proponents, councils, and waste facility operators.

7.3 Scenario 3

7.3.1 Baseline estimate

Scenario 3 builds upon the previous scenarios by incorporating the projected waste generated from renewable energy developments, including solar and wind farms, BESS, PHES. This scenario captures the combined impact of both renewable and non-renewable developments on regional waste generation. The Baseline Estimate includes only high-probability renewable and non-renewable projects (Figure 24). It provides the most comprehensive outlook for future waste generation associated with NE REZ and NE REZ Project development.

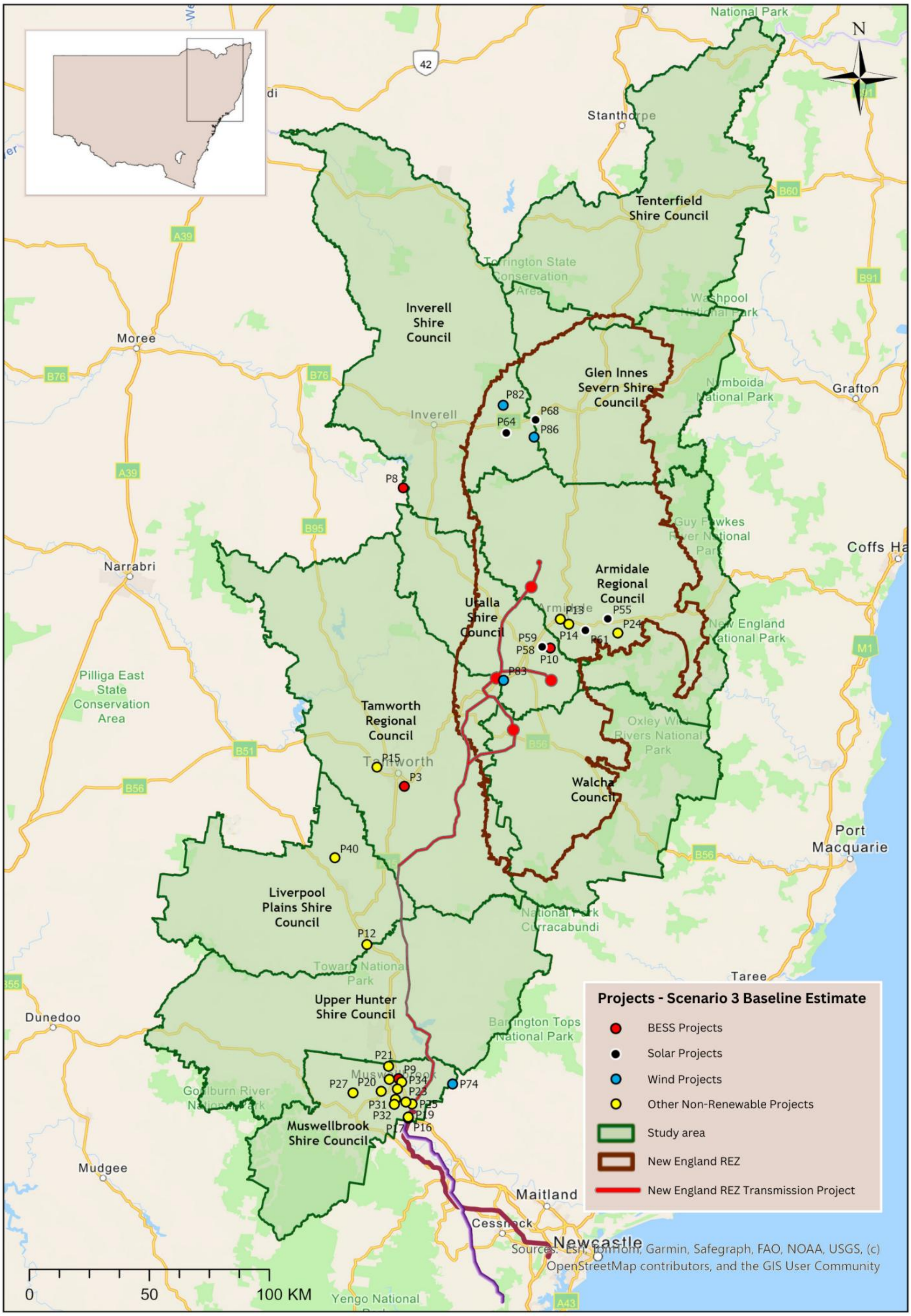


Figure 24: Scenario 3 Baseline Estimate, Map of Projects

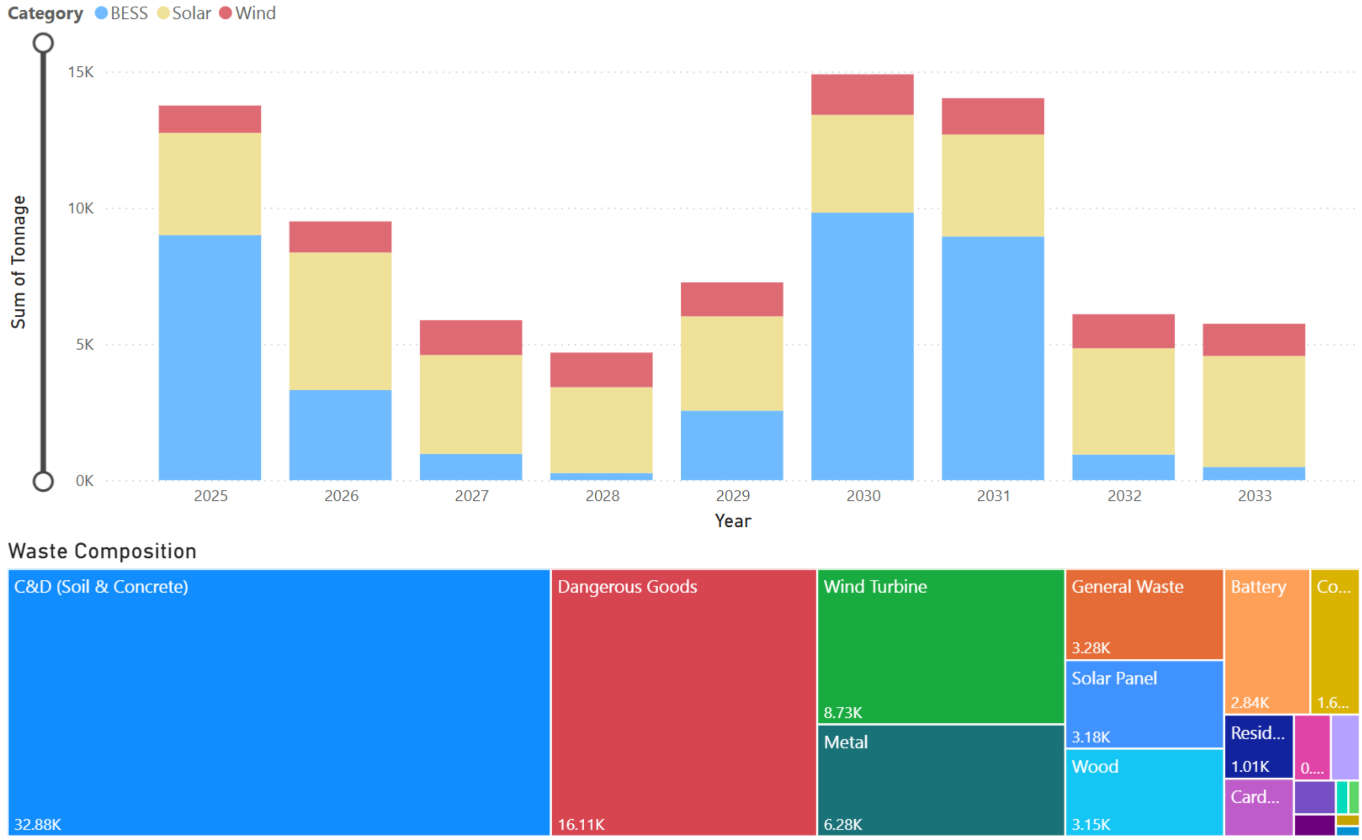


Figure 25: Scenario 3 Baseline Estimate Waste Projections – Renewable Energy Projects only

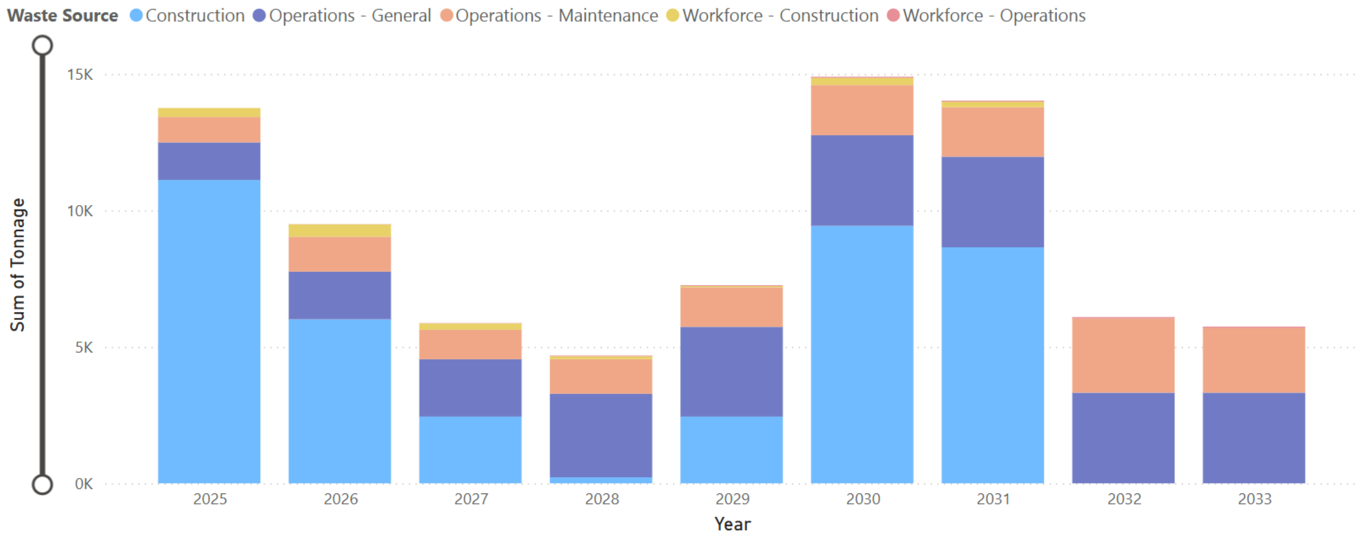


Figure 26: Scenario 3 Baseline Estimate Waste Projections – Delivery Stage (Renewable Energy Projects only)

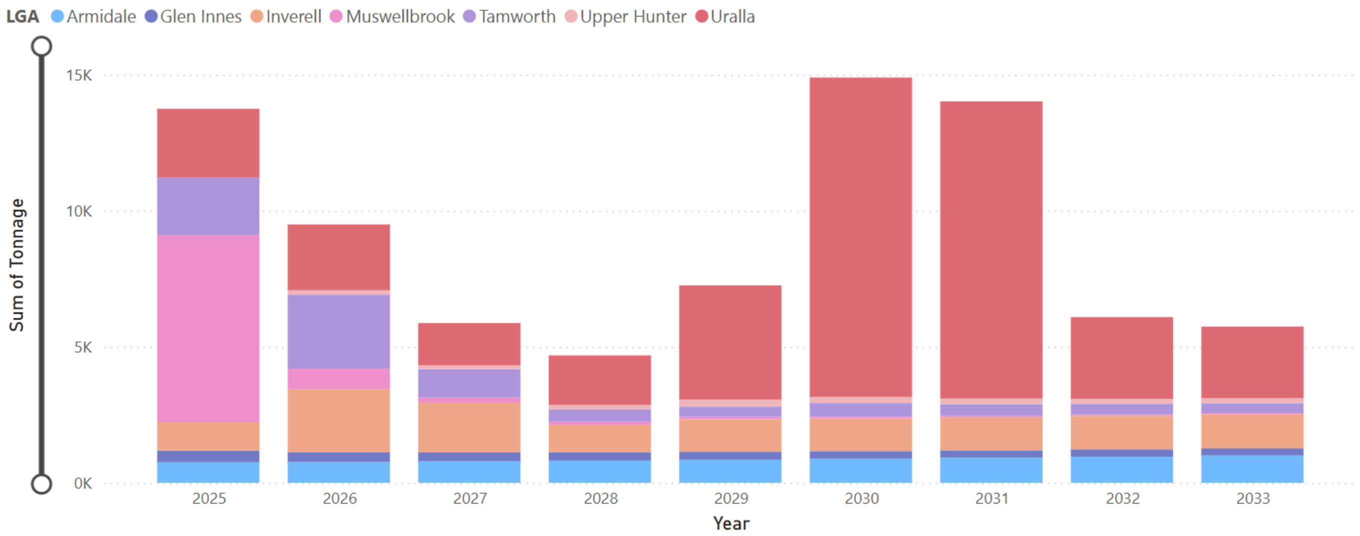


Figure 27: Scenario 3 Baseline Estimate Waste Projections – Impacted LGA (Renewable Energy Projects only)

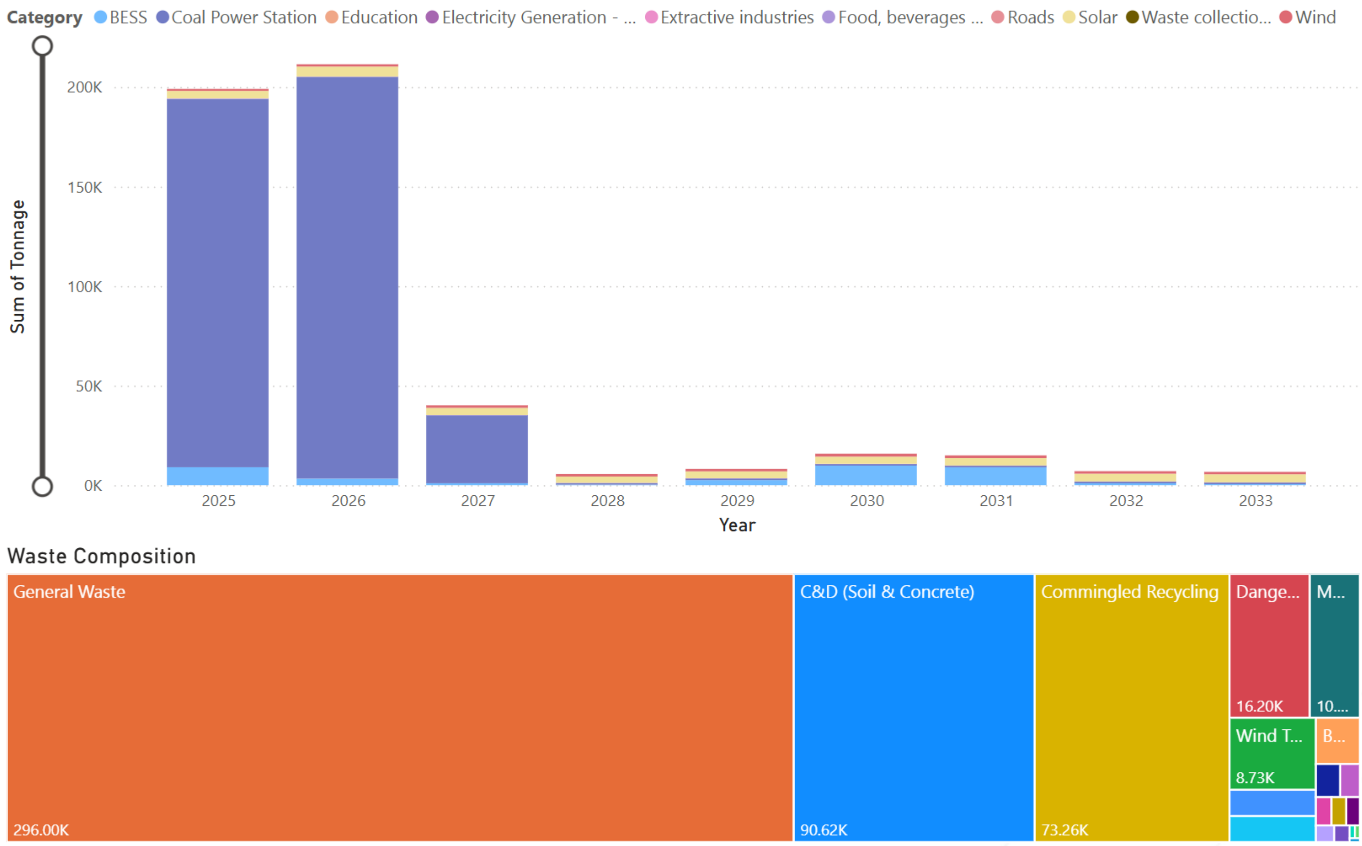


Figure 28: Scenario 3 Baseline Estimate Waste Projections from projects excluding Scenario 1

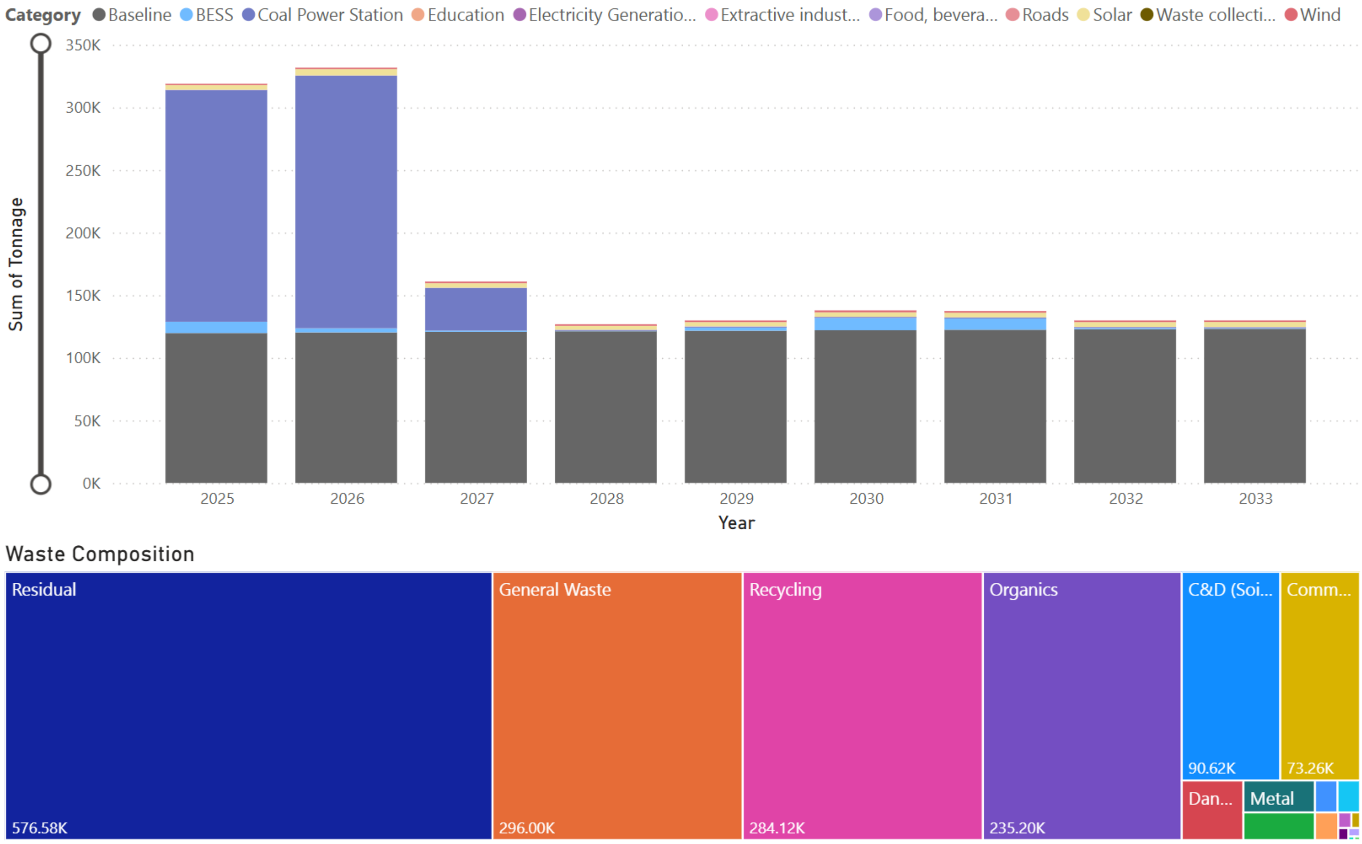


Figure 29: Scenario 3 Baseline Estimate waste projections from project categories

Key Findings

1. The waste generated solely from renewable projects is modest when compared to the Study Area's baseline waste volumes and the waste from non-renewable projects (Figure 29).
    a. Baseline waste continues to dominate regional volumes.
    b. Non-renewable developments remain the primary drivers of projected increases.
    c. Renewable project waste, while significant for specific LGAs, represents a relatively minor component of the overall regional burden.
2. Waste generation from renewable projects is spread across the study period, with minor peaks observed in 2025–2026 and again in 2030–2031. These peaks align with delivery stages of the NE REZ (Figure 25).
3. The composition of renewable energy projects generates a specialised waste profile (Figure 25), including:
    a. C&D waste (Soil & Concrete) (~32.9K tonnes)
    b. Dangerous Goods (~16.1K tonnes)
    c. Wind Turbine Components (~8.7K tonnes)
    d. Solar Panels (~3.2K tonnes)
    e. Metal Waste (~6.3K tonnes)
    f. Smaller quantities of batteries, residual waste, wood, cardboard, and plastics
4. LGA specific impacts (Figure 27):
    a. Uralla, Tamworth, Muswellbrook and Armidale emerge as the LGAs most impacted by renewable energy waste.

b. Impact relative to baseline waste generation:
    i. Uralla: Most significant relative increase, experiencing up to an 81% spike in 2030–2031 and a sustained 65% increase over the second half of the study period.
    ii. Upper Hunter: 56% increase in 2028, averaging 42% above baseline.
    iii. Armidale: Moderate impact, peaking at a 50% increase in 2027, averaging 30% over the study period.
    iv. Tamworth: Peaks at a 20% increase in 2026, averaging 17% across the period.

