

Cleanaway Operations Pty Ltd

Bromelton Energy and Resource Centre

Engineering (Infrastructure) Report

Reference: BERC-ARU-BNE-ENG-RPT-0001

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This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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Arup Australia Pty Ltd
123 Albert Street
Brisbane
QLD 4000
Australia
arup.com

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Acknowledgement of Country

Arup acknowledges the Traditional Owners across all lands, waters and skies our firm may reach; we acknowledge their wisdom, resilience, and rich cultural heritage. We pay our respects to the Elders, past and present, and to all Aboriginal and Torres Strait Islander peoples.

'Continuing to Shift to shape an even better world'
original artwork by Tarni O'Shea of Gilimbaa and
updated by David Williams of Gilimbaa.

Abbreviations and glossary

Abbreviation	Definition
AHD	Australian Height Datum
APCr	Air Pollution Control Residue
AS	Australian Standard
BDS	Beautesert Bulk Supply Substation
BERC	Bromelton Energy and Resource Centre
BREF	Best Available Techniques Reference document
C&I	Commercial and Industrial
DBYD	Dial Before You Dig
DI	Ductile Iron
EfW	Energy from Waste
GPS	Global Positioning System
GSUT	Generator Step-Up Transformer
HV	High Voltage
IBA	Incinerator Bottom Ash
IBAA	Incinerator Bottom Ash Aggregate
IED	Industrial Emissions Directive
LHV	Lower Heating Value
MRTS	Main Roads Technical Specification
MSW	Municipal Solid Waste
MWe	Megawatt Electric
NBN	National Broadband Network
NER	National Electricity Rules
NSP	Network Service Provider
POC	Point of Connection
RL	Relative Level
SDA	State Development Area
TEEP	Technically, environmentally, and economically practicable
TMR	Department of Transport and Main Roads

Abbreviation	Definition
tpa	Tonnes per annum
UU	Urban Utilities

Executive Summary

Cleanaway Operations Pty Ltd (Cleanaway) is an Australian waste management, recycling, and industrial services company. Cleanaway is developing an energy from waste (EfW) facility in Queensland known as the Bromelton Energy and Resource Centre (BERC /the Project). The Project will be located within the Special Industry Precinct of the Bromelton State Development Area (SDA), west of Beaudesert.

This report provides information relevant to the engineering design of the Project, including earthworks, infrastructure servicing, and road design. The report should be read in conjunction with the *Stormwater Management Plan* and *Flood Risk Assessment*, which provides details on stormwater management and flood risk across the Project area and the *Traffic Impact Assessment* which provided details on the access design.

The key findings are:

- **Bulk Earthworks:** The earthworks design balances cut and fill volumes to suit the site's steep and varied topography, incorporating batters, retaining walls, and revegetation for stability and erosion control.
- **Water:** The site will connect to an extended Urban Utilities (UU) DN375 water main which runs along the alignment of Beaudesert Boonah Road, currently terminating east of the site at Waste Facility Road to the east of the Project sit. Connection to the UU recycled water network remains a future opportunity.
- **Wastewater:** Due to the absence of nearby sewer infrastructure, on-site sewer holding tanks are proposed with future connection to a precinct gravity sewer the preferred solution, if feasible.
- **Electricity:** A 110kV grid connection and on-site substation will support the facility's estimated 73.2 MWe net power output, with emergency generators and fault protection systems included.
- **Communications:** Satellite NBN is recommended for site connectivity, with Telstra cabling as a potential alternative pending further assessment.
- **Gas:** No gas infrastructure is required for the site.
- **Site Access:** It is proposed that the site is accessed from Beaudesert Boonah Road via a new four-way signalised access with Recycling Street. Consultation with TMR has occurred and is expected to continue during the assessment period.
- **Internal Roads Network:** The internal road network is designed for safe and efficient traffic flow. Separation of light and heavy vehicles and dedicated parking accommodating both staff and visitors has been prioritised.