5. Implications for Resource Recovery
    a. Renewable projects offer strong opportunities for recycling and recovery due to their specialised waste streams (solar panels, batteries, metals, organics).
    b. Planning should target these streams to minimise landfill reliance and maximise resource recovery, especially for solar panels, battery systems, wind turbine components, and associated construction waste.
    c. Given the spike patterns, targeted resource recovery infrastructure upgrades or services could be staged around key peak delivery years (2025–2026 and 2030–2031).

7.3.2 Upper limit estimate

Scenario 3 Upper Limit builds on the baseline estimate by including both high- and medium-probability projects (Figure 30), capturing a broader and more ambitious rollout of developments across the Study Area. It provides a conservative, worst-case assessment of the potential waste impacts from developments, offering a comprehensive view of how waste generation could escalate if a larger share of planned projects is realised.

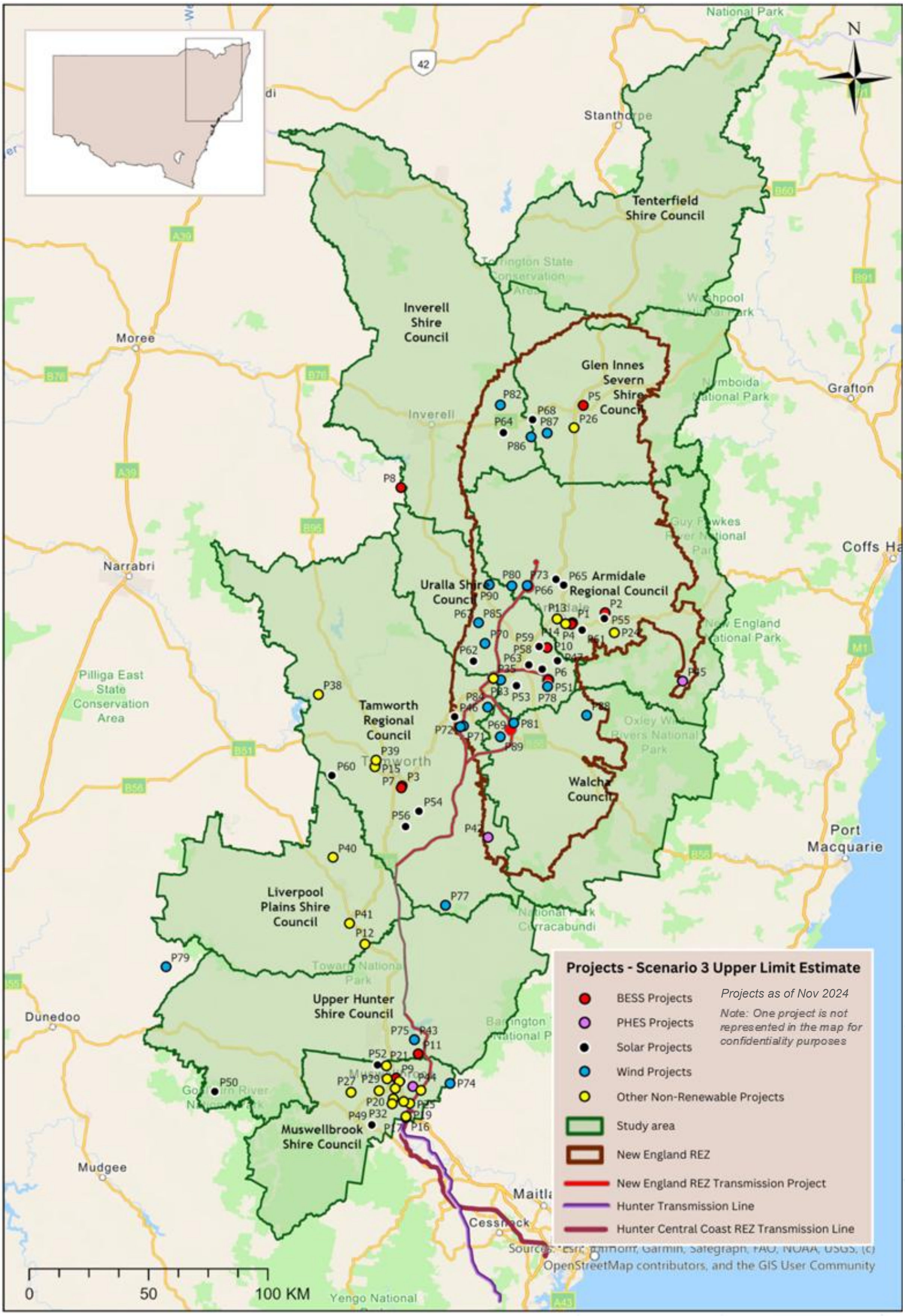


Figure 30: Scenario 3 Upper Limit Estimate, Map of Projects

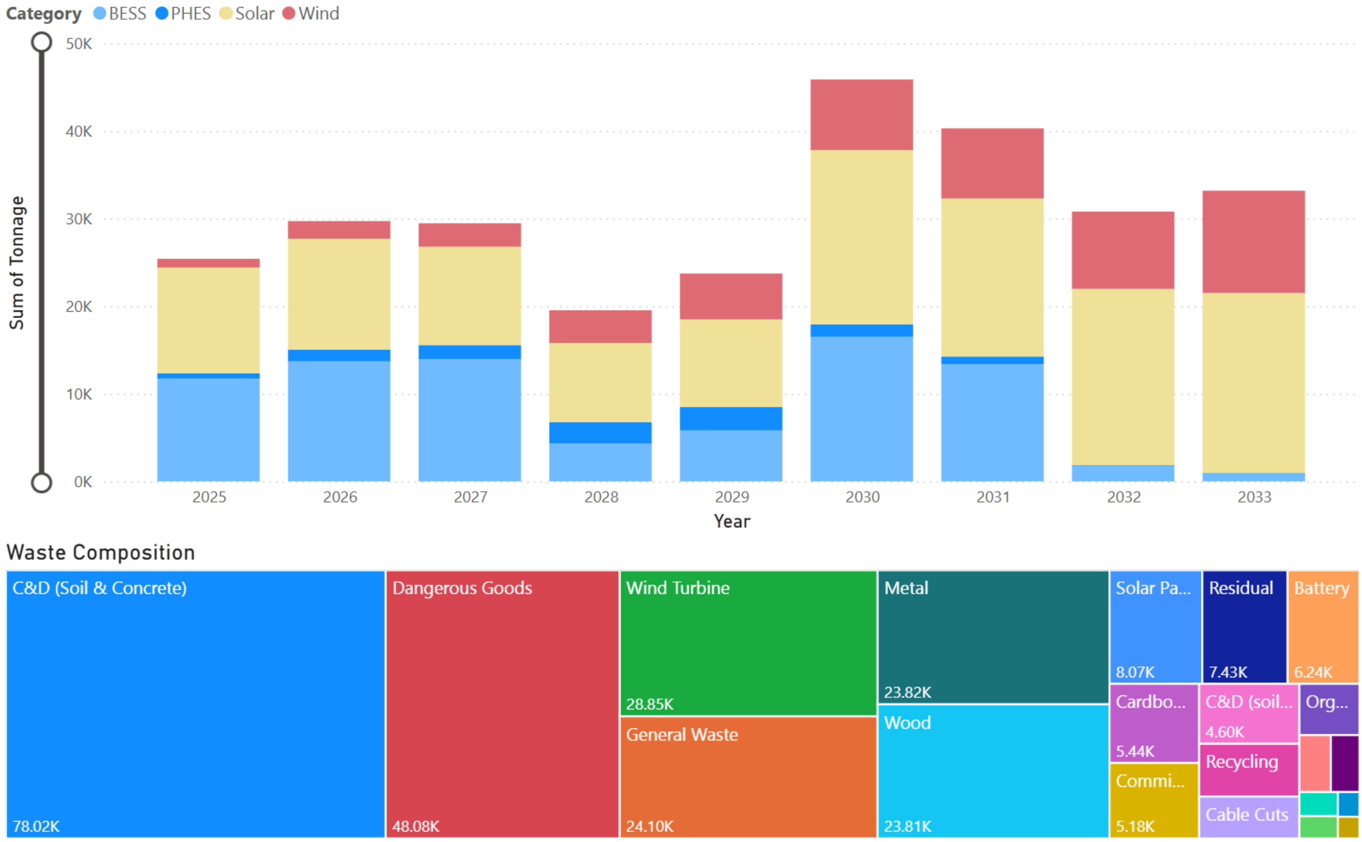


Figure 31: Scenario 3 Upper Limit Estimate Waste Projections – Renewable Energy Projects only

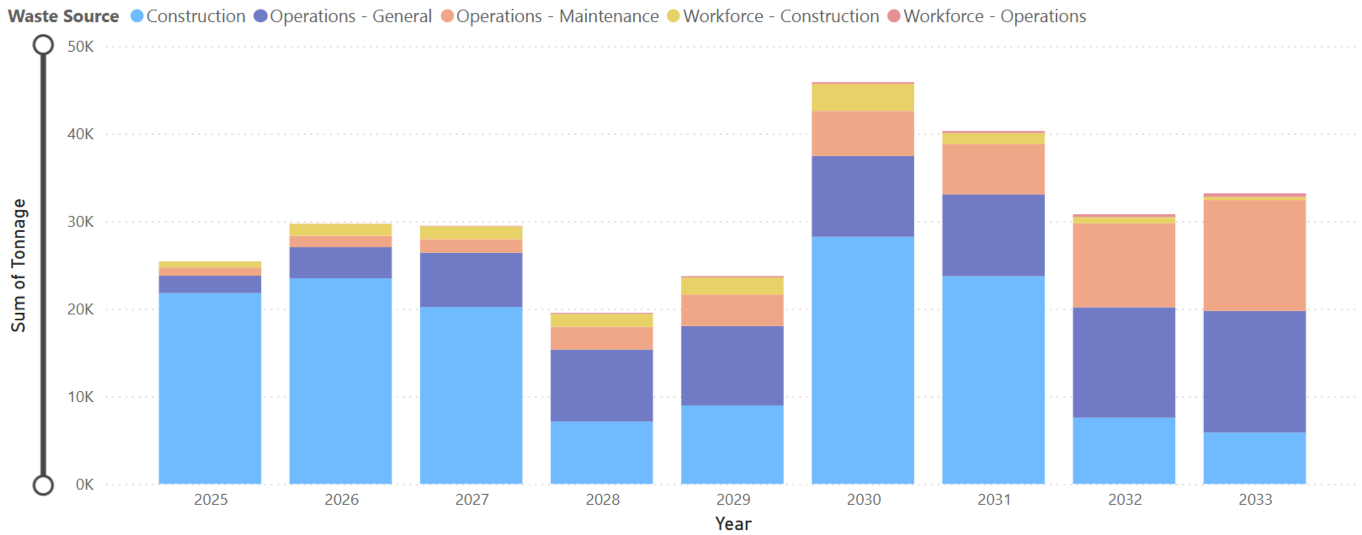


Figure 32: Scenario 3 Upper Limit Estimate Waste Projections – Delivery Stage (Renewable Energy Projects only)

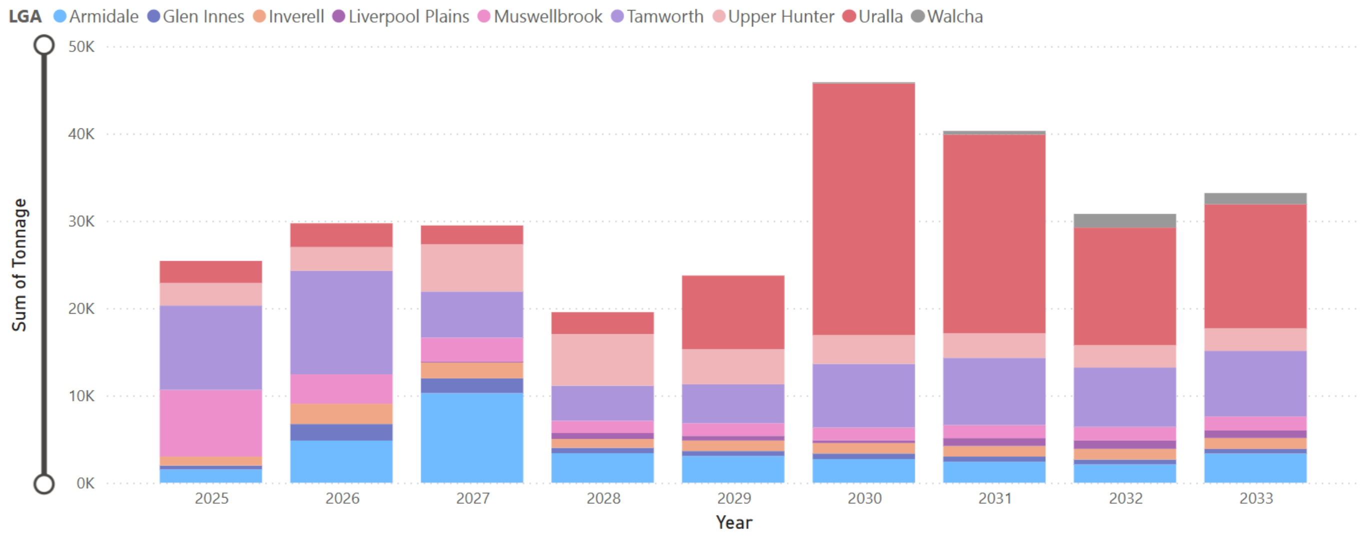


Figure 33: Scenario 3 Upper Limit Estimate Waste Projections – Impacted LGA (Renewable Energy Projects only)

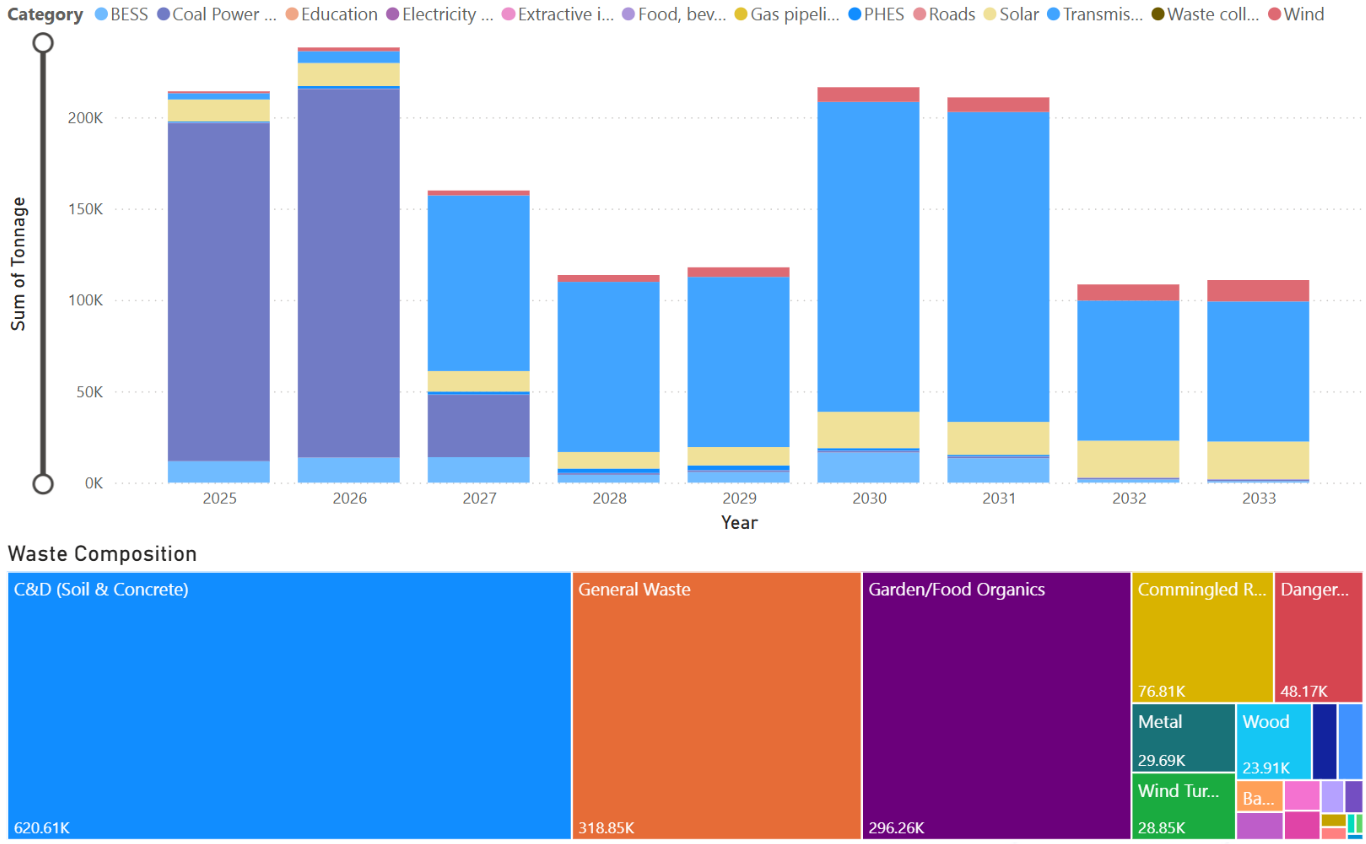


Figure 34: Scenario 3 Upper Limit Estimate Waste Projections from projects (excluding Scenario 1)

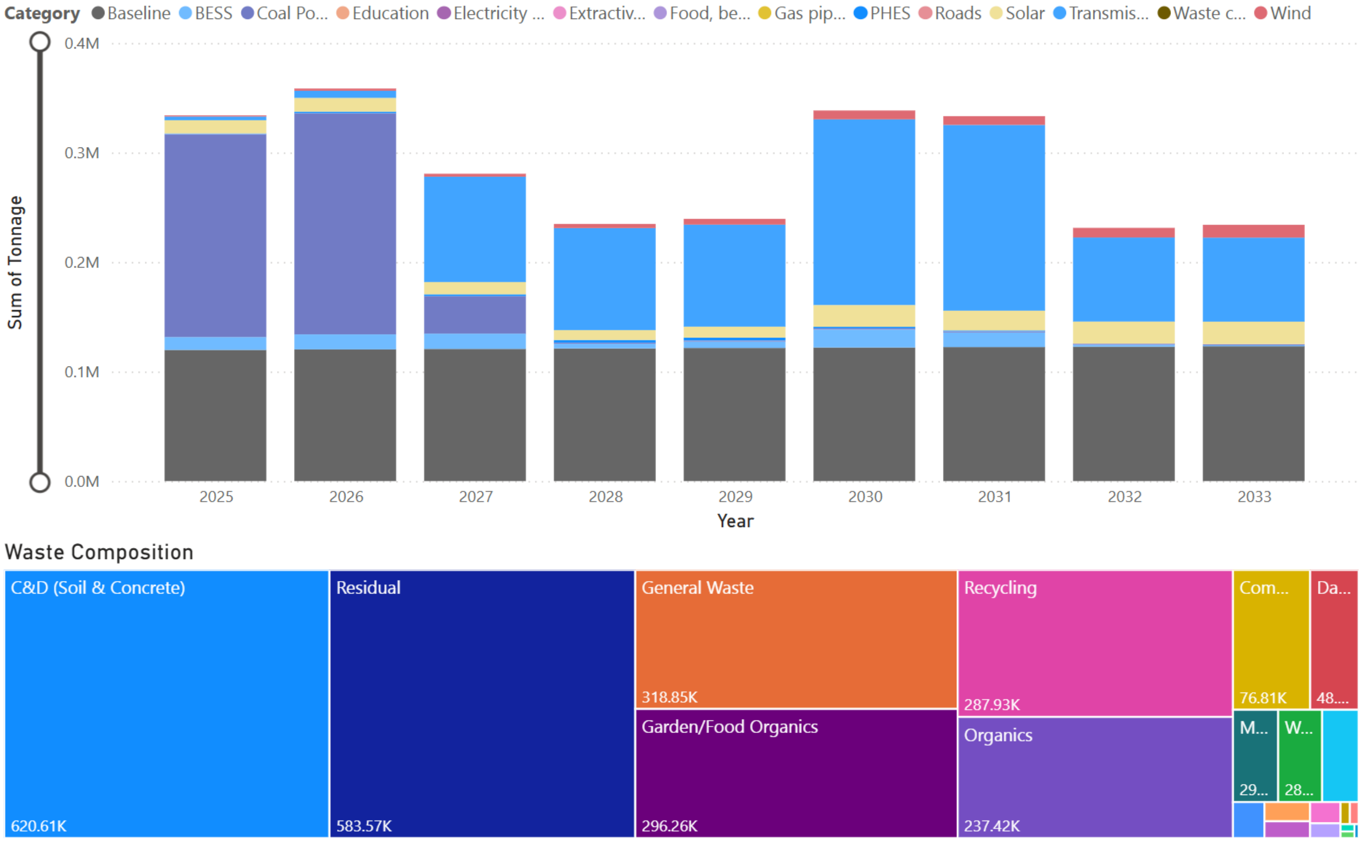


Figure 35: Scenario 3 Upper Limit Estimate – All waste projections from project categories

Key Findings

1. Renewable energy projects drive a noticeable increase in waste generation across the study period, particularly between 2025 - 2027 and again from 2029 - 2033 which align with the delivery periods (Figure 31). Waste volumes from renewables show a two-peak pattern: one earlier spike led by BESS and PHES construction, and a second, later spike largely associated with solar and wind projects. Despite these increases, baseline (existing) waste still dominates total volumes across the region.
2. Transmission line construction is again the primary driver of waste under this scenario (Figure 34). These projects span multiple LGAs and extend throughout the study period, resulting in a more even spatial and temporal waste distribution. The largest contributions occur between 2027 and 2031. This aligns with the delivery stages of the NE REZ Project.
3. Renewable Waste Composition (Figure 31):
    a. C&D Waste (Soil & Concrete) remains the largest stream (~78K tonnes).
    b. Dangerous Goods (~48K tonnes) become a material stream, mainly linked to energy storage and battery components.
    c. Wind Turbine Materials (~29K tonnes) and Metals (~24K tonnes) also contribute significantly, reflecting the construction of wind farms and renewable infrastructure.
    d. Other streams include smaller but material quantities of Solar Panels, Wood, General Waste, and Recyclables.
4. Waste generation is primarily construction-driven, with only a moderate contribution from operational, maintenance, and workforce waste streams.
5. Most Impacted LGAs (Figure 33):

    a. Uralla: Experiences the highest relative increase in waste compared to its baseline. Waste volumes spike dramatically from 2030 onwards, more than doubling compared to the baseline for several years. This is linked to clustered wind and solar developments.
    b. Tamworth: Sees a significant uplift particularly early in the period (2025-2026), primarily driven by BESS, PHES and solar projects. Impacts then plateau but remain consistently above the baseline throughout the study period.
    c. Upper Hunter: Shows a sustained increase (~50% above baseline) between 2027-2031, mainly due to solar and wind farm construction activities.
    d. Armidale: Experiences a moderate (~20-30%) increase in waste generation during 2027–2029, attributed mainly to solar and BESS developments. The increase is less sustained than in Uralla or Upper Hunter but is still material during peak years.
    e. Glen Innes: Displays a moderate spike around 2026-2027 linked to BESS developments, although overall volumes remain small relative to larger LGAs.
6. Implications for Resource Recovery
    a. Strong opportunities exist to divert metals, concrete, and recyclable construction materials generated from renewable projects.
    b. Without new processing capacity, much of the dangerous goods, residual general waste, and end-of-life renewable equipment (especially battery waste) will be directed to landfill, exacerbating capacity constraints in regional facilities.
7. Implications for neighbouring LGAs
    a. Although Kempsey Shire LGA is not part of the Study Area and has therefore not been included in the Study, it is noted that the Oven Mountain Pumped Hydro project (illustrated as P45 in Figure 30 and detailed in Table 36) could generate significant waste streams, which may look to use waste management infrastructure located in Kempsey Shire LGA. It is anticipated that this would be assessed as part of the Oven Mountain Pumped Hydro project planning process.

8 Waste Management and Maintenance Plans

This section provides guidance to project proponents on best-practice waste management and maintenance planning during the construction phase of renewable and non-renewable projects in the study area. It addresses the study's scope requirement to "identify management and maintenance plans required, including monitoring, conservation, and security of waste streams," by presenting practical strategies that support circular economy outcomes, maximise resource recovery, and reduce landfill reliance.

Given the scale and remoteness of many projects, combined with limited regional waste infrastructure, robust waste planning is critical. The guidance outlined here are advisory in nature and can be integrated into Construction Environmental Management Plans (CEMPs), Waste Management Plans (WMPs), or equivalent documents. They are designed to help proponents anticipate, manage, and track waste streams across their project lifecycle, while aligning with NSW regulatory requirements and broader sustainability objectives.

8.1 General Management Measure

The following best-practice waste management measures listed in Table 22 are commonly implemented across construction activities for projects. While most are relevant to the construction phase, some may also apply during early operations or decommissioning, depending on the project context.

Table 22: General Waste Management Measures

Category	Measure
Waste Management Coordination	• Appoint a waste management manager or coordinator to oversee onsite waste management responsibilities. • Establish designated waste management areas for bulk storage, source separation, collection, and handling of site-generated wastes.
Soil Management	• Reuse uncontaminated soils onsite for cut-and-fill balancing or land rehabilitation. • Dispose of contaminated soils at appropriately licensed landfills.
Vegetation and Organic Waste	• Chip or shred cleared organic waste for use as mulch or delivery to an organics processor. • No disposing of vegetation in ecologically sensitive areas.
Material Reuse and Recycling	• Maximise reuse and recycling of materials wherever feasible. • Minimise excess construction material supply. • Provide separate bins for source separation of waste types.
Residual and Hazardous Waste	• Collect residual waste and dispose of it at a licensed landfill. • Store hazardous and problem wastes separately onsite, ensuring disposal or recycling at facilities licensed to handle these substances.
Asbestos Management	• Conduct a risk assessment to determine appropriate management measures. • Dispose of asbestos waste at a landfill licensed to receive it, following these steps: • Wet the asbestos waste, wrap it in 200μm thick plastic, seal it with tape, and label it as "asbestos waste." • Transport the waste in a covered, leak-proof vehicle.

Category	Measure
	• Retain landfill receipts for all asbestos disposal. • Engage a qualified asbestos removalist for amounts exceeding 10m².
Litter and Ablution Waste	• Regularly manage onsite litter to maintain a tidy environment. • Dispose of sewerage from portable toilets and other effluent through a licensed contractor.
Waste Transport	• Engage a licensed operator to transport all waste. • Maintain records of waste transport and disposal.

8.2 Separate Resource Recovery and Management Options

As outlined in Section 8.1, a variety of waste materials will require management throughout the development of the projects. Many of these materials have potential for reuse or resource recovery. However, the remote location of the projects and limited access to comprehensive waste services, as well as the proximity to collection, reuse, and resource recovery facilities, will influence the feasibility of recovering different materials.

Table 23 provides a detailed breakdown of the expected waste materials, including their resource recovery potential and corresponding management options. The table also highlights specific considerations for handling various material types, ensuring compliance with regulatory requirements and supporting circular economy practices.

Table 23: Material Recovery and Management Options

Material Type	Resource Recovery Potential	Waste Stream Management Options
Packaging derived waste materials		
Paper and cardboard	Valuable commodities in recycling markets; the sale of source-separated materials can offset collection/processing costs.	Separate materials into bins or bale for volume reduction. Send to MRFs or major centres for recovery. Reprocess into new paper products.
Metals (ferrous and non-ferrous)	Steel, aluminium, and copper wiring are suitable for recycling and may provide cost offsets or be accepted free of charge.	Separate scrap metals into bins. Send to local or central scrap metal recyclers.
Plastics (hard and soft)	Soft plastics, polystyrene, and mixed hard plastics vary in recovery potential due to low material value and transport costs.	Separate and bale for volume reduction. Send to MRFs or metropolitan centres for recycling. May require specialist services for appropriate recycling.
Timber (pallets and drums)	**Heat Treated (HT) or Kiln Dried (KD) Pallets**: High reuse and recycling potential if untreated.	**Heat Treated (HT) or Kiln Dried (KD) Pallets:** Mulch onsite using a mobile grinder for land application. Transport whole pallets to recyclers for reuse.

Material Type	Resource Recovery Potential	Waste Stream Management Options
	Methyl Bromide (MB) Treated Pallets: Limited reuse potential due to environmental risks associated with chemical treatment.	Shred and repurpose timber as mulch, ensuring compliance with EPA requirements for application under the Mulch Resource Recovery Exemption (2016). **Methyl Bromide (MB) Treated Pallets:** Transport whole pallets to recyclers for reuse where possible. If reuse is not viable, dispose of pallets at a licensed landfill or treated timber management facility. Retain or chip onsite for volume reduction, then transport for disposal using a licensed operator. Note: MB-treated pallets cannot be used for mulching or land application.
E-waste and wiring	Recoverable materials such as wiring and small electronics; panels may be returned to manufacturers.	Separate wiring and store with other metals or non-ferrous metals. Send e-waste to recyclers. Return damaged PV panels to manufacturers for replacement.
Other expected waste materials		
Green waste	Reusable through composting or mulching if free of noxious weeds.	Compost or mulch onsite for rehabilitation. Stockpile and mulch logs, branches, and vegetation. Ensure compliance with risk protocols for land application.
Excavated material	Virgin Excavated Natural Material (VENM) and Excavated Natural Material (ENM) can be reused onsite.	Use for backfilling or rehabilitation. Excess ENM may be sent to Landfill for use as daily cover (normally accepted free of charge).
Hazardous or Liquid Waste	Includes fuels, lubricants, chemicals, and herbicides; requires specialised handling.	Store and transport through licensed waste management contractors.
Co-mingled containers	Readily recyclable materials like plastic, glass, and metal containers; eligible for refunds under the NSW Container Deposit Scheme.	Use bins provided by waste service providers. Collect for transport to MRFs. Value of containers under the NSW Container Deposit Scheme may allow free or reduced-cost collection.
Food and Organic waste	Compostable food scraps and organic material are suitable for on-site composting.	Use pre-manufactured composting units or open compost piles. Separate compostable waste from general waste streams. If not composted onsite, dispose of organic waste at a licensed landfill.

Material Type	Resource Recovery Potential	Waste Stream Management Options
Residual waste	Non-recyclable waste generated by site personnel requires disposal.	Provide general waste bins in key personnel areas. Collect regularly and dispose of waste at a licensed landfill.

8.3 Construction Waste Management System

To support efficient site waste management and adherence to resource recovery practices, appointing a dedicated site waste manager can be an effective approach. The responsibilities of the site waste manager include:

- Maintaining site waste storage areas, bins, equipment, and infrastructure.
- Managing contracts and liaising with waste service providers.
- Ensuring appropriate WHS and waste management signage is displayed and maintained in all waste areas and on equipment.
- Overseeing the operation of onsite equipment (e.g., balers, compactors, bin lifters, woodchippers) and ensuring safe work practices.
- Informing staff about waste management practices to optimise resource recovery and landfill diversion.

Waste Management Areas

Waste management areas serve as centralised locations for:

- Final storage of waste and easy access for waste collection vehicles.
- Unpacking materials, such as timber pallets, to reduce unnecessary packaging waste being transported to installation areas (only if it does not compromise safe transport).
- Centralising equipment for volume reduction, bulk storage, and material handling, which may include:
    - Waste balers (paper/cardboard, plastic film, containers).
    - Pallet shredders.
    - Bin lifters.
    - Skip and bulk bins.
    - Spare Mobile Garbage Bins (MGBs).

Field Waste Management

Given the extensive and often remote nature of transmission and generation projects, the following methods are commonly used to support effective waste management in the field:

- Use mobile bin trailers to transport various-sized MGBs around installation areas. These trailers enable separation of waste at the source and transport full bins to centralised waste management areas.
- Trailers can carry multiple bins efficiently, such as:
    - Up to 12 x 240L bins.
    - 5 x 660L bins.
    - 4 x 1,100L bins.

Additional Considerations:

- Trailers can be customised to attach to standard vehicle towbars or specialised electric carts.
- Plastic MGBs protect waste from wet and windy conditions, minimising material damage or loss.
- A car or electric cart with a trailer can service large areas efficiently, ensuring quick transportation to and from central waste management areas.

9 Recycling and Waste Minimisation

This section addresses the scope requirement to review recycling and waste minimisation efforts from comparable renewable energy projects and identify opportunities relevant to the NE REZ and the Project. It presents a forward-looking overview of circular economy strategies that could be applied throughout the project lifecycle, from sourcing and construction through to operation, maintenance, and decommissioning.

The intent is to inform project proponents, regulators, and policymakers of best practice approaches that embed circularity, reduce waste, and improve resource efficiency. These strategies are drawn from industry experience and international examples, with case studies provided in Appendix B to illustrate successful circular initiatives in renewable energy developments

9.1 Circular Materials Plan

While no Circular Materials Plan currently exists for the NE REZ or the Project, this section outlines how such a plan could be structured. The purpose of the plan would be to guide the responsible sourcing, use, and end-of-life recovery of materials, minimising waste generation, extending product lifespans, and supporting local resource recovery capabilities.

The proposed structure aligns with the principles of *Australia's Circular Economy Framework*, which emphasises product stewardship, materials efficiency, and systems thinking to retain value and minimise environmental harm. Applying these principles to renewable energy projects offers a pathway to embed circularity at scale, with long-term benefits for cost, performance, and sustainability outcomes.

The following strategies reflect leading practices from renewable energy projects in Australia and abroad. Organised by project lifecycle stage, they provide a foundation for applying circular economy principles across future developments. Further examples of these approaches in action are presented in the case studies in Appendix B.

9.1.1 Circular and Sustainable Materials Sourcing

Circular and sustainable materials sourcing is a key enabler of waste minimisation across the full lifecycle of renewable energy projects. It involves decisions about product specifications, material selection, origin, and manufacturing processes that collectively influence the potential for reuse, recycling, and reduced environmental impact.

While these decisions are typically made by developers and project proponents, they are also relevant to regulators, procurement teams, and supply chain partners who shape technical requirements and delivery models.

The following principles provide practical guidance that can inform procurement specifications and project planning:

- Prioritise materials with low environmental footprints (e.g., recycled steel, bio-based composites, or sustainably sourced timber);
- Engage suppliers that design for repairability and ease of refurbishment, supporting maintenance and lifespan extension during operation;
- Select products that can be disassembled and recycled efficiently into robust end markets at end of life;
- Seek suppliers that use sustainable packaging, with options for reuse or recycling;
- Favour suppliers that adhere to ethical and environmentally sustainable practices across their value chains.

9.1.2 Modular Design

Designing for modularity is a key pillar to ensure circularity throughout the lifecycle of a renewable energy project. Modular design and planning facilitate ease of delivery, future repairs, upgrades, and disassembly through modular component designs to expand the lifespan and reduce maintenance costs of a project or product. An example of a modular design for wind projects is described below:

EXAMPLE: MODULAR DESIGN FOR WIND PROJECTS

EnVentus™ Platform

1. Modular Architecture: The EnVentus platform uses modular nacelle design, allowing for the interchangeability of components across different turbine models. This enables swift adaptation to diverse market and project requirements without compromising performance.
2. Scalability: The platform supports a range of turbine configurations catering to various wind conditions and project sizes. This scalability facilitates tailored solutions for specific site needs.
3. Enhanced Performance: By integrating proven technologies from Vestas' previous platforms, EnVentus achieves higher energy production and improved efficiency.
4. Sustainability: The modular design contributes to sustainability by optimising material use and simplifying maintenance processes, leading to reduced environmental impact over the turbine's lifecycle.

Benefits of Vestas' Modular Wind Turbine Design:

- Operational Flexibility: The modular approach allows for rapid customisation and deployment, accommodating a wide range of project specifications and environmental conditions.
- Cost Efficiency: Standardised components and streamlined manufacturing processes reduce production costs and facilitate easier maintenance, lowering the total cost of ownership.
- Future-Proofing: The design's adaptability ensures compatibility with future technological advancements, allowing for upgrades and extensions without extensive redesigns.

Source: *https://www.vestas.com/en/energy-solutions/onshore-wind-turbines/enventus-platform*

9.1.3 Delivery, Installation and Reverse logistics

Packaging for major renewable energy projects requires an appropriate circular materials approach. Remote and rural communities rarely have sophisticated waste infrastructure that can manage high volumes of a certain type of packaging waste. Ensuring a plan for waste packaging is established prior to delivery is crucial. Identifying opportunities to develop programs that can reuse or repurpose packaging in the local area can be negotiated/initiated prior to delivery. This creates an opportunity to create mutually beneficial projects within the local community or industry. Packaging optimisation can take the form of:

- Use reusable or recyclable packaging for components – ensure a local assessment of waste and resource recovery infrastructure is completed, understand volumes of packaging waste that will be created and if or how the local community can manage these volumes.
- Optimise logistics to reduce transport emissions and material use (e.g., shared transportation networks to ensure trucks that are delivering the products are also returning to major waste and resource recovery hubs with full loads to ensure efficient reverse logistics).

9.1.4 Operation and Maintenance

9.1.4.1 Monitoring Systems

Use Internet of Things (IoT) and Artificial Intelligence (AI) to monitor the performance of materials and identify maintenance needs early; this ensures the lifespan extension of the products and ensures that repairs can be conducted before a part needs to be replaced. An example of using IoT and AI to monitor performance in wind projects is described below:

EXAMPLE: IoT and AI MONITORING SYSTEMS FOR WIND PROJECTS

Vestas Wind Systems (Global)

IoT and AI Integration:

- Vestas employs advanced IoT sensors and AI-driven analytics in their wind turbines to monitor performance, predict failures, and optimise maintenance schedules. Sensors measure vibration, temperature, and wind speed, allowing operators to identify issues like gearbox wear or blade misalignment before they become critical.
- The AI-based system analyses real-time data to predict maintenance needs, significantly reducing downtime and extending turbine lifespan.

Impact:

- Improved efficiency by up to 20%.
- Reduced maintenance costs by proactively addressing issues.

Source: *https://medium.com/@paralogyx/iot-integration-in-turbines-the-future-of-data-collection-and-analysis-c8fbd14561f1*

9.1.4.2 Repair over Replacement

Develop repair programs for damaged components instead of outright replacements; this will ensure cost savings and extend the product lifespan. An example of a repair strategy for wind projects is presented below:

EXAMPLE: REPAIR STRATEGY FOR WIND PROJECTS

Ørsted's Offshore Wind Farms (Europe) Repair Strategy:

- Ørsted prioritises repairing wind turbine components, such as blades and nacelles, instead of replacing them outright. They have established specialised facilities to repair rotor blades damaged by storms or wear.
- Technicians are trained to conduct in-situ repairs using innovative solutions, such as drones and resin injection for small blade cracks.

Impact:
- Up to 30% cost savings compared to full component replacement.
- Reduction in material waste by extending component life.

Source: *https://orsted.com/en/what-we-do/renewable-energy-solutions/offshore-wind/technology*

9.1.4.3 Inventory Recycling

Repurpose decommissioned parts as spares for other operational facilities or identify local industries that could recycle or repurpose the materials for their operations. A local ecosystem analysis would assist in identifying local industries and setting up potential pathways for repurposes or recycling. Two examples of inventory recycling for wind projects are described below:

EXAMPLE 1: INVENTORY RECYCLING FOR WIND PROJECTS

Condit Dam Decommissioning and Material Reuse

- **Overview**: The Condit Dam on the White Salmon River in Washington State was decommissioned to restore natural river flow and ecosystems.
- **Recycling Process**: Materials from the dam, such as concrete and steel, were repurposed in local construction projects, reducing waste and supporting community development.
- **Impact**: The project exemplifies sustainable decommissioning practices by integrating material recycling and environmental restoration.

Source: *https://www.water.vic.gov.au/__data/assets/pdf_file/0029/671951/decommissioning-and-repurposing-dams-a-guide-for-dam-owners.pdf*

<u>EXAMPLE 2: INVENTORY RECYCLING FOR WIND PROJECTS</u>

Siemens Gamesa Wind Turbine Parts Recycling (Global)

Blade Recycling for Spares:

- Siemens Gamesa recycles parts from decommissioned wind turbines, such as blades, by processing the materials for reuse. Steel and aluminium are recovered for new turbines, while undamaged parts like control systems and cabling are repurposed as spares for operational wind farms.

Impact:

- Recovery of 85-90% of material by weight from decommissioned turbines.
- Supports cost-effective maintenance and sustainability goals.

Source: https://www.siemensgamesa.com/global/en/home/explore/journal/2023/02/offshore-kaskasi-recyclable-wind-turbine-blades.html

9.1.5 End-of-Life Management and Decommissioning Planning

9.1.5.1 Reuse Programs

Reusing and repurposing products before entering the recycling pathway is the least energy and carbon intensive option. It also aligns with CE principles where keeping products in their intended state or as unaltered as possible is the preferred option.

Repurposing wind turbine blades is gaining momentum as a sustainable solution for managing decommissioned blades. Researchers from Cork County Council and various universities collaborated on a project to build a pedestrian bridge for cyclists and walkers near Cork City using three 14-meter blades from a decommissioned turbine. These blades, significantly smaller than the modern 50-meter onshore versions, were tested for strength. The final bridge spans 5.5 meters and can support vehicles up to 12 tonnes, making it suitable for emergency services (Ruane, 2023). This bridge follows earlier similar projects, such as one in Poland, and others like the Draperstown bridge in Northern Ireland and a new bridge currently under construction in Atlanta, Georgia (WindEurope, 2022).