1. Introduction

1.1 Purpose of Assessment

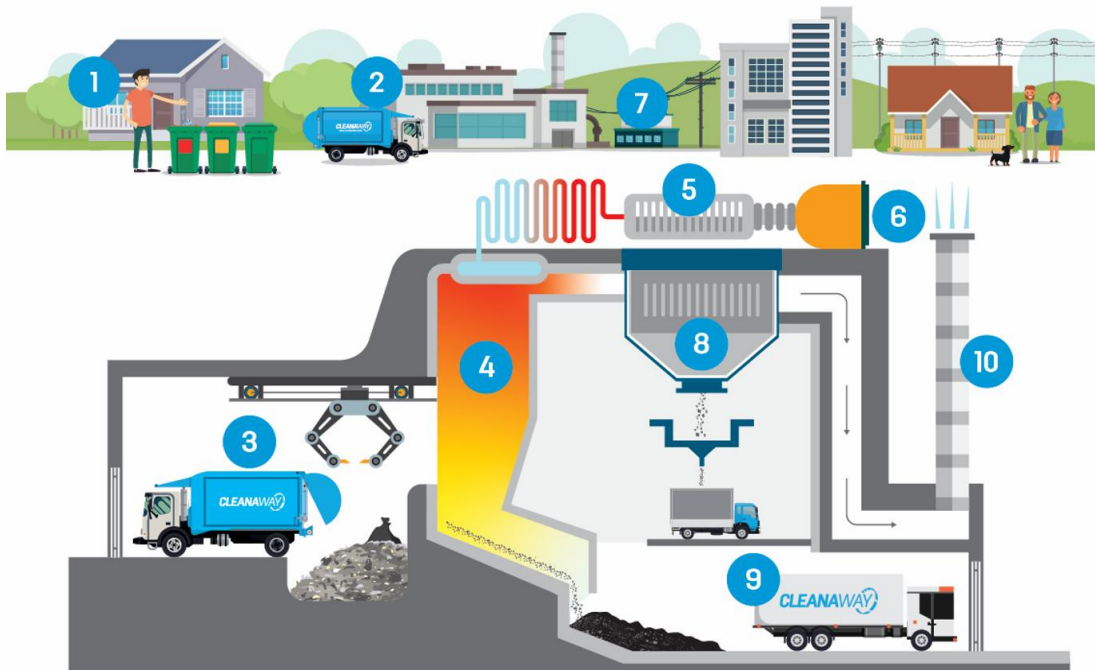
This report provides information on the infrastructure engineering design for the BERC. Its primary purpose is to outline the key engineering considerations and design solutions related to bulk earthworks, infrastructure servicing and internal road networks. The report aims to inform stakeholders of the proposed technical approach to site development, ensuring alignment with operational requirements, regulatory standards and site-specific constraints. Additionally, this report serves to complement related documents, including the *Stormwater Management Plan and Flood Risk Assessment* and the *Traffic Impact Assessment*.

1.2 Project Description

1.2.1 Project Overview

Cleanaway Operations Pty Ltd (Cleanaway) is an Australian waste management, recycling, and industrial services company. Cleanaway is developing an Energy from Waste (EfW) facility in Queensland known as the Bromelton Energy and Resource Centre (BERC) (the Project). The Project will be located within the Special Industry Precinct of the Bromelton State Development Area (SDA), west of Beaudesert within the Scenic Rim Regional Council local government area.

The Project has been designed to thermally treat approximately 760,000 tonnes per annum (tpa) of waste feedstock, consisting of residual Municipal Solid Waste (MSW) and residual Commercial and Industrial (C&I) waste. Residual waste is waste that is not technically, environmentally, and economically practical (TEEP) to reuse or recycle, which would otherwise be sent to landfill for disposal. The facility's actual annual throughput will vary depending on the calorific value of the feedstock and plant availability. To account for variability in feedstock energy content, the facility will be designed for a maximum processing capacity of up to 10% above the nominal figure (836,000 tpa). The EfW process is summarised in Figure 1.



- 1 At home and work, we sort our waste into recyclable and non-recyclable items.
- 2 Before arrival at the energy from waste facility, residual waste that has been sorted at home and work is delivered to the facility.
- 3 In the bunker, waste is mixed, ensuring consistency, by large crane claws before placement into the combustion chamber.
- 4 Waste is combusted as it moves along a moving grate. The temperature in the combustion chamber reaches more than 850°C to ensure that waste combusts completely while also destroying organic pollutants and odour.
- 5 Water is heated during combustion creating steam which turns a turbine.
- 6 Baseload electricity is generated.
- 7 Electricity is put back into the grid and used to power homes and businesses.
- 8 Gases created during combustion pass through a multi-step flue gas treatment system, removing pollutants from the gases. Residues from the flue gas treatment are collected in a sealed system for treatment before disposal.
- 9 Bottom ash from the combustion process is collected and stored. Metals are recovered for recycling. It is intended that the remaining bottom ash is sent for reuse in construction.
- 10 Cleaned gases and steam are dispersed high into the atmosphere, mixing well to ensure negligible impact on the surrounding air quality.

Figure 1: Energy from Waste Process

1.2.2 Proponent

Cleanaway, an Australian owned company, has operated for more than 50 years, supporting industry, government, communities and households across Australia. Its mission is to make a sustainable future possible, achieved through action across all levels of the waste hierarchy. Waste generation is minimised through extensive education programs, with Cleanaway's 50 education officers reaching over 120 businesses, 30 councils, and almost 33,000 school participants in the last financial year.

Cleanaway invests heavily in recycling, operating several Material Recovery Facilities nationwide and has partnered with Pact Group, Asahi Beverages and Coca-Cola to deliver two large-scale PET (polyethylene terephthalate) recycling facilities and a HDPE (high density polyethylene) recycling facility with Pact Group. In addition, in collaboration with Viva Energy, Cleanaway is developing a soft plastics recycling plant. EfW is recognised by Cleanaway as an important part of the future waste management framework, enabling recovery of energy and other resources from residual waste that cannot otherwise be recycled.

1.2.3 Policy Alignment

The BERCC aligns with the Queensland EfW Policy and the Queensland EfW Guideline (2021) by diverting residual waste from landfill and delivering economic and social benefits through employment and local business opportunities in South East Queensland.

In accordance with Policy outcome 7 of the Queensland EfW Policy, the BERC will be designed to meet the best practice emission standards and requirements of the European Industrial Emissions Directive (IED) (2010) and the associated Best Available Techniques Reference (BREF) Document for Waste Incineration (2019), which sets the European Union environmental standards for waste incineration.

The Project also supports the Queensland Waste Strategy contributing to its 2050 targets to reduce household waste by 25%, recycle 75% of all waste, and divert 90% from landfill. In doing so, the BERC will play a key role in advancing Queensland's transition to a circular economy and reducing long-term reliance on landfill.

1.2.4 Key Components

The key components of the Project are summarised in Table 1.

Table 1: Key Project Components

Project Component	Detail
Address	Lot 1 Beaudesert Boonah Road, Bromelton, Queensland, 4285 (Lot 1 on RP45234). Refer Figure 2.
Site Area	63 hectares
Summary of proposed works	The project includes the construction of a main EfW facility for waste processing, incinerator bottom ash (IBA) maturation and processing facility and an air pollution control residue (APCr) facility. It also includes all onsite infrastructure needed for the EfW facility, such as site utilities, internal roads, weighbridges, parking and hardstand areas, stormwater infrastructure, fencing and landscaping. The Project will include a visitor centre to help educate and inform the community on circular economy principles, the waste hierarchy, including waste avoidance, recycling, resource recovery, the benefits of landfill diversion and the EfW process. The intent behind this education is to drive a shift in community awareness and attitudes toward waste management and resource recovery.
Technology Used	The proposed technology is moving grate combustion technology. This has been used globally for over 100 years and is common in many of the 500 similar operational examples across Europe.
Facility Outputs	Approximately 73.2MW (577,600 MWh/year, corrected for ambient temperature) exported to grid as baseload electricity. Potential to supply energy in the form of heat and/or process steam to local industrial users. Residual material include IBA and APCr. It is intended that the IBA will be mechanically processed on site to create incinerator bottom ash aggregate (IBAA). During the process, both ferrous and non-ferrous metals are recovered for recycling and sale. It is intended that the remaining material is re-purposed for use as an aggregate in construction. The Project includes a facility to stabilise APCr before removal and disposal at a licensed landfill.
Key Infrastructure	EfW facility including administration and visitors centre IBA maturation and processing facility (2 x pads and 2 x sheds) APCr facility (1 x pad, 1 x shed) Transformer yard and switchyard De-coupling area for trucks Weighbridges Internal road network and carparking 2 x combined storm water treatment and detention basin 1 x lined retention basin Access from Beaudesert Boonah Road via a signalised intersection with Recycling Street

Project Component	Detail
Hours of Operation	24 hours per day, seven days per week (365 days per year)
Operational Staff	Approximately 60 staff



Figure 2: Site Location Plan

2. Earthworks

2.1.1 Existing

The Project area is currently pastoral land comprising grasses with low density shrubs and trees. A topographical survey of the site and adjacent road was undertaken by TJ Kelly Surveys Pty Ltd in May 2023 and is contained in Appendix A.