There are numerous other potential applications for retired turbine blades. These include turning them into animal feeding troughs, bicycle and bus shelters, glamping pods, cattle partitions, housing materials, noise barriers, public furniture, railway sleepers, thermal insulation, and wave attenuators (Global Wind Energy Council, 2023). Blades have also been repurposed into building materials such as roofing and deep foundations, which is currently an area of active research and development (Ruane, 2023).

9.1.5.2 Recycling Programs

Set up partnerships with recycling facilities to recover valuable materials such as rare earth elements (from wind turbines) or silicon (from solar panels), steel, resin, etc.

In addition, connecting with specialised recyclers where possible (see case studies pertaining to recycling programs). Identifying recycling opportunities available now may be outdated when the renewable energy project is dismantled. Staying abreast of innovative opportunities for reuse and recycling is integral to managing materials at end of life (refer to case studies in Appendix B).

10 Planning Considerations

10.1 General Planning for New Waste Facilities

Establishing waste processing facilities in NSW requires careful consideration of land and property requirements, as well as alignment with local planning policies and strategies. During consultations with Councils, several key challenges contributing to a reluctance to establish new landfills were identified:

- Prohibitive Costs
- Lengthy Development Approval Processes
- Political Challenges and Community Opposition
- Ongoing Liabilities
- Resource Constraints
- Threshold Limits and Licensing Costs
- Competing Waste Management Priorities.

These challenges make councils reluctant to pursue the establishment of new landfills, leading them to focus instead on optimising existing infrastructure and exploring alternative waste management solutions to meet their needs. Consequently, no potential locations were identified within this study. Nevertheless, the general planning considerations outlined in Table 24 provide a framework for future decision-making.

Table 24: General Planning Consideration for New Waste Facilities

Category	Key Considerations
Land and Property Requirements	
Location and Zoning	Facilities must be located in industrial or compatible zones under Local Environmental Plans (LEPs), such as General Industry Zone IN1. Proximity to residential areas, sensitive environmental locations, and flood-prone zones must be managed to minimise impacts. Landfills must not be located within: • 250 metres of significant environmental or conservation value areas, such as national parks, wetlands, or critical habitats. • Specially reserved drinking water catchments or over aquifers containing drinking-quality groundwater vulnerable to pollution. • 250 metres of residential zones, dwellings, schools, or hospitals (1,000 metres for large putrescible landfills where practicable). • 40 metres of permanent or intermittent water bodies. • Flood-prone areas at risk of washout during major flood events (1-in-100-year events). Avoid land prone to subsidence or landslides, such as karst regions.
Site Characteristics	Adequate space is required for operations, including processing, storage, and potential expansion. Ancillary infrastructure such as stormwater and leachate management systems, access roads, and buffer zones must also be considered during site selection. Sites of high Aboriginal cultural or biodiversity significance, as identified in planning instruments, are inappropriate for landfills.

Category	Key Considerations
	Smaller-scale organics processing facilities may be viable locally, but larger facilities require regional feedstocks and markets to reduce transport costs.
Infrastructure and Accessibility	Access to transfer infrastructure is critical to bulk and transport materials to processing sites. Proximity to transport networks such as highways, rail, or ports is essential to ensure efficient movement of waste and recovered materials. Utilities such as electricity, water supply, and sewerage connections must be available to support facility operations. Facilities should be near end markets to minimise multiple handling and transport costs. Availability of nearby workshops or service providers for equipment maintenance is beneficial.
Alignment with Local Planning Policies and Strategies	
State Environmental Planning Policy (SEPP)	Amendments to SEPPs can prioritise waste and recycling infrastructure in designated industrial areas. Policies should limit incompatible land use encroachment near existing facilities.
Community Engagement	Early and proactive engagement with the community is essential to minimise objections and gain public support. Involving communities in the planning process can improve approval prospects.
Compliance with Regulations	Facilities must comply with the *Protection of the Environment Operations (Waste) Regulation 2014* and other environmental regulations. Rigorous assessments and approvals are required to ensure environmental protection and international best practices.
Strategic Planning	An overarching infrastructure plan is needed to guide investments in waste and recycling facilities. The plan should address infrastructure needs, optimal locations, and capacity gaps to meet state targets. Ancillary services, such as workforce housing or transportation for remote facilities, may be required to support operations in rural areas.
Licensing and Approvals	Securing planning approval and EPA licensing requires early consultation with councils, the EPA, and other agencies. Pre-lodgement meetings are essential to understand planning and assessment requirements. Consideration must be given to ancillary approvals, such as those for transport, utility connections, and site remediation during closure phases.

10.2 Spatial Challenges in Waste Management

The spatial distribution of waste generation within the Study Area presents significant challenges for effective waste management planning. Waste will primarily be generated at project sites, which are unevenly distributed across the region and tend to cluster in specific locations. However, existing waste management infrastructure is not always co-located with or situated near these project sites, resulting in a spatial mismatch between waste generation and processing or disposal facilities.

10.2.1 Waste Transport Considerations

Under Section 143 of the *POEO Act*, waste must be transported to a facility that can lawfully accept it. Both the owner of the waste and the transporter are legally responsible for demonstrating that the waste has been disposed of lawfully.

To meet these requirements, waste generators and transporters must maintain detailed records, including:

1. Waste dockets that identify the facility receiving the material for recycling or disposal.
2. Transporter details, such as the company name, ABN, vehicle registration, driver details, and the date and time of transport.
3. Facility receipts that include the name and address of the facility, its ABN, a contact person, and the date and time of delivery.
4. Evidence that waste materials were transported by a licensed operator.

Ensuring compliance with these requirements is an essential consideration when planning for waste management activities in the region.

11 Legislative and Policy Overview

Compliance with relevant legislation, licences, policies, and guidelines is critical to effective waste management, resource efficiency, and environmental protection in the Study Area. These instruments establish requirements for how waste is handled, recovered, and disposed of, while also influencing broader outcomes such as circular economy practices, emissions reduction, and materials efficiency Table 25 summaries the key regulatory instruments and strategies frameworks applicable to both project proponents and waste infrastructure operators.

Table 25: Legislative and Policy Overview

Category	Name	Purpose/Key Relevance
Legislation	Protection of the Environment Operations Act 1997 (NSW)	Governs waste management, including pollution control and licensing for waste facilities. Key driver for compliance with environmental protection and resource recovery
	Environmental Planning and Assessment Act 1979 (NSW)	Sets planning and development requirements, including waste minimisation strategies during construction and operation.
	Waste Avoidance and Resource Recovery Act 2001 (NSW)	Promotes waste reduction, resource recovery, and recycling initiatives. Framework for achieving a circular economy.
	Biodiversity Conservation Act 2016 (NSW)	Ensures protection of sensitive ecosystems during land clearing and project development.
	National Environment Protection (Movement of Controlled Waste) Measure 1998	Regulates the interstate movement of hazardous waste, including batteries and e-waste.
	Australian Code for the Transport of Dangerous Goods by Road and Rail (2022)	Outlines safe transportation of hazardous materials, such as end-of-life batteries.
	Work Health and Safety Act 2011 (NSW)	Ensures the safe handling, storage, and disposal of waste materials on site.
Licenses and permits	Environmental Protection Licences (EPL)	Required for activities involving waste disposal or processing.
	Development Approvals	Issued under local and state planning authorities for waste processing facilities.
	Resource Recovery Orders and Exemptions	Allows reuse of specific waste materials, such as mulched timber, without requiring a waste licence under certain conditions.
	Waste Transport Licences	Mandatory for contractors handling and transporting controlled waste.
Policies and Guidelines	NSW Waste and Sustainable Materials Strategy 2041	Provides a framework for reducing waste and increasing recycling and circular economy initiatives.

Category	Name	Purpose/Key Relevance
	NSW Circular Economy Policy Statement (2019)	Outlines goals for transitioning to circular economy practices, focusing on resource recovery and material reuse.
	National Waste Policy: Less Waste, More Resources (2018)	Establishes a national vision for waste management and recycling to support a circular economy.
	National Greenhouse and Energy Reporting Act 2007 (NGER)	Encourages reduction in greenhouse gas emissions associated with waste management.
	Environmental Guidelines: Solid Waste Landfills (NSW EPA)	Provides operational guidelines for landfills, including handling and disposal of solid waste.
	NSW Energy from Waste Policy Statement	Regulates the use of energy recovery processes, ensuring compliance with environmental standards.
	Climate Change Policy Framework for NSW	Supports adaptation to climate change, with a focus on emissions reduction and resource efficiency.
	Guidelines on Resource Recovery in Construction Projects (NSW EPA)	Promotes sustainable practices in construction, such as waste minimisation and recycling.
	Australian Battery Recycling Initiative (ABRI)	Provides best practices for battery recycling and handling end-of-life batteries.
	National E-Waste Policy	Outlines strategies for managing electronic waste, including recycling and hazardous material recovery.
	Large-Scale Solar Energy Guideline (2022)	Provides waste minimisation strategies for large-scale solar farm development, operation, and decommissioning by promoting circular design.
	Wind Energy Guideline (2024)	Provides waste minimisation strategies for wind farm development, operation, and decommissioning by promoting circular design.
	Australia's Circular Economy Framework (2024)	Provides businesses and policymakers with strategies to reduce emissions and waste, innovate, and achieve consistent, impactful outcomes, supporting new national ambitions and targets.

11.1 Drivers and Barriers to Adaptation and Materials Efficiency

The transition to circular economy practices in the Study Area is influenced by a range of external and internal factors, including policy settings, infrastructure capacity, market dynamics, and technological maturity. These elements can either enable or constrain efforts to reduce waste generation, improve materials efficiency, and support long-term sustainability outcomes. Table 26 outlines the key drivers and barriers currently shaping waste and resource recovery practices in the region.

Table 26: Drivers and Barriers to Adaptation and Materials Efficiency

Category	Driver	Barrier
Regulatory & Policy	- Rising landfill levies and stricter NSW waste regulations incentivise diversion from landfill and support growth in resource recovery. - NSW and Federal Government funding schemes support innovation in recycling and circular materials management. - Strengthened Extended Producer Responsibility (EPR) schemes (e.g. for batteries, packaging, and e-waste) are pushing industry toward product design that enables disassembly and recyclability. - Mandatory emissions and sustainability disclosures (e.g. through ESG reporting and the Safeguard Mechanism for large emitters) are encouraging proponents to reduce lifecycle waste impacts and carbon intensity.	- Inconsistent application of circular economy principles at the local government level can complicate regional planning for material recovery and create uncertainty for developers. - Slow regulatory adaptation for emerging waste streams (e.g. solar panels, wind blades, and lithium-ion batteries) limits the development of compliant and scalable processing pathways. - Strict hazardous waste regulations, while necessary, can increase compliance complexity and costs. - Lack of long-term regulatory certainty around circular economy targets or obligations may deter private sector investment in new processing facilities or recovery solutions.
Economic & Market Demand	- Corporate ESG and net-zero commitments are increasing demand for sustainable supply chains and circular procurement practices. - Growing global demand for critical minerals and recycled materials (e.g., lithium, aluminium, rare earths) is improving the business case for material recovery. - Expansion of domestic secondary materials markets, supported by government investment and regulatory drivers, makes recycling more viable. - Emerging opportunities in onshore manufacturing using recovered materials (e.g., recycled PV panels, wind turbine parts) support local jobs and circular supply chains.	- High costs associated with processing complex and mixed-material waste (e.g., bonded solar panels, composite turbine blades, lithium-ion batteries) can outweigh material value. - Volatile commodity prices for recycled materials make long-term commercial planning difficult for recyclers and manufacturers. - Early-stage circular economy sectors often face difficulty accessing private capital, particularly for higher-risk infrastructure and innovation, limiting scale and market maturity.
Technological & Infrastructure	- Emerging processing technologies such as AI-powered sorting, chemical recycling, and advanced disassembly techniques are enabling recovery of previously non-recyclable or complex materials.	- Lack of end-of-life processing infrastructure for renewable energy technologies (e.g., PV panels, turbine blades, lithium-ion batteries) creates stockpiling and limits recycling rates.

Category	Driver	Barrier
	- Growth of regional resource recovery infrastructure, supported by federal and state initiatives, is improving access and reducing haulage distances for common waste streams. - Digital waste tracking tools (e.g., barcode-based systems, blockchain, smart bins) are increasing traceability and enabling more efficient material flows across the supply chain.	- Long transport distances and low economies of scale in remote areas increase the cost of recovering and processing waste. - Limited financial drivers (e.g., levies, rebates, mandates) for advanced recovery of difficult or low-value materials reduces business case certainty for investment.
Logistical & Operational Efficiency	- On-site or modular waste processing solutions reduce the need for long-haul transport and support circular practices in remote or low-volume settings. - Repurposing of infrastructure and materials, such as turbine foundations, cable reels, and mounting systems, extends product lifespans and avoids disposal. - Cross-sector collaboration (e.g., reuse of recovered materials in construction, agriculture, or manufacturing) enables regional circular economy synergies.	- Limited availability of trained personnel in advanced recycling and hazardous materials handling can restrict adoption of circular practices on-site. - Complex or poorly designed components (e.g., multi-material laminates, bonded composites, or embedded electronics) hinder disassembly and cost-effective recycling. - Recycling solutions for key materials (e.g., composite wind blades, encapsulated PV modules, lithium-ion batteries) remain under development or face commercialisation hurdles.
Social & Cultural	- Increased community expectations for sustainable practices and zero waste goals.	- Local resistance to new waste infrastructure due to perceived environmental or health impacts (NIMBYism).

12 Funding Considerations

Funding for waste management infrastructure in NSW has traditionally been sourced from a combination of government grants, private investment, and loan financing. Public sector projects typically rely heavily on state and federal grants, while private sector infrastructure is often funded through a mix of government co-funding, private equity, and bank financing.

Historically, grant funding has been directed toward projects that enhance waste management outcomes, improve resource recovery, and support circular economy initiatives. Even for privately funded waste infrastructure, government support has played a key role in de-risking investments, particularly for emerging waste processing technologies or infrastructure in regional and remote areas.

12.1 Funding Sources Assessed

Government grants have historically been the primary source of funding for waste management infrastructure, particularly for public sector projects. Even for privately funded infrastructure, government grants often co-fund projects, with the remainder sourced from private investment or bank financing.

Therefore, this study only considered government grant funding and did not assess alternative financing mechanisms such as private equity, loan schemes, or Public-Private Partnerships (PPPs).

12.2 Funding Applications

Funding for waste management and circular economy initiatives generally supports activities such as those presented in Table 27.

Table 27: Typical Activities that are Funded

Activity	Description of activity
Feasibility Studies	Identifying capacity needs, market gaps, and infrastructure requirements.
Resource Recovery Infrastructure	Developing recycling facilities for materials such as metals, plastics, and composites from renewable energy projects.
Circular Economy Projects	Supporting the reuse, remanufacturing, and repurposing of waste materials, such as solar panels, wind turbine blades, and battery components.
Waste Processing Facilities	Developing and modernising facilities to process mixed and separated waste streams.
Landfill Expansion & Modernisation	Upgrading existing landfills to handle increased waste volumes.
Transport & Logistics	Improving waste collection, sorting, and transportation in remote areas.
Innovative Recycling Technologies	Supporting the development of advanced recycling solutions.
Workforce Training & Waste Education	Equipping project managers, operators, and workers with best-practice waste minimisation and handling skills.

12.3 Key Grant Opportunities

A summary of specific grant opportunities is provided in Table 28, outlining eligibility criteria, funding scope, grant amounts, and application timelines.

Table 28: Grant Funding Opportunities

Grant Name	Scope	Eligibility	Prerequisites	Grant Amount	Timing	Closing Date	Link
Regional Microgrids Program: Stream A	Renewable energy technology deployment	LGA, State or Terr Govt entity, any Aust business/entity, land council	Innovative technology solutions for microgrids	$5M - $10M per grant	Ongoing	19/12/2025	Link
Regional Microgrids Program: Stream B	Renewable energy technology for First Nations	LGA, State or Terr Govt entity, any Aust business/entity, land council	Focus on energy cost reduction and reliability for First Nations	$5M - $25M per grant	Ongoing	19/12/2025	Link
Joint Procurement Funded Support program for councils	Waste management collaboration	Councils	Assistance for collaborative waste planning	Up to $500,000	Ongoing	01/01/2027	Link
Regional Precincts and Partnerships Program: Precinct Development and Planning	Urban development, precinct planning	Governments, First Nations groups, Community organisations, Private enterprises	Deliver precinct plans and contribute to government priorities	$80M	Ongoing	2025-26	Link
High emitting industries grants	Decarbonisation in manufacturing and mining	High-emitting facilities in manufacturing and mining	Decarbonisation projects to meet 2030 emission reduction goals	Up to $305M	Ongoing	Unknown	Link

Grant Name	Scope	Eligibility	Prerequisites	Grant Amount	Timing	Closing Date	Link
Industry Growth Program	SME commercialisation and growth	SMEs, Startups	Support for growth in NRF priority areas	$50,000 to $5M	Ongoing	27/11/2023	Link
Urban Precincts and Partnerships Program	Urban infrastructure investment	Business and industry	Investment in best-practice urban infrastructure	$150M over 3 years	Unspecified	Unspecified	Link
Advancing Renewables Program	Renewable energy development	LGA, State or Terr Govt entity, any Aust business/entity	Fund activities in renewable energy to reduce cost	$216.7M	Unspecified	Unspecified	Link
Renewables and low emission technologies	Renewable energy and emissions reduction	Industries, manufacturers, innovators	Invest in renewable energy and emissions reduction products	Unspecified	Unspecified	Unspecified	Link
Remanufacture NSW	Recycling infrastructure for plastics, paper, glass, tyres	Councils, businesses, NFPs, waste operators	Project plan for material recovery and recycling	Stream 1 - $100K to $3 million Stream 2 - $50K to $1 million	Unspecified	Closed Future funding expected	Link
Circular Solar Grants Program	Solar panels, lithium-ion batteries recycling	Businesses, councils, universities, NFPs	Pilot or operational project for solar panel or battery recycling	Future funding expected	Future funding expected	Future funding expected	Link

Grant Name	Scope	Eligibility	Prerequisites	Grant Amount	Timing	Closing Date	Link
Waste and Recycling Infrastructure Fund	Resource recovery facilities, recycling innovation	Local councils, waste processors, private industries	Feasibility study and community benefit	Future funding expected	Future funding expected	Future funding expected	Link
Major Resource Recovery Infrastructure Program	Recycling of steel, concrete, electronics	Regional/local councils, private sector	Alignment with NSW Waste Strategy required	Future funding expected	Future funding expected	Future funding expected	Link
NSW Circular Plastics Program	Plastics recycling, repurposing	Businesses, research institutions, councils	Innovation and scalable solutions for plastic recovery	Future funding expected	Future funding expected	Future funding expected	Link
Local Government Waste Solutions Fund	Waste reduction, recycling projects	NSW councils in waste levy area	Scalable waste reduction and recycling projects	$200,000 for individual council, $400,00 for groups	30 September 2024	12 December 2024	Link
Circulate Industrial Ecology Program	Industrial waste recovery and repurposing	Businesses, NFPs, councils	Redirect material streams from landfill	Future funding expected	Future funding expected	Future funding expected	Link
Civil Construction Market Program	C&D waste recycling for civil projects	Businesses, councils	C&D waste diversion and resource reuse	Future funding expected	Future funding expected	Future funding expected	Link

13 Key Findings

This study highlights a series of interconnected challenges and opportunities for managing waste across the NE REZ and NE REZ Project corridor. The findings reinforce the need for proactive planning, investment, and innovation to ensure that renewable and non-renewable developments support circular economy outcomes, rather than adding to landfill pressures.

13.1 Infrastructure Availability and Spatial Gaps

While many NE REZ projects are located within 35 km of an existing waste facility, this proximity does not guarantee access. Many relevant facilities (landfills capable of accepting commercial-scale waste) are clustered around town centres, while major projects are located in more remote areas. Transport distances are likely to be significant for some projects, increasing costs and complicating logistics.

Spatial mapping also revealed notable service gaps on the northern, eastern, and southern edges of the Study Area, where waste infrastructure coverage is limited to one or two landfills, sometimes only able to accept minor volumes of waste. Compounding this, the majority of mapped facilities are small transfer stations designed for domestic use, not the scale or type of waste produced by large infrastructure projects. Without upgrades to either the landfills or transfer stations, these sites will not be suitable for handling NE REZ construction, operation, or decommissioning waste.

13.2 Capacity, Capability, and Access Constraints

The Study Area's 18 existing landfills and processing facilities are already under considerable pressure. Many are operating close to their licensed throughput limits, leaving little headroom for surges in waste volumes. Even where nominal spare capacity exists, access may be restricted by operational limitations such as the absence of weighbridges, vehicle size constraints, or requirements for formal commercial agreements with councils.

- Northern Region: Inverell Shire's landfill is the largest facility, reportedly operating at approximately one-third of its licensed annual capacity. It remains the primary disposal site for the region and is expected to remain operational until 2039. Tenterfield Shire's landfill is nearing end-of-life, while Glen Innes Shire's landfill is relatively small and unlikely to accommodate significant additional waste volumes.
- Central Region: Armidale Regional Council's landfill is already operating at full capacity, although plans are underway to increase annual throughput by an additional 10K tpa. Tamworth Regional Council's Forest Road landfill is the most significant facility in the region, offering extensive infrastructure and processing capability. However, strategic management will be essential to optimise its future performance. Tamworth is also developing a new regional organics processing facility to address growing waste volumes. Uralla Shire's landfill is at capacity and scheduled for closure within three years, while Walcha Shire operates the smallest landfill in the region, which has no capacity to accept further waste.
- Southern Region: Liverpool Plains Shire's Willow Tree landfill serves as the main active facility, while the remaining landfills are operating at or near capacity and face imminent closure. Muswellbrook Shire's landfill is the largest in the southern region, offering comparatively greater available capacity. Upper Hunter Shire's two landfills are small and constrained, although plans are underway to upgrade the Scone landfill to better meet future demand.

Managing specialist waste streams (eg solar PV panels, wind turbine blades, and BESS components) presents further challenges. Very few facilities across the Study Area are currently licensed or equipped to handle these materials, increasing the risk that valuable resources will be lost to landfill unless targeted investment and infrastructure upgrades are implemented.

13.3 Council observations

Councils across the Study Area reported that they are already facing substantial challenges in managing waste, with capacity and capability gaps likely to worsen as NE REZ development progresses. Key concerns included limited time, funding, and resources to plan for and deliver new waste infrastructure, shortages of skilled staff, trucks and equipment, and constraints in the ability of existing facilities to store, process, or manage emerging waste streams such as hazardous materials, large-scale construction waste, and batteries. Councils also flagged the risk of unmanaged legacy waste if robust, standardised waste management processes and end-of-life agreements are not implemented from the outset of project development.

Despite these pressures, councils recognised that the NE REZ presents important opportunities to strengthen regional waste management systems and drive economic benefits. Priorities identified included attracting investment and partnerships for new infrastructure, creating local jobs and upskilling the workforce, building regional collaborations to achieve economies of scale, and positioning the region as a leading waste and resource recovery hub. Councils also highlighted the potential to repurpose infrastructure from mine and power station closures to expand capacity for REZ-related waste and circular economy initiatives.

13.4 Projected Waste Generation

Under the Baseline Scenario, waste volumes generated by residents and businesses across the Study Area remain stable over 2025 - 2033, averaging around 120K tpa. Residual waste dominates, with only 47% of material diverted through recycling or organics processing, reinforcing ongoing reliance on landfill.

Scenario 2 introduces non-renewable developments:

- Baseline Estimate: Sharp waste spike from 2025 - 2027, driven by coal power station upgrades and extractive industries (primarily in Muswellbrook), before returning to baseline levels.
- Upper Limit Estimate: Sustained waste generation through to 2033, largely from the additionan of transmission line construction impacting multiple LGAs.
- Key waste streams: C&D waste, garden/food organics, and general waste dominate.
- Infrastructure risks: Without upgrades, a significant portion of recoverable construction waste will be landfilled, accelerating landfill capacity issues.

Scenario 3 adds renewable energy developments:

- Renewable projects contribute additional waste, but impacts are smaller than those from non-renewable infrastructure.
- Waste volumes from renewables show two minor peaks (2025 - 2026 and 2030 - 2031), aligning with NE REZ delivery stages.
- Waste composition becomes more specialised (solar panels, wind components, battery waste, dangerous goods).
- Without recovery pathways, much of this material risks being landfilled.
- LGA-Specific Impacts:
    - Uralla: Highest relative increase, waste volumes spike by ~80% post 2030.
    - Upper Hunter: Sustained 50% rise above baseline between 2027 - 2031.
    - Tamworth: Early spike (~20% above baseline) linked to BESS and PHES.
    - Armidale and Glen Innes: Moderate increases, particularly from solar and BESS projects.

Overall, across all scenarios:

- Construction activities (rather than operations) are the dominant source of waste generation.
- Significant opportunities exist to divert C&D and renewable component waste if regional processing capacity is expanded.
- Without intervention, landfill dependence will increase, particularly for specialised renewable waste streams.

13.5 Circular Economy Opportunities

Despite the projected increase in waste volumes, the study identifies strong potential to embed circular economy principles into the NE REZ's development lifecycle. Many project components (eg wind turbine blades, solar panels, and battery units) retain significant value for reuse, refurbishment, or advanced recycling. However, realising this potential will require systemic interventions, including:

- Investment in new recycling technologies for complex waste streams (e.g., composite blades, laminated solar panels).
- Mandating reverse logistics plans during construction phases to transport recyclable materials back to metropolitan processing centres.
- Developing digital marketplaces and repair/refurbishment networks for second-life infrastructure components.
- Advocacy for Extended Producer Responsibility (EPR) frameworks to ensure manufacturers retain end-of-life responsibility for key materials.

Without proactive measures, valuable materials risk being lost to landfill, undermining both economic and environmental outcomes.

14 Opportunities

This section of the study identifies opportunities in waste management and circular economy that could assist with coordinating the delivery of the New England REZ. EnergyCo, with the support of the Whole of Government, Local Government, and industry, has the chance to lead initiatives that prioritise resource efficiency, waste recovery, avoidance, and reduction.

These opportunities cover the entire infrastructure lifecycle from design and construction to operation and decommissioning. They align with EnergyCo's broader objective to plan and coordinate the delivery of infrastructure projects within the NE REZ.

They have been shaped by the key findings of this study, which highlighted significant gaps in waste management planning, infrastructure capacity, data transparency, and coordination between stakeholders. By responding directly to these issues, the opportunities outlined below offer practical pathways to support the effective and sustainable delivery of projects across the NE REZ.

This section outlines 11 key opportunity areas (in no particular order) where action can improve waste management outcomes in the NE REZ:

1. Waste Advisory Service
2. Standardised Waste Management Plans
3. NE REZ Waste Management Framework
4. Centralised Waste Facility Database
5. Pre-Approved Waste Service Agreements
6. Waste and Circular Economy Grants Advisory Service
7. NE REZ Waste Working Group
8. Streamlined Approvals for Waste Infrastructure
9. Circular Economy Initiatives & Reverse Logistics
10. Monitoring and Reporting Mechanisms
11. Coordinated Decommissioning Plans

14.1 Waste Advisory Service

Establish and fund a centralised waste advisory service to support affected councils in assessing the Waste Chapters of submitted EISs for NE REZ projects. This service would provide councils with on-demand access to expert waste management consultants who can review project applications, offer technical advice, and ensure alignment with best practices.

This model has been successfully implemented by councils to alleviate pressure on planning departments, particularly for complex waste projects. By providing a shared resource, the waste advisory service would help councils manage the increasing volume of NE REZ-related planning applications without requiring individual councils to engage their own waste specialists.

A centralised service model offers several advantages:

- Efficiency: Expertise is deployed where and when needed, avoiding duplication across multiple councils.
- Cost-effectiveness: Centralised funding would relieve individual councils of the financial burden, making specialist advice accessible regardless of local resourcing constraints.
- Consistency: A single advisory team ensures uniform assessment standards across different jurisdictions, reducing inconsistencies in project approvals.
- Scalability: The service could initially focus on high-impact projects and expand based on demand.

A specialist waste management consultancy should be commissioned to oversee service delivery, ensuring councils have consistent, expert-led support without the need for internal resourcing

14.2 Standardised Waste Management Plans

Develop a standardised waste management report template for all NE REZ proponents. This template would establish clear and consistent planning requirements, ensuring councils receive structured, policy-aligned waste reports that streamline project assessments.

Currently, waste reporting varies significantly across projects, leading to inconsistent submissions, approval delays, and administrative burdens for councils. A mandatory, standardised template would improve regulatory efficiency by ensuring all waste management plans meet NSW EPA and Department of Planning, Housing and Infrastructure (DPHI) requirements, enabling councils to assess projects faster and more effectively.

This initiative would benefit both councils and proponents:

- For Councils – The template would reduce workload, improve consistency, and enhance compliance by ensuring all applications present required waste data in a structured format.
- For Proponents – Clear guidance upfront reduces costly revisions and delays, simplifies the approvals process, and provides certainty around compliance expectations.

To implement this, it is recommended that:

1. Waste management specialists be engaged to develop the template in collaboration with councils, the NSW EPA, and DPHI to ensure regulatory alignment.
2. The template be mandated as part of the planning or access scheme for all NE REZ projects to ensure consistency.
3. Flexibility be built into the template to accommodate waste variations across different infrastructure types (e.g. solar, wind, BESS, and PHES).
4. Digital reporting tools (e.g. an online submission portal) be explored to streamline data collection and analytics.

Commissioning the development of this template through independent waste experts will ensure it is technically robust, user-friendly, and aligned with best-practice resource recovery and waste minimisation strategies.

14.3 NE REZ Waste Management Framework

Establishing an overarching Waste Management Framework for the NE REZ would provide a consistent, strategic approach to waste handling, resource recovery, and circular economy integration across all stages of renewable energy project development.

This Framework could outline clear expectations for project proponents and councils regarding best-practice waste minimisation, reuse, recycling, and reporting. It would also help align waste management across the NE REZ with broader NSW Government strategies, including the *Waste and Sustainable Materials Strategy 2041* and the *Circular Economy Policy Statement*.

Key elements of the Framework could include:

- Standard principles and targets for waste avoidance, resource recovery, and circularity.
- Guidelines for waste data reporting, reverse logistics planning, and end-of-life recovery.
- Reference to approved waste management templates and assessment tools.
- Alignment with NSW EPA and DPHI requirements to streamline planning approvals.
- Clear roles and responsibilities for councils, proponents, and regulators.

This Framework would reduce regulatory fragmentation, provide greater certainty for proponents, and ensure that councils have a clear reference point when assessing development applications. It would also serve as a foundation for implementing many of the other initiatives proposed in this study.

14.4 Centralised Waste Facility Database

Establish a centralised, web-based database of waste facilities servicing the NE REZ region. This tool would provide councils and project proponents with up-to-date, verified information on available waste infrastructure, ensuring more consistent, efficient, and transparent waste planning for NE REZ projects.

Currently, proponents must individually source facility data independently, leading to inconsistent reporting, project delays, and additional burdens on councils tasked with verifying waste management plans. A single-source database would:

- Reduce approval timelines by providing councils with pre-verified waste facility data.
- Streamline proponent planning by removing the need for independent research.
- Improve regional waste coordination, helping identify gaps in processing capacity.

To ensure the database is effective and trusted:

1. A waste data provider, government agency, or regulatory body (e.g., the EPA) could be engaged to manage and maintain the database.
2. Integration into the planning process could be mandated by requiring proponents to reference the database in their EIS Waste Chapters.
3. The scope should focus on key planning information, such as facility locations, accepted waste streams, licensing status, and capacity constraints.
4. The platform should be maintained as a live, web-based resource to allow regular updates and ongoing accessibility.

This shared resource would support more efficient project approvals, improved waste outcomes, and better-informed infrastructure planning across the NE REZ region. It could prioritise renewable energy waste streams that are high-volume or technically challenging to manage, such as solar panels, wind turbine blades, and battery energy storage components.

14.5 Pre-Approved Waste Service Agreements

To support consistent and efficient waste management outcomes across NE REZ projects, a pre-approved waste service agreement framework could be established. By securing regional waste service arrangements in advance, project proponents would gain access to reliable, cost-effective disposal and recycling options during the planning phase, reducing approval delays and enabling improved environmental outcomes.

To support implementation, the following steps could be considered:

1. Commission an industry-led procurement process to establish a prequalified panel of waste service providers.
2. Prioritise service coverage for high-volume or complex waste streams with known gaps in processing infrastructure, such as solar panels, wind turbine blades, and BESS.
3. Engage with waste industry stakeholders to ensure agreements are aligned with relevant regulatory frameworks and allow for flexibility in service delivery and pricing.

A shared, pre-approved services model would encourage private investment in regional waste infrastructure, reduce duplication of procurement efforts, and streamline regulatory approvals. It ensures that proponents have access to appropriate waste solutions from the outset of project planning.

14.6 Waste and Circular Economy Grants Advisory Service

A centralised grants advisory service could be established to support councils in identifying, applying for, and securing funding for waste and circular economy infrastructure. Many regional councils face resource and capacity constraints, which can limit their ability to navigate complex grant programs and capitalise on available funding opportunities.

By providing on-demand access to grant specialists, the service would help councils improve application quality, foster collaboration, and increase success rates, ultimately accelerating the delivery of infrastructure aligned with renewable energy development.

Key features of the service could include:

1. Engagement of a specialist grants consultant or advisory firm to provide tailored support to councils.
2. Development of standardised grant application templates aligned with regional priorities.
3. Coordination of multi-council applications to strengthen funding proposals through collaborative approaches.
4. Delivery of training and workshops to build grant-writing skills among council staff.

This initiative would reduce administrative burdens, unlock additional funding streams, and enhance the rollout of waste and circular economy infrastructure supporting NE REZ projects.

14.7 NE REZ Waste Working Group

A NE REZ Waste Working Group could be established to bring together councils, regulators, private waste service providers, and technical experts to coordinate waste management strategies, infrastructure planning, and circular economy initiatives across the NE REZ.

Rather than forming a new standalone body, the working group should align with existing regional waste groups and embed a dedicated REZ waste stream to address the specific challenges associated with renewable energy project waste.

Key functions of the working group could include:

1. Developing coordinated waste solutions – Identifying infrastructure gaps, facilitating regional waste processing options, and supporting reuse and recycling initiatives.
2. Providing a forum for ongoing collaboration – Enabling stakeholders to remain informed and engaged on evolving NE REZ waste issues and regulatory updates.
3. Aligning waste infrastructure planning with NE REZ development – Encouraging proactive planning of facilities and services to meet forecasted needs.
4. Tracking and coordinating cumulative impacts – Ensuring waste generated from multiple NE REZ projects is assessed and managed holistically.

To implement this initiative:

- Regional councils and existing waste groups could be engaged to integrate NE REZ waste matters into their agendas.
- Collaboration with the EPA and DPHI would ensure regulatory alignment.
- Participation from private industry, including waste and recycling contractors, should be encouraged to incorporate market-based perspectives.
- Funding or technical support could be made available to ensure the group delivers practical, action-oriented outcomes.

This initiative would reduce regulatory fragmentation, improve long-term waste infrastructure planning, and drive region-wide collaboration to effectively manage NE REZ waste in alignment with circular economy principles.

14.8 Streamlined Approvals for Waste Infrastructure

There is an opportunity to advocate for the inclusion of NE REZ-related waste infrastructure in the NSW Planning Concierge Service, ensuring councils and private proponents receive dedicated support to navigate the planning system. As NE REZ development progresses, new or expanded waste facilities will likely be required, both by councils to meet growing local demand and by industry to manage the large volumes of project-generated waste.

Given that councils will play a key role in delivering public waste infrastructure, as well as private sector proponents delivering new recycling and recovery facilities, access to dedicated planning support could significantly reduce administrative burdens and approval timeframes across both sectors. Similarly, private developers seeking to establish recycling or processing infrastructure to service renewable energy project waste would benefit from a streamlined approach.

In addition, selected NE REZ-related waste infrastructure projects could be considered for designation as State Significant Development (SSD), where appropriate. Elevating eligible projects to SSD status would enable assessments to be led by DPHI, rather than local councils, helping to avoid capacity constraints and ensure strategic alignment with regional and state priorities.

Benefits of this approach include:

- Faster Approvals – Councils developing new waste facilities would receive direct support, reducing bottlenecks in planning assessments.
- Consistent Decision-Making – A centralised approach ensures waste infrastructure is assessed against uniform state-level criteria, preventing inconsistencies between LGAs.
- Greater Investment Certainty – Private waste facility developers would have a clearer and more predictable approvals pathway, encouraging investment in REZ-adjacent waste solutions.
- Improved Council Capacity – Councils would still play a role in local land-use planning but would benefit from a streamlined, state-led approvals process.

To implement this initiative:

1. Engage with NSW Government agencies (e.g. DPHI) to explore options for expanding the Concierge Service to include NE REZ-related waste infrastructure.
2. Work with councils and industry stakeholders to identify priority infrastructure needs and support requirements.
3. Identify waste infrastructure projects that may qualify for SSD status and assist with their advancement through the planning system.

By streamlining approvals for waste infrastructure, this initiative would help ensure the timely delivery of critical facilities needed to support NE REZ development, while also encouraging broader private sector investment in waste and recycling solutions.

14.9 Circular Economy & Reverse Logistics

14.9.1 Circular economy

There is an opportunity for relevant government agencies and regional stakeholders to take a more active role in facilitating circular economy initiatives that extend the lifespan of renewable energy components, reduce disposal burdens, and unlock economic opportunities within NSW's waste and recycling sector. Given the scale of infrastructure development across the NE REZ, a coordinated approach to reuse, refurbishment, and advanced recycling is critical to minimising environmental impacts and supporting a more sustainable energy transition.

In addition to renewable-specific initiatives, strengthening baseline resource recovery through expanded organics processing and enhanced recycling efforts across NE REZ councils should also be prioritised. Improving current diversion rates will reduce reliance on landfill and maximise the cumulative benefits of circular economy initiatives.

Encouraging Reuse and Refurbishment

Many renewable energy components retain value beyond their first life. A digital marketplace could be developed, accessible to project developers, councils, and community groups, to facilitate the exchange or repurposing of used infrastructure components such as:

- Second-hand wind towers and blades for alternative uses (e.g., bridges, outdoor structures, or architectural features);
- Re-engineered battery modules repurposed for lower-demand energy storage applications;
- Decommissioned solar panels with remaining functional capacity reused in off-grid or community settings.

Such a platform could be integrated into existing planning and engagement channels, offering a low-cost, high-impact mechanism to improve resource efficiency and reduce waste volumes across the NE REZ.

Investing in Research & Innovation

Collaboration between research institutions, waste operators, and government bodies can support the development and pilot testing of advanced recycling technologies for challenging renewable energy waste streams such as PV laminates, composite wind turbine blades, and lithium-ion batteries. Small-scale trials can de-risk innovation, validate new processing methods, and encourage private-sector investment in circular solutions.

The University of New England, located in the heart of the NE REZ, has expressed interest in partnering on research into the recycling of renewable energy waste and the management of obsolete or broken materials. This potential collaboration could support innovation and strengthen circular economy initiatives within the region.

This effort could also align with the NSW EPA's emerging *Resource Recovery Innovation Pathway*, which is designed to streamline approvals for new technologies and remove regulatory roadblocks (e.g., complex waste classifications, stockpiling limits). Supporting projects through this pathway would accelerate commercialisation and help NSW meet its circular economy and resource recovery targets.

Advocating for Extended Producer Responsibility (EPR)

To shift the burden of end-of-life disposal away from councils and toward producers, policymakers and industry could collaborate to advocate for an EPR framework covering:

- Solar panels;
- Wind turbine blades;
- BESS.

Global precedents (e.g., EU EPR schemes for batteries and PV panels) show that this approach can close material loops and incentivise sustainable product design. Stakeholders across industry, government, and the waste sector could play a role in advancing this framework in NSW to ensure circular principles are embedded in manufacturing and procurement standards.

14.9.2 Mandating Reverse Logistics for Construction Waste

Reverse logistics strategies should be embedded into construction-phase waste management plans to ensure recyclable and reusable materials, such as pallets, packaging, steel offcuts, and excess materials, are transported to facilities with appropriate processing capacity (eg metropolitan areas where specialised facilities exist). This is particularly important for NE REZ regions, where local infrastructure may be limited.

To implement this:

1. Require Reverse Logistics Plans in EIS Submissions: Proponents should demonstrate how they will implement reverse logistics for recyclable materials, with a particular focus on packaging

materials and construction offcuts. Waste management plans should identify materials suitable for backloading and outline transport logistics.

2. Encourage Bulk Transport Coordination: Proponents operating within the same geographic cluster should be encouraged to coordinate transport logistics, reducing the need for empty return trips and lowering emissions.
3. Monitor Compliance and Outcomes: Reporting frameworks should be established to track reverse logistics performance, ensuring that commitments are met and waste is diverted from landfill. These requirements could be linked to planning conditions or post-approval compliance monitoring.

By embedding reverse logistics into the construction process, proponents can reduce environmental impacts, increase recovery rates, and deliver more cost-effective outcomes across the NE REZ.

14.10 Monitoring & Reporting Mechanisms

Monitoring

Establishing a structured waste monitoring and reporting framework for all NE REZ projects will support consistent data collection on waste generation, disposal, and recovery outcomes. This will enhance regional waste infrastructure planning, provide insights into emerging waste streams, and drive continual improvements in resource recovery practices.

Critically, collected waste data should not only support compliance monitoring but also be used to inform strategic waste infrastructure investment across the NE REZ, ensuring facilities are planned and developed in response to cumulative project impacts.

Reporting

A mandatory waste reporting framework could be developed in consultation with the NSW EPA and DPHI. This framework would define:

- What data must be reported – including waste quantities, material types, treatment methods (e.g. recycling, landfill, reuse), and transport movements;
- Who is responsible for reporting – such as project proponents, principal contractors, or licensed waste service providers;
- How often data must be reported – whether on a quarterly, annual, or project-lifecycle basis.
- How data will be used – to inform government policy, regional infrastructure investment, and compliance monitoring.

To improve efficiency and consistency, the introduction of a centralised digital reporting system should be considered. This system could allow for electronic submissions and potentially integrate with existing NSW EPA tracking platforms where appropriate.

Public Transparency and Benchmarking

To maximise the value of the data collected, aggregated and de-identified information should be published regularly. This would help promote industry transparency, stimulate innovation, and drive performance improvements across the sector. Opportunities include:

- Annual REZ Waste Reports – summarising total waste volumes, recycling rates, and alignment with circular economy targets.
- Industry Benchmarking – enabling proponents to assess their waste management performance relative to peers.
- Recognition Programs – highlighting and rewarding projects that demonstrate excellence in waste minimisation, reuse, and recycling.

A robust monitoring and reporting regime will ensure that all NE REZ projects are held to consistent standards, provide local governments with valuable infrastructure planning data, and support NSW's transition toward a more circular and resource-efficient economy.

14.11 Coordinated Decommissioning Plans

Improved coordination between project proponents, councils, and waste service providers will be essential to efficiently manage the decommissioning of renewable energy infrastructure within the NE REZ. As projects reach end-of-life at different times, there is potential for fluctuating waste volumes that could strain recycling capacity and impact regional waste infrastructure. A coordinated approach to decommissioning can help mitigate these impacts, create cost savings, and support investment in dedicated recycling facilities.

Key opportunities to improve decommissioning coordination include:

1. Facilitating Regional Decommissioning Plans: Establishing indicative decommissioning schedules across projects would allow identification of overlapping timeframes where economies of scale could be leveraged. Sharing this information with local councils and waste service providers can improve forward planning for infrastructure capacity and investment.
2. Engaging with the Recycling Sector: Early engagement with recycling operators can help identify potential barriers to processing large volumes of end-of-life materials such as solar panels, wind turbine blades, and battery components. Greater demand visibility may encourage investment in regional facilities and technologies to support high-volume decommissioning.
3. Encouraging Bulk Procurement and Reverse Logistics: Coordinated decommissioning activities could enable bulk contracting for transport and processing services, reducing per-unit disposal costs for asset owners. Incorporating reverse logistics into decommissioning plans would allow for more efficient collection and transport of reusable or recyclable components.
4. Supporting Standardised End-of-Life Reporting: In collaboration with the NSW EPA and DPHI, best-practice guidelines could be developed to standardise decommissioning processes and reporting. A centralised database tracking planned decommissioning projects would support infrastructure planning and prevent bottlenecks in waste processing.

By proactively planning for infrastructure end-of-life, proponents and stakeholders can reduce reliance on landfill, improve circular economy outcomes, and achieve greater cost and operational efficiency across the NE REZ.

15 Employment Opportunities and Legacy Outcomes

15.1 Employment Opportunities

The transition to a more resource-efficient and circular economy within the NE REZ will drive new employment opportunities across multiple sectors, from waste management and recycling to logistics, manufacturing, and research & development. These jobs will emerge as a result of improved waste infrastructure, mandated resource recovery measures, and policy-driven shifts toward circular economy principles. Table 29 presents the potential employment opportunities.

Table 29: Potential Employment Opportunities

Sector	Employment Opportunities	Drivers of Job Creation
Waste & Recycling Sector	Equipment and vehicle suppliers Recycling facility operators and technicians Material recovery specialists Hazardous waste management professionals	Increased processing of solar panels, wind turbine blades, batteries, and construction waste Growth of secondary material processing and recycling Implementation of hazardous waste regulations
Circular Economy Business Models	Refurbishment and remanufacturing technicians Digital marketplace administrators Product lifecycle managers	Demand for second-hand wind turbine blades, re-engineered battery modules, and repurposed solar panels Development of trading platforms for used components EPR regulations promoting manufacturer take-back schemes
Logistics & Reverse Logistics	Transport & freight coordinators Waste logistics planners On-site waste management specialists	Mandated reverse logistics for REZ projects Backhauling of construction materials and packaging waste to metro areas Increased coordination of bulk transport for project components
Research & Innovation	Material scientists & engineers Circular economy consultants AI & automation specialists in waste processing	Investment in solar panel, wind turbine, and lithium battery recycling Development of advanced material recovery methods AI-driven waste tracking and automation
Local Government & Policy Implementation	Planning officers & environmental assessors Waste policy analysts Grants & funding advisors Auditors	Increased responsibility for waste management planning and approvals Development of waste and circular economy regulations Need for funding support for new recycling initiatives
Community Engagement & Education	Sustainability trainers & workforce developers Community engagement officers	Growth of training programs on resource efficiency and waste management

Sector	Employment Opportunities	Drivers of Job Creation
	Circular economy educators	Community involvement in circular economy initiatives Need for local business engagement in reuse and recycling

15.2 Legacy Outcomes

The transition to a circular economy within the NE REZ presents significant opportunities to deliver lasting social and economic benefits to host communities. By prioritising resource efficiency, waste reduction, and sustainable material use, EnergyCo can help create local employment, support business innovation, and strengthen regional waste and recycling infrastructure. These initiatives will not only mitigate environmental impacts but also ensure that REZ developments contribute to long-term community resilience and economic prosperity.

Table 30 outlines the key social impacts, benefits, and legacy outcomes associated with circular economy initiatives in the REZs, demonstrating how EnergyCo can maximise positive long-term outcomes for communities, businesses, and the waste sector.

Table 30: Key Social Impacts, Benefits, and Legacy Outcomes

Key Area	Impact	Benefit	Legacy Outcome
Regional Economic Development & Job Creation	Increased resource efficiency and circularity will create stable, long-term employment across waste management, recycling, logistics, and policy development.	Regional communities will benefit from sustained job growth, reducing reliance on transient construction jobs.	Development of a skilled workforce in waste management and circular economy sectors, with long-term employment prospects beyond REZ construction.
Strengthening Local Waste & Recycling Infrastructure	Investment in regional waste processing facilities will reduce dependency on distant metropolitan infrastructure.	Councils and businesses will have greater control over waste streams, fostering economic resilience and reducing transport costs.	A permanent, well-integrated regional waste and recycling network, supporting both REZ projects and local industry beyond the life of individual developments.
Supporting Social Equity & Community Wellbeing	Efficient waste management and circular economy initiatives will reduce environmental burdens on host communities, such as illegal dumping and waste stockpiling.	Improved environmental management will enhance quality of life and strengthen community trust in the REZ development process.	A proven model for sustainable infrastructure planning, ensuring future energy projects integrate waste minimisation from inception.
Enhancing Circular Economy Culture & Business Innovation	Mandating reuse, refurbishment, and extended producer responsibility will drive innovation in secondary markets for renewable infrastructure components.	Creation of new business opportunities for local entrepreneurs and industries focused on material recovery and repurposing.	A self-sustaining circular economy ecosystem that extends beyond REZ projects, ensuring NSW remains a leader in sustainable energy and waste management.

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Additional internal data sources, stakeholder interviews, and consultation outcomes have been referenced throughout the study where relevant.

Appendix A

Stakeholders

Local Government Councils

Table 31: Issues Identified by LGAs

Key issue	LGA Group	Description	Potential Impact
Landfill capacity	North and South	Councils are concerned that their landfills do not have the capacity to accept the volumes of waste generated through development of the NE REZ.	Reducing landfill capacities can skew planned landfill lifespans for local communities, putting pressure on communities and neighbouring councils.
Licensing caps	North and South	EPL licence caps the amount that can be received.	Inability to meet the increased volumes in waste generation.
Data sharing issues	North and South	Delayed access to data pushes out processes for implementing infrastructure upgrades.	Councils lack time and data to forecast waste flows to be able to plan upgrades / increase licence limits.
Resource shortages	North and South	Limited staff capacity and competing waste and resource recovery priorities for councils, particularly due to the NSW mandate for universal FOGO services by 2025. Limited funding also available to fund future waste demands.	Delayed implementation of critical waste infrastructure and services.
Regional council staff shortages	North and South	Regional council staff already manage multiple responsibilities, therefore existing priorities are often prioritised.	Waste management planning is often not seen as an immediate concern for the public service and health sectors.
Hard to recycle waste challenges	North	Renewable energy projects produce hard to recycle wastes, such as treated packaging materials and timber spools.	Increased resources required for processing and lost recycling opportunities.
Recycling infrastructure	North	Insufficient suppliers and facilities to handle increased recycling obligations.	Missed recycling targets and over-reliance on landfills.
Decommissioning issues	North and South	Lack of clear strategies for end-of-life equipment like wind towers and solar panels. Agreements for decommissioning sit with landowners, with concerns over risk and accountability.	Risk of improper decommissioning, Potential for legacy waste and environmental impacts.
REZ equipment	North	High waste volumes expected from solar PV units and other equipment due to renewal, damage, or technology upgrades.	Puts pressure on existing landfill capacity due to limited established recycling options and markets. Stockpiling is also an issue and councils are obligated to landfill under current EPA definitions.

Key issue	LGA Group	Description	Potential Impact
Hazardous waste	North and South	Limited regional capacity for hazardous waste like asbestos.	Increased risk of improper disposal and environmental harm.
C&D waste management	North	Construction and demolition waste needs better recycling enforcement.	Valuable materials may be landfilled unnecessarily.
VENM / ENM and contaminated soils	North and South	Large-scale VENM / ENM, contaminated soils pose disposal / processing challenges as well as limited storage/processing capacities.	Inadequate established disposal processes and potential for legacy waste and environmental impacts.
Scalability concerns	North and South	Existing contractors may lack capacity for the scale of REZ waste management needs.	Potential service gaps and inefficiencies in waste handling.
Weighbridge limitations	South	Waste could flow from outside the waste levy boundary, increasing weighbridge data requirements. Current single-direction weighbridges unsuitable for large multi-axle trucks; semi-trailer and height restrictions.	High capital and operational costs for weighbridge upgrades and data handling. Potential for increased waste volumes. Current weighbridges unable to handle large waste items like wind farm equipment.
Waste projection modelling	South	Infrastructure projects (roads, underground cables, and other supporting facilities) create waste not accounted for. Proponents may alter roads for delivering generator parts.	Insufficient planning for waste volumes from infrastructure construction, leading to inefficiencies in waste management systems.
Worker accommodation waste	South	Waste responsibility should lie with generators, this requires adequate storage and collection design.	Poorly planned waste systems could lead to inefficiencies, community impact, and legacy issues after project completion.

Table 32: Opportunities Identified by LGAs

Key Opportunity	LGA Group	Description	Potential benefit
Business and industrial economy	North	Establish an industrial precinct for reuse, recycling, and storage of problematic materials, FOGO processing and treatment, or solar panel reuse and recycling.	Supports regional economic growth, creates jobs, and enables innovative waste processing.
Increased regional investment	North and South	Leverage higher waste quantities from NE REZ being the largest REZ in NSW, attracting private companies and incentivising resource recovery locally.	Leverages higher waste quantities, reverse logistics, and focus on the region to attract businesses to the region, increasing employment opportunities and economic growth.
Skills and training	South	Potential to bring greater training and skills to regional areas.	Strengthens the regional workforce, improving employability and economic stability.
Early data sharing	North	Share population, waste flow, and renewable energy capacity data early.	Enables better planning, facilitates partnerships, and supports commercial negotiations and investments.

Key Opportunity	LGA Group	Description	Potential benefit
Local solutions and negotiation	North	Prioritise local development of infrastructure and investment in recycling hubs.	Reduces transport needs, builds regional infrastructure, and strengthens council negotiation power.
Community funding and legacy planning	South	Provides a significant pool of community funds, not only aiding the development of recycling infrastructure, but supports the broader communities. Legacy planning can repurpose infrastructure for additional community benefits post-decommissioning.	Leaves lasting benefits for the community.
Available land	North	Utilise vacant industrial land for circular economy initiatives, and leveraging feedstock like PV, glass, and steel.	Benefits from developing existing vacant land, promotes circular economy opportunities, and encourages the growth of sustainable industries.
Regional collaboration	North and South	Collaborate with neighbouring councils to develop sustainable industries, including a crate recycling, organics processing, expansion of reuse/recycling marketplaces, metals recycling, and C&D waste upcycling.	Achieves economies of scale, promotes collaboration amongst communities and councils, reduces emissions from waste transport, and improves regional resource recovery rates.
Expanding partnerships	North	Build on existing partnerships with UNE, CSIRO, and agribusiness for solar PV recycling and other initiatives.	Strengthens innovation and collaboration, creating pathways for advanced recycling technologies and research-driven solutions.

Regional Joint Organisations

Table 33: Opportunities Identified by Hunter Joint Organisation

Topic	Detail
Waste Logistics and Storage Planning	The remote locations of NE REZ projects will require careful planning for waste transport, storage, and logistics. Dedicated space should be allocated for the future storage and recovery of large components, such as wind turbine blades.
Lessons from Singleton's Energy Transition	Mining closures and infrastructure decommissioning have generated large volumes of bulky waste, such as oversized power poles. Lack of specialised equipment has limited recovery opportunities, forcing some materials to be sent to landfill or offsite processors.
Waste Transport Pressures	Waste from NE REZ developments is likely to be transported through or into the Hunter region in search of appropriately licensed landfills.
Impacts of Waste Levy Changes	Scheduled waste levy changes in 2026 will impact waste transport economics, particularly for waste moved into levy regions from outside.

Topic	Detail
Need for Waste Flow Monitoring	Monitoring material flows will be critical, as significant quantities of waste may transit through the Hunter region over the project delivery period.
Opportunities for Industrial Circular Economy Growth	The broader industrial transition in the Hunter creates opportunities for REZ developments to plug into and strengthen emerging circular economy business cases.
Land Clearing Waste Management	Construction of projects and transmission lines will involve extensive vegetation removal. Best-practice processes for handling cleared materials should be followed.
Circular Procurement Opportunities	Greater emphasis is needed on material selection and circularity principles early in project design stages, well before procurement decisions are finalised.
Current Circular Economy Initiatives	HJO is actively working with State Government on low-carbon concrete initiatives. HJO operates a Material Exchange Knowledge Hub that tracks council-managed waste streams, identifies onsite and offsite processing, and pinpoints regional collaboration opportunities.
Hunter Circular Digital Hub	A digital platform exists to support regional collaboration in material management and circular economy initiatives.
Precincts and Ports for Material Management	HJO is working to coordinate material management efforts across identified precincts and ports, aiming to facilitate circular economy infrastructure through an independent hub. Several battery recycling businesses and soft plastics manufacturers (e.g., IQ Renew in Taree) are active in the broader region. Potential biochar facilities are emerging but currently lack the scale needed to support REZ-level waste volumes.
Repair, Reuse, and Operational Waste Opportunities	Opportunities exist to establish local repair, refurbishment, and reuse industries to manage operational phase waste from renewable energy assets. Strategic signalling from EnergyCo could help catalyse private sector investment in these industries rather than relying on grant programs.
Lessons from Central-West Orana (CWO) REZ	Feedback from Mid-Western Council regarding the CWO REZ highlighted concerns about limited long-term jobs and economic benefits post-construction. Investing strategically in infrastructure and circular economy initiatives, rather than focusing solely on grants, could help deliver more sustained regional benefits.

Table 34: Opportunities Identified by Northern Inland Regional Waste

Topic	Detail
Pre-Planning Gaps	Very little pre-planning occurs prior to project commencement; councils often caught unprepared.
Size and Processibility of Waste	Wind blades, plastic strapping, and oversized components create handling issues; councils require equipment to downsize items; generators should size-reduce components before transport.
Contamination of Waste Streams	REZ waste often contaminated (e.g., bromide-treated crates, timber with bolts) limiting recycling options; need for clean stream separation and alternative, sustainable materials.
Early Data on Waste Flows	Indicative quantities of waste types and timing are critical for council planning but usually missing from WMPs.
Waste Pricing and Market Control	Councils should consistently review and align fees and charges to prevent waste diversion based on cost alone.
Bulking Centres for Transport	Opportunity to build a regional bulking centre (e.g., near Armidale or Tamworth) to consolidate REZ waste for cost-effective transport to processing facilities.
C&I MRF Development	Potential for a Commercial and Industrial (C&I) Materials Recovery Facility (MRF) but timelines for approvals and construction are a major concern.
Disaster Waste Management	Disaster events (avian flu, bushfires, floods, hailstorms) can severely impact landfill capacity; planning must incorporate these risks.
Current and Future Projects	Updated NIRW strategy 2022–27 forthcoming. Awaiting NSW Infrastructure Plan and EPA Material Flow Analysis. Working on regional disaster waste management MOUs. Focus on landfill closures and specific material streams (plastics, FOGO). Managing regional contracts for recycling and waste services (e.g., scrap metal, green waste, e-waste).

Appendix B

Case Studies

This appendix presents a portfolio of case studies highlighting successful resource recovery and circular economy initiatives implemented on comparable renewable energy projects. These examples support the findings of Section 9 by illustrating how circular strategies have been applied in real-world contexts, both in Australia and internationally.

Each case study outlines:

- Project context
- Location
- Initiative details
- Approximate costs or cost savings (where available)
- Engagement with suppliers or stakeholders
- Performance data
- Social, economic, and environmental outcomes
- Lessons learned

A summary of all case studies is provided in 35.

Table 35: Summary of Circular Economy and Resource Recovery Case Studies for Renewable Energy Projects

Renewable type	Case study
BESS	Case Study 1: Moment Energy's Circular Economy Initiative Case Study 2: Redwood Materials
Solar	Case Study 1: Reclaim PV Recycling, South Australia Case Study 2: First Solar Global Recycling Program Case Study 3: Lotus Energy Recycling Plant, Victoria
Wind	Case Study 1: Siemens Gamesa RecyclableBlad Case Study 2: ZEBRA Project (Zero waste Blade ReseArch) Case Study 3: Re-Wind Project
PHES	Case Study 1: Okinawa Yanbaru Seawater Pumped Storage Power Station (Japan) Case Study 2: Taum Sauk Hydroelectric Power Station (USA) Case Study 3: Glenmuckloch Pumped Storage Hydro Project (Scotland)

BESS

Case Study 1: Moment Energy's Circular Economy Initiative

Project Context

Moment Energy, a Canadian cleantech company, repurposes electric vehicle (EV) batteries for energy storage projects. Moment Energy's initiative aims to address these challenges by extending the lifecycle of EV batteries, reducing waste, and enabling sustainable energy storage options for off-grid and remote communities reducing reliance on non-renewable energy sources.

Location

Canada

Initiative Details

Moment Energy partnered with EV manufacturers to source retired batteries that still retain 70-80% of their capacity. These batteries are refurbished and repurposed into modular energy storage systems. The systems are then deployed for use in renewable energy projects, industrial operations, and areas where reliable energy access is limited.

Approximate Costs or Cost Savings

- Initial Investment: $5-7 million (estimated, inclusive of R&D, testing infrastructure, and initial supplier agreements).
- Cost Savings: Customers using repurposed batteries report up to 30% lower costs compared to new energy storage systems.
- Revenue Generation: Increased revenues for Moment Energy by offering a cost-competitive and sustainable alternative to traditional battery systems.

Engagement Conducted with Suppliers or Stakeholders

- Partnered with leading automakers to secure a consistent supply of used EV batteries.
- Engaged with local governments, Indigenous communities, and renewable energy providers to identify deployment opportunities.
- Consulted environmental organisations to ensure compliance with circular economy best practices and local regulations.
- Conducted workshops with stakeholders to demonstrate the environmental and economic benefits of repurposed batteries.

Performance Data

- Energy Output: Batteries maintain an average efficiency of 85% for their intended secondary use.
- Lifespan Extension: EV batteries' lifecycles are extended by 5-7 years.
- Deployment Impact: Over 200 systems installed across Canada to date, providing clean energy to 15,000+ households and businesses.

Social, Economic, and Environmental Benefits and Outcomes from Resource Use Changes

- Environmental Benefits:
  - Diverted over 500 metric tons of battery waste from landfills.
  - Reduced greenhouse gas emissions by reusing materials instead of producing new batteries or recycling batteries that have higher uses.
- Social Benefits:
  - Provided reliable energy to remote and Indigenous communities, supporting energy equity and resilience.
  - Created jobs in battery testing, refurbishment, and system integration.
- Economic Benefits:
  - Enabled cost savings for businesses and communities adopting renewable energy solutions.
  - Strengthened Canada's leadership in the global circular economy market.

Lessons Learnt and Recommendations

1. Secure Reliable Partnerships: Establish long-term agreements with EV manufacturers to ensure a steady supply of used batteries.
2. Focus on Scalability: Invest in modular designs that can be adapted to various energy storage needs.
3. Community Involvement: Engage local communities early to align solutions with their specific energy needs and build trust.
4. Innovate Testing Protocols: Streamline battery grading and testing processes to improve efficiency and reduce costs.
5. Advocate Policy Support: Work with governments to incentivise circular economy initiatives and provide subsidies for secondary use systems.

Sources:

- Moment Energy Official Website
- Repurposing EV Batteries with Moment Energy - Vancouver Tech Journal
- Moment Energy Awarded US$20.3 million by U.S. Dept of Energy

Case Study 2: Redwood Materials

Project Context:

Founded by Tesla co-founder JB Straubel, Redwood Materials aims to create a closed-loop system for lithium-ion batteries, addressing environmental concerns and resource scarcity.

Location:

North America

Initiative Details:

- Developed advanced recycling processes to recover up to 95% of critical materials such as lithium, nickel, and cobalt from used batteries.
- Supplies recovered materials back to battery manufacturers to produce new batteries, reducing reliance on virgin materials.
- Established partnerships with automakers to collect used batteries from EV's and other applications.

Approximate Costs or Cost Savings:

- Initial investment includes millions for building recycling infrastructure but not publicly available.
- Cost savings are achieved through reduced reliance on newly mined materials, supporting sustainable supply chains.

Engagement Conducted with Suppliers or Stakeholders:

- Collaborates with major automakers like Tesla, BMW, and Ford to streamline collection and recycling processes.
- Works with local governments to create policies promoting battery recycling and reuse.

Performance Data:

- Processes enough end-of-life batteries annually to supply materials for approximately 60,000 new EVs.
- Achieves a recovery rate of 95% for critical battery materials.

Social, Economic, and Environmental Benefits:

- Social: Creation of new jobs in the recycling and materials recovery sectors.
- Economic: Strengthens the domestic supply chain for battery materials, reducing dependency on imports.
- Environmental: Avoids significant carbon emissions associated with mining and processing raw materials.

Lessons Learnt and Recommendations:

- Lessons Learnt: Effective partnerships with automakers are crucial for collecting end-of-life batteries efficiently.
- Recommendations: Scale operations globally and develop policies to incentivise recycling of batteries by consumers.

Sources:

- Redwood Materials Official Website

Solar

Case Study 1: Reclaim PV Recycling, South Australia

Project Context

With Australia experiencing a surge in solar panel installations, end-of-life panels present a growing waste management challenge. Reclaim PV Recycling was established to address this issue and promote a circular economy for solar panel waste.

Location:

Australia

Initiative Details

Reclaim PV Recycling operates a facility in Lonsdale, South Australia, dedicated to dismantling and recycling solar panels. The process involves recovering materials such as aluminium, glass, and silicon for reuse in manufacturing.

Approximate Costs or Cost Savings

- Initial establishment cost: Approximately AUD $2.5 million.
- Cost savings: Reduces landfill disposal fees and recovers materials for resale.

Engagement Conducted with Suppliers or Stakeholders

Reclaim PV collaborates with solar panel manufacturers, local councils, and waste management companies to establish a steady supply of end-of-life panels and promote the service to end users.

Performance Data

- Recovery rate: 90–95% of solar panel materials.
- Over 10,000 panels processed in the first operational year.

Social, Economic, and Environmental Benefits

- Diverted significant quantities of waste from landfill.
- Created 15 local jobs in the recycling and logistics sectors.
- Reduced reliance on virgin raw materials, contributing to emissions reductions.

Lessons Learnt and Recommendations

- Policies that mandate solar panel recycling are essential for scaling operations.
- Raising awareness among consumers and installers ensures a consistent material flow.
- Expanding recycling facilities to other states would amplify environmental benefits.

References

- Reclaim PV Recycling: www.reclaimpv.com

Case Study 2: First Solar Global Recycling Program

Project Context

First Solar recognised the environmental risks of disposing of cadmium-telluride (CdTe) photovoltaic modules and launched a closed-loop recycling program to address the issue.

Location

North America

Initiative Details

The program enables the recovery of up to 95% of semiconductor materials and 90% of glass from decommissioned modules. Recovered materials are reused in manufacturing new solar panels.

Approximate Costs or Cost Savings

- While costs are commercially sensitive, First Solar reports cost efficiencies by reducing the need for virgin raw materials and enhancing brand sustainability.

Engagement Conducted with Suppliers or Stakeholders

The initiative includes partnerships with waste management companies and industry stakeholders to create a seamless recycling process.

Performance Data

- Over 28,000 tonnes of materials recycled since the program's inception.
- Reduced greenhouse gas emissions from material recovery compared to virgin material production by approximately 20%.

Social, Economic, and Environmental Benefits

- Significantly reduced waste and mitigated risks of toxic material leakage.
- Contributed to a sustainable supply chain by reusing valuable materials.
- Improved corporate sustainability credentials and compliance with environmental regulations.

Lessons Learnt and Recommendations

- Investing in R&D for recycling technologies improves recovery rates.
- Early stakeholder engagement is critical to the program's success.
- Governments can drive wider adoption through supportive policies and incentives.

References

- First Solar Recycling Program: www.firstsolar.com

Case Study 3: Lotus Energy Recycling Plant, Victoria

Project Context

Victoria faced increasing waste from solar PV systems as panels approached the end of their operational lifespan. Lotus Energy responded by creating one of Australia's first solar panel recycling plants.

Location

Australia

Initiative Details

The plant uses a chemical-free process to recycle 100% of solar panels, including inverters and mounting systems, into reusable materials.

Approximate Costs or Cost Savings

- Estimated investment: AUD $3 million.
- Cost savings: Reduced landfill fees and recovered high-value materials for resale.

Engagement Conducted with Suppliers or Stakeholders

Lotus Energy worked with Victorian councils, solar installers, and community groups to promote the recycling service and ensure a consistent supply of panels.

Performance Data

- Processes approximately 500 tonnes of solar waste annually.
- Achieved a recovery rate of nearly 100% for materials.

Social, Economic, and Environmental Benefits

- Prevented large volumes of waste from entering landfill.
- Reduced demand for virgin materials, lowering resource extraction impacts.
- Provided employment opportunities in recycling operations and logistics.

Lessons Learnt and Recommendations

- Community education on the importance of recycling can increase participation rates.
- State-level initiatives should be expanded nationwide for consistent outcomes.
- Continued innovation in recycling processes can further improve efficiencies.

References

- Lotus Energy: www.lotusenergy.com.au
- Victorian Government Circular Economy Plan: www.sustainability.vic.gov.au

Wind

Case Study 1: Siemens Gamesa has developed the RecyclableBlade, the world's first wind turbine blade designed for full recyclability at the end of its lifecycle.

Project Context:

As the wind energy sector expands, the disposal of decommissioned turbine blades, traditionally challenging to recycle due to their composite materials, has become a significant environmental concern. Siemens Gamesa aims to address this issue by enhancing the recyclability of wind turbine components, aligning with their goal to produce fully recyclable turbines by 2040.

Location:

Global

Initiative Details:

The RecyclableBlade uses a novel resin that efficiently separates materials at the end of the blade's operational life. This innovation enables the recycling of blade components into new applications across various industries, promoting circularity within the wind energy sector. The first RecyclableBlades have been produced and installed, marking a significant advancement in sustainable wind turbine technology.

Approximate Costs or Cost Savings:

While specific financial details are not disclosed, the adoption of RecyclableBlades is expected to reduce waste management costs and create new revenue streams through the sale of recycled materials. Additionally, the initiative may lead to long-term savings by mitigating environmental liabilities associated with blade disposal.

Performance Data:

The RecyclableBlade has been successfully produced and installed, with initial deployments in offshore wind power plants. These installations serve as pilot projects to monitor the performance and recyclability of the blades under operational conditions.

Source : Siemens Gamesa

Social, Economic, and Environmental Benefits:

- Environmental: Significant reduction/avoidance in landfill waste and costs, and conservation of resources through material reuse.
- Economic: Potential cost savings in waste management and the creation of new markets for recycled materials.
- Social: Enhanced public perception of wind energy as a sustainable and environmentally responsible energy source.

Lessons Learned and Recommendations:

- Innovation in Materials: Developing new materials, such as the novel resin used in RecyclableBlades, is crucial for improving the recyclability of wind turbine components.
- Industry Collaboration: Engaging with industry partners and research institutions accelerates the development and adoption of sustainable technologies.
- Policy Support: Advocating for industry-wide standards on product decommissioning and recycling can facilitate the transition to a circular economy in the wind energy sector.

Siemens Gamesa's RecyclableBlade represents a significant step toward sustainable wind energy, addressing the critical issue of blade disposal and setting a precedent for future developments in turbine recyclability.

Case Study 2: ZEBRA Project (Zero waste Blade ReseArch) aims to design and manufacture the wind industry's 100% recyclable turbine blade.

With a product lifespan of 30 years and a wind turbine recyclability rate of 85% to 90%, the wind power industry is now looking to close the remaining gap by designing and manufacturing the first 100% recyclable wind turbine blade. To accelerate the wind power industry's transition to a circular economy for wind turbine blades, the ZEBRA project establishes a strategic consortium that represents the full value chain: from the development of materials to blade manufacturing to wind turbine operation and decommissioning and recycling of the decommissioned blade materials.

Project Context:

The wind energy industry faces challenges in recycling composite materials used in turbine blades, which are traditionally difficult to process at the end of their lifecycle.

Location:

Global

Initiative Details:

Launched in September 2020, the ZEBRA project aimed to develop the first 100% recyclable wind turbine blade using thermoplastic resin. The project involved designing, manufacturing, and testing full-scale prototypes to validate the feasibility of recyclable blades.

Approximate Costs:

The project had a budget of €18.5 million over 42 months.

Stakeholder Engagement:

The consortium included Arkema (resin supplier), CANOE (polymer formulation), ENGIE (wind farm operator), LM Wind Power (blade manufacturer), Owens Corning (glass fibre supplier), and SUEZ (recycling expertise). This collaboration covered the entire value chain from material development to recycling.

Source: LM Wind Power

Performance Data:

In March 2022, the project produced its first 62-meter recyclable blade. By October 2024, the project demonstrated a closed-loop recycling process, achieving over 75% yield in resin recovery and successful reintegration of recycled materials into new blades.

Source: Arkema

Benefits:

- Environmental: Significant reduction in landfill waste and resource conservation through material reuse.
- Economic: Potential cost savings in raw materials and waste management.
- Social: Advancement in circular practices within the wind energy sector.

Lessons Learned:

- Cross-sector collaboration is essential for developing comprehensive recycling solutions.
- Thermoplastic resins offer viable pathways for blade recyclability.
- Scaling up recycling processes requires addressing technical and economic challenges.

Source:

https://www.lmwindpower.com/en/stories-and-press/stories/news-from-lm-places/zebra-project-launched

Case Study 3: Re-Wind Project

Project Context:

Globally, the decommissioning of wind turbine blades presents environmental challenges due to their composite material composition.

Location:

Europe & North America

Initiative Details:

The Re-Wind project explores repurposing decommissioned blades into civil engineering applications, such as pedestrian bridges and utility poles, thereby extending their lifecycle and reducing landfill waste.

Approximate Costs:

The project is funded through various academic and research grants. Specific financial details are not publicly disclosed.

Stakeholder Engagement:

The project involves collaboration between University College Cork (UCC), City University of New York (CUNY), Georgia Institute of Technology, and Queen's University Belfast, along with industry partners and government agencies.

Source: CompositesWorld

Performance Data:

Pilot projects have successfully repurposed blades into functional structures, demonstrating the feasibility of such applications. Detailed performance metrics are documented in academic publications.

Benefits:

- Environmental: Mitigation of waste through repurposing.
- Economic: Cost savings in construction materials and waste management.
- Social: Provision of infrastructure and community amenities using recycled materials.

Lessons Learned:

- Repurposing requires careful assessment of structural integrity and safety.
- Community engagement is essential to identify suitable applications.
- Standardisation of repurposing methods can facilitate broader adoption.

PHES

Case Study 1: Okinawa Yanbaru Seawater Pumped Storage Power Station (Japan)

Project Context:

The Okinawa Yanbaru facility was a seawater-based pumped storage hydroelectric station designed to test the viability of utilizing seawater for energy storage in remote island locations.

Location:

Japan

Initiative Details:

Operational since 1999, the facility used corrosion-resistant materials for pipelines and infrastructure due to the saline environment. In 2016, it was decommissioned due to limited power demand growth and high operational costs.

Approximate Costs or Cost Savings:

Decommissioning costs were reportedly high due to the need for specialised dismantling processes and environmental remediation. Exact figures remain undisclosed.

Engagement Conducted with Suppliers or Stakeholders:

Extensive stakeholder consultation was conducted to manage environmental risks and ensure safe dismantling. This included engagement with local authorities and environmental groups to prevent marine contamination.

Performance Data:

The station had a capacity of 30 MW during its operation. Performance was deemed technically successful, but economic viability was limited due to the high costs of materials and maintenance in a saline environment.

Social, Economic, and Environmental Benefits and Outcomes:

- Environmental: The project demonstrated the feasibility of seawater-based energy storage, informing future designs.
- Economic: Limited local economic benefits due to early decommissioning.
- Social: Raised awareness about innovative renewable energy solutions but highlighted the importance of robust feasibility studies.

Lessons Learned and Recommendations for Application:

- Site selection must account for long-term economic viability and maintenance costs in harsh environments.
- Environmental risks must be proactively mitigated through robust design and stakeholder engagement.
- Future projects should incorporate modular and recyclable materials to reduce decommissioning costs.

Case Study 2: Taum Sauk Hydroelectric Power Station (USA)

Project Context:

After a catastrophic upper reservoir failure in 2005, the Taum Sauk facility in Missouri underwent reconstruction rather than full decommissioning. This provides insights into partial decommissioning and redevelopment.

Location:

USA

Initiative Details:

The reconstruction involved the dismantling of damaged infrastructure and rebuilding with roller-compacted concrete. Completed in 2010, the redesign improved structural resilience and safety.

Approximate Costs or Cost Savings:

Reconstruction costs were estimated at $450 million, reflecting both demolition and new construction expenses.

Engagement Conducted with Suppliers or Stakeholders:

Collaboration with local communities, environmental regulators, and suppliers ensured the project met safety and environmental standards.

Performance Data:

Post-reconstruction, the facility has a capacity of 408 MW, with enhanced operational efficiency and safety measures.

Social, Economic, and Environmental Benefits and Outcomes:

- Environmental: Improved reservoir design reduced the risk of future failures.
- Economic: Secured the long-term economic viability of the plant and created construction jobs during the rebuild.
- Social: Increased trust in the facility through transparent stakeholder engagement.

Lessons Learned and Recommendations for Application:

- Robust engineering designs are crucial to preventing future failures.
- Early stakeholder engagement is essential for rebuilding trust and ensuring regulatory compliance.
- Decommissioning or reconstruction should prioritize sustainability and safety.

Source:

https://damfailures.org/case-study/taum-sauk-dam-missouri-2005/

Case Study 3: Glenmuckloch Pumped Storage Hydro Project (Scotland)

Project Context:

This project involves repurposing a disused opencast coal mine into a pumped hydroelectric storage facility, highlighting a transition from traditional to renewable energy sources.

Location:

Scotland

Initiative Details:

Designed as a 400 MW pumped storage facility, Glenmuckloch demonstrates the potential of utilising abandoned industrial sites for renewable energy projects.

Approximate Costs or Cost Savings:

Estimated project costs are around £250 million, with significant savings on land acquisition due to the reuse of an existing site.

Engagement Conducted with Suppliers or Stakeholders:

Stakeholder engagement included local authorities, environmental organisations, and community groups to address site impacts and benefits concerns.

Performance Data:

The facility, when operational, is expected to provide 1,600 MWh of energy storage, supporting grid stability.

Social, Economic, and Environmental Benefits and Outcomes:

- Environmental: Rehabilitated a degraded mining site, reducing its ecological footprint.
- Economic: Created local employment during construction and long-term operational roles.
- Social: Boosted community morale by transforming a legacy of industrial decline into a renewable energy project.

Lessons Learned and Recommendations for Application:

- Repurposing industrial sites can reduce costs and environmental impacts while preserving land.
- Collaboration with stakeholders ensures projects align with community and ecological priorities.
- Future projects should leverage similar opportunities for dual benefits of site rehabilitation and energy storage.

Source:

https://www.op-en.co.uk/projects/glenmuckloch-wind-farm-and-pumped-storage-hydro

Appendix C

Project List

Table 36: Project List (*Note: Confidential information has been redacted from this table*)

	PROJECT NAME	CATEGORY	LGA			
	Eastern Hub Firming Battery	Battery	Uralla Shire			
	New England Battery	Battery	Uralla Shire			
	Glen Innes Battery Energy Storage System	Battery	Glen Innes Severn			
	Armidale East BESS	Battery	Armidale Regional			
	Kingswood Battery Energy Storage System	Battery	Tamworth Regional			
	Upper Hunter Battery Energy Storage System	Battery	Upper Hunter Shire			
	Liddell Battery	Battery	Muswellbrook Shire			
	Calala Battery Energy Storage System	Battery	Tamworth Regional			
	Armidale Battery Energy Storage System	Battery	Armidale Regional			
	Muswellbrook BESS	Battery	Muswellbrook Shire			
	Bayswater	Coal	Muswellbrook Shire			
	Bayswater Power Station Turbine Efficiency Upgrade	Coal	Muswellbrook Shire			
	Bayswater Power Station Upgrade	Coal	Muswellbrook Shire			
	Drayton Mine Extension	Coal Mining	Muswellbrook Shire			
	Dartbrook Coal	Coal Mining	Muswellbrook Shire			
	Bengalla Coal Mine - Continuation	Coal Mining	Muswellbrook Shire			

	PROJECT NAME	CATEGORY	LGA			
	Mt Arthur Open Cut MOD 2	Coal Mining	Muswellbrook Shire			
	Mt Arthur Open Cut Extension	Coal Mining	Muswellbrook Shire			
	Mt Arthur Underground Mine	Coal Mining	Muswellbrook Shire			
	Hillgrove Mine	Coal Mining	Armidale Regional			
	Liddell Coal	Coal Mining	Muswellbrook Shire			
	Mount Pleasant Coal	Coal Mining	Muswellbrook Shire			
	Mount Pleasant Optimisation Project	Coal Mining	Muswellbrook Shire			
	Maxwell Underground Coal Mine Project	Coal Mining	Muswellbrook Shire			
	Mangoola Coal Mine	Coal Mining	Muswellbrook Shire			
	Drayton Rail Loop	Coal Mining	Muswellbrook Shire			
	Werris Creek Coal Mine Expansion	Coal Mining	Liverpool Plains Shire			
	Armidale High School	Education	Armidale Regional			
	Richard Gill School	Education	Upper Hunter Shire			
	Liddell Future Land Use and Enabling Works Project	Electricity Generation - Other	Muswellbrook Shire			
	Bayswater Pumping Station	Electricity Generation - Other	Muswellbrook Shire			
	Ardglen Quarry	Extractive industries	Liverpool Plains Shire			
	Willow Tree Gravel Quarry Extension	Extractive industries	Liverpool Plains			
	Baiada Integrated Poultry Processing Facility	Food, beverages and tobacco manufacturing	Tamworth Regional			
	Rushes Creek Poultry Production Farm	Food, beverages and tobacco manufacturing	Tamworth Regional			
	Queensland-Hunter Gas Pipeline	Gas pipeline	Liverpool Plains Shire, Muswellbrook, Singleton, Upper Hunter			

	PROJECT NAME	CATEGORY	LGA			
	HVO North/South Open Cut Coal Continuation Project	N/A	Singleton			
	Tangaratta Feedmill	Other	Tamworth Regional			
	Muswellbrook Bypass Project (REF)	Roads	Muswellbrook Shire			
	New England REZ Roads Program	Roads	Upper Hunter Shire, Tamworth, Muswellbrook etc			
	Singleton Bypass	Roads	Singleton			
	Armidale Waste Facility	Waste collection, treatment and disposal	Armidale Regional			
	Dungowan Pumped Hydro Project	Hydro	Tamworth Regional			
	Muswellbrook Pumped Hydro Energy Storage Project	Hydro	Upper Hunter Shire			
	Oven Mountain Pumped Hydro	Hydro	Armidale Regional			
	Glenbawn Pumped Hydro	Hydro	Upper Hunter Shire			
	Glennies Creek Pumped Hydro	Hydro	Singleton			
	Hillview Solar Farm	Solar	Uralla Shire			
	Deeargee Solar Farm	Solar	Uralla Shire			
	New England Solar Farm Stage 1	Solar	Uralla Shire			
	New England Solar Farm Stage 2	Solar	Uralla Shire			
	Oxley Solar Farm	Solar	Armidale Regional			
	Tilbuster Solar Farm	Solar	Armidale Regional			
	Sundown Solar Farm	Solar	Inverell Shire			
	Kayuga Solar Farm	Solar	Muswellbrook			

	PROJECT NAME	CATEGORY	LGA			
	Nottingham Park Solar Farm	Solar	Tamworth Regional			
	Edderton Solar Project and BESS	Solar	Muswellbrook Shire			
	Metz Solar Farm	Solar	Armidale Regional			
	Tilbuster 2 Solar Farm	Solar	Armidale Regional			
	Muswellbrook Solar Farm	Solar	Muswellbrook Shire			
	White Rock Solar Farm	Solar	Glen Innes Severn			
	Goulburn River Solar Farm	Solar	Upper Hunter Shire			
	Bendemeer Solar Farm	Solar	Tamworth Regional			
	Salisbury Solar Farm	Solar	Uralla Shire			
	Uralla Solar Farm	Solar	Uralla Shire			
	Maison Dieu Solar Farm	Solar	Singleton			
	Middlebrook Solar Farm	Solar	Tamworth Regional			
	Lambruk Solar Project	Solar	Tamworth Regional			
	Hunter Central Coast REZ Transmission	Transmission	Singleton, Muswellbrook, Upper Hunter Shire			
	Hunter Transmission Project	Transmission	Singleton, Muswellbrook, Upper Hunter Shire, Cessnock City			
	New England REZ Transmission Stage 1	Transmission	Upper Hunter Shire, Tamworth, Muswellbrook, Armidale, Uralla, Walcha etc			
	New England REZ Transmission Stage 2	Transmission	Upper Hunter Shire, Tamworth, Muswellbrook, Armidale, Uralla, Walcha etc			
	Hillview Wind Farm	Wind	Uralla Shire			

	PROJECT NAME	CATEGORY	LGA			
	Liverpool Range Wind Farm	Wind	Warrumbungle Shire, Liverpool Plains			
	Sapphire Wind Farm	Wind	Inverell Shire			
	Bowmans Creek Wind Farm	Wind	Tamworth Regional, Upper Hunter Shire			
	Thunderbolt Wind Farm Stage 1	Wind	Tamworth Regional, Uralla Shire			
	White Rock 1 Wind Farm	Wind	Glen Innes Severn			
	White Rock 2 Wind Farm	Wind	Glen Innes Severn			
	Yarrowyck Wind Farm	Wind	Armidale Regional, Uralla Shire			
	Hills of Gold Wind Farm	Wind	Tamworth Regional, Upper Hunter Shire			
	Bendemeer Wind Farm Stage 1	Wind	Tamworth Regional			
	Northern Tablelands Wind Farm	Wind	Armidale Regional, Uralla Shire			
	Skye Ridge Wind Farm	Wind	Tamworth Regional, Walcha Shire			
	Uralla Wind Farm	Wind	Uralla Shire			
	Boorolong Wind Farm	Wind	Armidale Regional, Uralla Shire			
	Balala Wind Farm	Wind	Tamworth Regional			
	Glenbawn Wind Farm	Wind	Upper Hunter Shire			
	Glennies Creek Wind Farm	Wind	Singleton			
	Winterbourne Wind Farm	Wind	Uralla Shire			

Appendix D

Existing Waste Storage and Processing Infrastructure in the Study Area

This appendix provides a detailed listing of existing waste storage and processing infrastructure across the Study Area. Facilities are summarised by type, location, licensing, and their potential suitability for NE REZ-related waste.

- **Capability** refers to the types of waste the facility is licensed or designed to accept.
- **Accessibility** indicates whether the facility can realistically accept typical NE REZ project waste (e.g. commercial volumes, vehicle access, pre-approval requirements).
- **Utilisation Rate** shows the current operational throughput relative to the facility's licensed capacity, where such data is available.

Table 37: Existing Storage and Processing Infrastructure

Facility Name and Address	Facility type	LGA	EPL No.	Capacity	Capability	Accessible	Utilisation rate
Armidale Waste Management Facility (108 Long Swamp Road Armidale)	Landfill Organics Recycling CRC	Armidale Regional Council	5860 21362	Storage - The total quantity of contaminated soil stored at the premises must not exceed 1,000m³ at any one time. The total quantity of waste disposed of at the premises must not exceed 20,000 tonnes per year (15,000 tonnes general solid waste per annum + soil cover requirements). The total quantity of waste tyres stored at the premises must not exceed 50 tonnes or 5,000 waste tyres at any one time. The total quantity of waste tyres stored at the premises must not exceed 50 tonnes or 5,000 waste tyres at any one time.	Garden Waste – waste processing (non-thermal treatment) Landfilling of general solid waste (putrescible and non-putrescible), asbestos waste and tyres. Concrete, bricks and roof tiles - waste processing (non-thermal treatment) Contaminated Soil from Armidale Gas works - Waste	Yes, however businesses must have an arrangement in place with Council prior to managing any commercial wastes.	At licenced annual limit. Council's primary landfill.

Facility Name and Address	Facility type	LGA	EPL No.	Capacity	Capability	Accessible	Utilisation rate
				Currently receiving maximum capacity under existing licence and approval conditions. ~45 years at existing filling rates. At annual capacity.			
Ebor Waste Transfer Station (5 to 6km from Ebor on Waterfall Way)	Transfer Station	Armidale Regional Council		No EPL found online	Accepts general household waste, some problem wastes and garden waste	N – for domestic waste only.	N/A
Guyra Recycling & Transfer Station (Everett Street, Guyra)	Transfer station	Armidale Regional Council	326	No EPL found online	Accepts general household waste, some problem wastes and garden waste	N – for domestic waste only.	N/A
Hillgrove Waste Transfer Station (On the Hillgrove Common)	Transfer Station	Armidale Regional Council		No EPL found online	Accepts general household waste, some problem wastes and garden waste	N – for domestic waste only.	N/A
Lower Creek Waste Transfer Station (Near the Lower Creek RFS station)	Transfer Station	Armidale Regional Council		No EPL found online	Accepts general household waste, some problem wastes and garden waste	N – for domestic waste only.	N/A
Wollomombi Waste Transfer Station (near Chandler School)	Transfer Station	Armidale Regional Council		No EPL found online	Accepts general household waste, some problem wastes and garden waste	N – for domestic waste only.	N/A

Facility Name and Address	Facility type	LGA	EPL No.	Capacity	Capability	Accessible	Utilisation rate
Deepwater Landfill (Deepwater Tip Road)	Transfer Station	Glen Innes Severn Shire Council	308	No capacity to receive, store, and process additional waste.		N – for domestic waste only.	N/A
Emmaville Landfill (Emmaville Tip Road)	Transfer Station	Glen Innes Severn Shire Council	309	No EPL found online No capacity to receive, store, and process additional waste.		N – for domestic waste only.	N/A
Glen Innes Waste Management Depot (88 Rodgers Road, Glen Innes)	Landfill	Glen Innes Severn Shire Council	5939	The total tonnage of waste disposed of at the premises must not exceed 4,000 tonnes in any reporting period. The total quantity of contaminated soil stored at the premises must not exceed 1,000m³ at any one time. The total quantity of waste tyres stored at the premises must not exceed 50 tonnes or 5,000 waste tyres at any one time. No capacity to receive, store, and process additional waste.	Waste disposal (landfill) of general solid waste (putrescible and non-putrescible) Waste storage of contaminated Soil from Grey Street Glen Innes - Contaminated Soil from Grey Street Glen Innes – waste processing (non-thermal treatment). Asbestos waste – Landfill	Y	At licenced annual limit. Council's primary landfill.
Red Range Landfill (Red Range Tip Road)	Transfer Station	Glen Innes Severn Shire Council	311	No capacity to receive and process additional waste. (TBC)		N – for domestic waste only.	N/A
Ashford Rural Transfer Station	Transfer station	Inverell Shire Council	340	No EPL found online (rehabilitated landfill).		N – for domestic waste only.	N/A

Facility Name and Address	Facility type	LGA	EPL No.	Capacity	Capability	Accessible	Utilisation rate
(159 Limestone Road, Ashford)							
Bonshaw Rural Waste Transfer Station (262 Campbells Road, Bonshaw)	Transfer station	Inverell Shire Council	341	No EPL found online (rehabilitated landfill).		N – for domestic waste only.	N/A
Delungra Rural Waste Transfer Station (123 Haywood Road, Delungra)	Transfer Station	Inverell Shire Council		No EPL found online		N – for domestic waste only.	N/A
Inverell Waste Depot (55 Burtenshaw Road, Inverell)	Landfill CRC	Inverell Shire Council	7463	The total tonnage of waste disposed of at the premises must not exceed 40,000 tonnes in any reporting period. The total quantity of waste tyres stored at the premises must not exceed 50 tonnes or 5,000 waste tyres at any one time.	Waste tyres – Waste disposal (application to land) Waste storage Landfilling of general solid waste (putrescible and non-putrescible) and asbestos waste. Garden waste - Waste processing (non-thermal treatment).	Y	Unknown Council's primary landfill.
Tingha Landfill (152 Kempton Road, Tingha)	Landfill	Inverell Shire Council	327	No EPL found online.		Y	Unknown
Yetman Rural Transfer Station (Warialda Road, Yetman)	Transfer station	Inverell Shire Council	352	No EPL found online (rehabilitated landfill).		N – for domestic waste only.	N/A

Facility Name and Address	Facility type	LGA	EPL No.	Capacity	Capability	Accessible	Utilisation rate
Blackville Transfer Station (Bartons Lane, Blackville)	Transfer Station	Liverpool Plains Shire Council		No EPL found online	Garbage, tyres, batteries, used oil, scrap metal, empty gas cylinders, white goods and sorted recyclables	N – for domestic waste only.	N/A
Caroona Transfer Station (4D Road, Caroona)	Transfer Station	Liverpool Plains Shire Council		No EPL found online	Garbage, green waste, tyres, batteries, used oil, scrap metal, empty gas cylinders, white goods and sorted recyclables	N – for domestic waste only.	N/A
Pine Ridge Landfill (Bundella Road, Pine Ridge)	Landfill	Liverpool Plains Shire Council	365	No EPL found online No capacity to receive and process additional waste.	Garbage, green waste, tyres, batteries, used oil, scrap metal, empty gas cylinders, white goods and sorted recyclables	Y	No capacity to receive and process additional waste.
Premer Transfer Station (Coonabarabran Road, Premer)	Transfer Station	Liverpool Plains Shire Council		No EPL found online	Garbage, green waste, tyres, batteries, used oil, scrap metal, empty gas cylinders, white goods and sorted recyclables	N – for domestic waste only.	N/A
Quirindi Landfill Merinda Road (off Werris Creek Road)	Landfill MRF	Liverpool Plains Shire Council	367	No capacity to receive and process additional waste.	Garbage, bulky goods, green waste, building and construction materials, tyres, batteries, used oil, scrap metal, empty gas cylinders, white goods, asbestos (with prior notice) and sorted recyclables	Y	No capacity to receive and process additional waste.
Spring Ridge Transfer Station (Silo Road (Railway Ave), Spring Ridge)	Transfer Station	Liverpool Plains Shire Council		No EPL found online	Garbage, green waste, tyres, batteries, used oil, scrap metal, empty gas cylinders, white goods and sorted recyclables	N – for domestic waste only.	N/A

Facility Name and Address	Facility type	LGA	EPL No.	Capacity	Capability	Accessible	Utilisation rate
Wallabadah Transfer Station (Elizabeth Street, Wallabadah)	Transfer Station	Liverpool Plains Shire Council		No EPL found online	Garbage, tyres, batteries, used oil and sorted recyclables	N – for domestic waste only.	N/A
Werris Creek Landfill Werris Creek Tip Road (off Werriston Rd)	Landfill	Liverpool Plains Shire Council	368	No capacity to receive and process additional waste.	Garbage, bulky goods, green waste, building and construction materials, tyres, batteries, used oil, scrap metal, empty gas cylinders, white goods and sorted recyclables	Y	No capacity to receive and process additional waste.
Willow Tree Waste Management Facility (Merriwa Road, Willow Tree)	Landfill	Liverpool Plains Shire Council	370	No capacity to receive and process additional waste.	Garbage, bulky goods, green waste, building and construction materials, tyres, batteries, used oil, scrap metal, empty gas cylinders, white goods and sorted recyclables	Y	No capacity to receive and process additional waste.
Denman Waste Transfer Station (Rosemount Road, Denman)	Transfer Station	Muswellbrook Shire Council		Trucks, large loads or business generated commercial waste cannot be accommodated	Accepts most common waste types	N – for domestic waste only.	N/A
Muswellbrook Waste and Recycling Facility (252 Coal Rd, Muswellbrook)	Landfill Transfer Station Organics processing	Muswellbrook Shire Council	5980	15-25 years lifespan remaining at current filling rates. Licence cap of 12,000 tonnes per annum general waste. Currently receiving maximum capacity under existing licence and approval conditions.	Landfilling of general solid waste (non-putrescible). Landfilling of general solid waste (putrescible), waste tyres and asbestos waste. The total combined tonnage of General Solid Waste (non-putrescible), General Solid Waste (putrescible) and Asbestos Waste disposed of at the premises must	Y	Unknown

Facility Name and Address	Facility type	LGA	EPL No.	Capacity	Capability	Accessible	Utilisation rate
					not exceed 50,000 tonnes/per annum. Waste storage of general solid waste (non-putrescible), Hazardous Wastes, Restricted solid waste, liquid waste.		
SIMS Muswellbrook	Scrap metal recycling	Muswellbrook Shire Council		Unknown	Accepts all scrap metal	Y	Unknown
Barraba Landfill (80 Wittens Lane, Barraba)	Transfer Station	Tamworth Regional Council		No EPL found online	Accepts most common waste types	N – for domestic waste only.	N/A
Bendemeer Transfer Station (3 Sophie Street, Bendemeer)	Transfer Station	Tamworth Regional Council		No EPL found online	Accepts most common waste types	N – for domestic waste only.	N/A
Dungowan Transfer Station (1395 Nundle Road, Dungowan)	Transfer Station	Tamworth Regional Council		No EPL found online	Accepts most common waste types	N – for domestic waste only.	N/A
Duri Transfer Station (520 Duri Winton Road, Duri)	Transfer station	Tamworth Regional Council	422	No EPL found online	Accepts most common waste types	N – for domestic waste only.	N/A
Forest Road Waste Management Facility (123A Forest Rd, North Tamworth)	Landfill Transfer Station	Tamworth Regional Council	5921 12673	Waste tyres - The total quantity of waste tyres stored at the premises must not exceed 50	Landfilling of general solid waste (putrescible and non-putrescible), asbestos waste.	N - Only suitable for small vehicles	At maximum capacity.

Facility Name and Address	Facility type	LGA	EPL No.	Capacity	Capability	Accessible	Utilisation rate
	MRF Organics recycling			tonnes or 5,000 waste tyres at any one time. Processes approximately 15,000 tonnes per year. The current operational footprint of the facility has reached maximum processing and storage capacity.	Certain liquid waste – waste processing (non-thermal treatment) Composting of domestic garden waste and some pre-approved commercial quantities. General or specific exempted waste (waste that meets conditions of a resource recovery exemption)		A new facility is under development.
Kootingal Transfer Station (1428 New England Highway, Kootingal)	Landfill	Tamworth Regional Council	6013	The total quantity of waste disposed of at the premises must not exceed 5,000 tonnes per annum	Landfilling of general solid waste (putrescible and non-putrescible), asbestos waste and waste tyres.	Y - Only suitable for small vehicles	Unknown
Manilla Landfill (Manilla Road, Manilla)	Landfill	Tamworth Regional Council	425		Accepts most common waste types	Only suitable for small vehicles	Unknown
Niangala Transfer Station (1069 Tobey Road, Niangala)	Transfer Station	Tamworth Regional Council		No EPL found online	Accepts most common waste types	N – for domestic waste only.	N/A
Nundle Landfill (136 River Road, Nundle)	Landfill	Tamworth Regional Council	426		Accepts most common waste types	Only suitable for small vehicles	Unknown
Somerton Transfer Station	Transfer station	Tamworth Regional Council	427		Accepts most common waste types	N – for domestic waste only.	N/A

Facility Name and Address	Facility type	LGA	EPL No.	Capacity	Capability	Accessible	Utilisation rate
(Somerton Tip Road, Somerton)							
Watsons Creek Transfer Station (30 Millers Road, Watsons Creek)	Transfer Station	Tamworth Regional Council		No EPL found online	Accepts most common waste types	N – for domestic waste only.	N/A
Matthews Metal Management	Metal recycling	Tamworth Regional Council		Unknown	Accepts all scrap metal	Y	Unknown
Boonoo Boonoo Landfill (1578 Mount Lindesay Road, Boonoo Boonoo)	Landfill	Tenterfield Shire Council	11435	The total quantity of waste disposed of at the premises must not exceed 20,000 tonnes per year.	Landfilling of general solid waste (putrescible and non-putrescible), asbestos waste and tyres.	Y – by appointment only and 48 hours' notice must be given.	Unknown Council's primary landfill.
Drake Waste Transfer Station (Long Gully Road, Drake)	Transfer Station	Tenterfield Shire Council		No EPL found online	Accepts most common waste types	N – for domestic waste only.	N/A
Legume Waste Transfer Station (8950 Mt Lindesay Road, Legume)	Transfer Station	Tenterfield Shire Council		No EPL found online	Accepts most common waste types	N – for domestic waste only.	N/A
Liston Waste Transfer Station	Transfer Station	Tenterfield Shire Council		No EPL found online	Accepts most common waste types	N – for domestic waste only.	N/A

Facility Name and Address	Facility type	LGA	EPL No.	Capacity	Capability	Accessible	Utilisation rate
(Tenterfield Street, Liston)							
Tenterfield Waste Transfer Station	Transfer Station	Tenterfield Shire Council		No EPL found online.	Accepts most common waste types	N – for domestic waste only.	N/A
Torrington Landfill (615 Silent Grove Road)	Transfer Station	Tenterfield Shire Council	434	No EPL found online.	Accepts most common waste types	N – for domestic waste only.	N/A
Urbenville Waste Transfer Station (Bonds Road, Urbenville)	Transfer Station	Tenterfield Shire Council		No EPL found online	Accepts most common waste types	N – for domestic waste only.	N/A
Aberdeen Resource Recovery Facility (45 Wells Gully Road, Aberdeen)	Landfill	Upper Hunter Shire Council	13107	The maximum amount of waste received at the premises must not exceed 5,000 tonnes in any year. ~5-10 years remaining across Council's existing landfills at existing filling rates. No capacity to receive and process additional waste.	Landfilling of general solid waste (putrescible and non-putrescible), asbestos waste and tyres.	Y	No capacity to receive and process additional waste.
Cassilis Waste Transfer Station (9756 Golden Highway, Cassilis)	Transfer Station	Upper Hunter Shire Council		No EPL found online	Accepts a variety of waste except asbestos	N – for domestic waste only.	N/A

Facility Name and Address	Facility type	LGA	EPL No.	Capacity	Capability	Accessible	Utilisation rate
Merriwa Landfill and Waste Depot (96 Depot Road, Merriwa)	Transfer Station	Upper Hunter Shire Council	13108	The maximum amount of waste received at the premises must not exceed 5,000 tonnes in any year. Recovery of general waste. No capacity to receive and process additional waste.	Landfilling of general solid waste (putrescible and non-putrescible), asbestos waste and waste tyresa Recovery of general waste.	N – for domestic waste only.	N/A
Murrurundi Landfill (58 Halls Road, Murrurundi)	Transfer Station	Upper Hunter Shire Council	13106	The maximum amount of waste received at the premises must not exceed 5,000 tonnes in any year. ~5-10 years remaining across Council's existing landfills at existing filling rates. No capacity to receive and process additional waste.	Landfilling of general solid waste (putrescible and non-putrescible), and waste tyres.	N – for domestic waste only.	N/A
Scone Waste Facility (129 Noblet Road, Scone)	Landfill CRC	Upper Hunter Shire Council	5863	The total combined tonnage of General Solid Waste (non-putrescible), General Solid Waste (putrescible) and Asbestos Waste disposed of at the premises must not exceed 7,000 tonnes/per annum. ~5-10 years remaining across Council's existing landfills at existing filling rates. No capacity to receive and process additional waste.	Waste storage of Restricted solid waste, Liquid Waste, Hazardous Wastes. Landfilling of General solid waste (putrescible and non-putrescible) and asbestos waste.	Y	At licenced annual limit. Council's primary landfill.
Bundarra Waste Management Facility	Transfer Station	Uralla Shire Council		No EPL found online	Accepts general household waste, green waste, metals, glass, cardboard, waste oil, and batteries	N – for domestic waste only.	N/A

Facility Name and Address	Facility type	LGA	EPL No.	Capacity	Capability	Accessible	Utilisation rate
(Bingara Road, Bundarra)							
Kentucky Recycling Station (Dorlie Lane, Kentucky)	Transfer Station Recycling	Uralla Shire Council		No EPL found online	Accepts household paper, cardboard, glass, hard plastics, and metals.	N – for domestic waste only.	N/A
Uralla Waste Management Facility (33 Tip Road, Uralla)	Landfill	Uralla Shire Council	5899	The total tonnage of waste must not exceed 3,000 tonnes per year.	Accepts general solid waste (putrescible and non-putrescible), asbestos and waste tyres	No – and the site has no weighbridge	At licenced annual limit.
Kingstown Waste Management Facility (Bendermeer Road, Kingstown)	Transfer Station	Uralla Shire Council		No EPL found online	Accepts recyclables and general household waste (consolidated for transport to UWMF)	No	N/A
Nowendoc Landfill (47 Tops Road, Nowendoc)	Transfer Station	Walcha Council	455	40 years lifespan left at current filling rates (small waste volumes of domestic only).	No EPL found online	N – for domestic waste only.	N/A
Walcha Community Recycling Centre (49 Aerodome Road, Walcha)	Landfill	Walcha Council	6120	The total quantity of waste disposed of at the premises must not exceed 1,500 tonnes per year. 40 years lifespan left at current filling rates (very small waste volumes of domestic inputs only). No capacity to receive and process additional waste.	Landfilling of general solid waste (putrescible and non-putrescible), asbestos and waste tyres.	No – for domestic waste only.	Council's primary disposal site.

Facility Name and Address	Facility type	LGA	EPL No.	Capacity	Capability	Accessible	Utilisation rate
Woolbrook Waste Transfer Station	Transfer station	Walcha Council	457	No capacity to receive and process additional waste.	No EPL found online	N – for domestic waste only.	N/A

MRA Consulting Group

Suite 408 Henry Lawson Building
19 Roseby Street
Drummoyne NSW 2047

+61 2 8541 6169
info@mraconsulting.com.au
mraconsulting.com.au