The Project area has several distinct ridgelines and low points. A high-level review of the survey notes that:

- In the northern portion of the site, the highest point is RL 98.9 m Australian Height Datum (AHD).
- Northwest corner of the site sits at RL 81.75 mAHd.
- Northeast corner of the site sits at RL 79.09 mAHd.
- Land directly adjacent to the culvert crossing under the railway line is at RL 70.54mAHd.
- Ridgeline at southwest corner of the site is at RL 119 mAHd.
- Southeast corner of the site sits at RL 66.5 mAHd.

Aside from the upper portion of the ridge, falls typically exceed 5% with the southern portion of the site containing steeply sloping terrain which exceeds 10% gradient in many places.

2.1.2 Bulk Earthworks

Bulk earthworks have been designed to create large, gently graded platforms for operational use while responding to the existing site topography, which features significant level variations and undulations throughout the project area. Consequently, a substantial volume of material movement is necessary to achieve the proposed finished surface levels and ensure appropriate grading for future development.

A balanced cut-to-fill strategy has been adopted to minimise the need for import or export of material, with the objective of reducing construction costs, environmental impact and haulage requirements on the surrounding road network. The current earthworks design achieves an approximate balance between cut and fill volumes (refer Table 2 and bulk earthworks plan contained within concept civil engineering drawings).

Table 2: Bulk Earthwork Volumes (refer BERC-ARU-BNE-CICW-DRG-1201)

Bulk Earthworks	Volume (m ³)
Total Cut	-233,730
Total Fill	205,990
Total Balance (excess of cut)	-27,740

To further support this balance and reduce the potential for off-site material disposal, an area in the southern portion of the site has been identified as a potential location for the placement of surplus fill material, if required. The location of the potential location of surplus fill has been located clear of overland flow path. This area provides flexibility in managing excess cut while avoiding unnecessary truck movements beyond the site boundary. Refer Drawing BERC-ARU-BNE-CICW-DRG-1030.

Ongoing refinement of the earthworks design will continue through detailed design to further optimise material usage and reduce earthwork movements. Refer to engineering drawings in Appendix B.

2.1.3 Batters and Retaining Walls

Level differences across the site are primarily managed through earthworks batters. A maximum batter slope of 3H:1V has been adopted to ensure stability under typical site conditions. Where space permits, a flatter slope of 4H:1V has been applied to improve stability and facilitate maintenance. Adjacent to a scar tree,

which has been identified as being culturally significant and therefore is to be retained, a section of batter is proposed as a 1:1 reinforced soil slope to achieve the required offsets and protect the tree.

The batters adjacent to the rail corridor have been designed with a maximum 3H:1V slope and are located a minimum of 5 m from the site boundary. This design ensures safe and stable earthworks in proximity to the corridor. The batter design also maintains an appropriate setback (> 25 m) from the Order 1 stream in accordance with SEQ Water guidance, ensuring protection of the waterway and surrounding environment.

Additionally, two retaining walls are incorporated into the civil design to accommodate localised level changes where batters are not feasible due to spatial constraints. These retaining walls are located on the entrance road south of the carpark access road and adjacent to the APCr building. Additional, low level retaining structures may be introduced as part of detailed design.

Batter slopes adjacent to the rail corridor be designed in accordance with the below TMR technical specifications:

- MRTS03 Drainage Structures, Retaining Structures and Embankment Slope Protections;
- MRTS04 General Earthworks;
- MRTS52 Erosion and Sediment Control; and
- MRTS16 Landscape and Revegetation Works.

All batters and slopes will be revegetated in accordance with MRTS 16 – Landscape and Revegetation Works and Standard Drawing SD 1651 – Vegetation Works: Seeding, Detail 2 to promote long-term stability and erosion control.

A cut-off drain will be installed at the base of all slopes to capture surface water runoff, ensuring water is collected within the site boundary and routed to the existing points of discharge.

3. Infrastructure Servicing

The approach to utility connections for the BERC prioritises early coordination with relevant service providers to ensure reliable and efficient access to all essential utilities, including electricity, water, telecommunications, and sewerage. It is not planned that the facility will be delivered in stages; therefore, full utility services will be required from day one.

Where existing utility networks are in place, the facility will be connected accordingly to support timely commissioning and start-up. In locations where utility networks are planned but not yet operational, the necessary infrastructure will be delivered in alignment with future network plans to ensure seamless integration upon completion. This proactive strategy supports uninterrupted service delivery, minimises duplication of infrastructure, and aligns with broader infrastructure sequencing and planning objectives. All utility connections will be designed to relevant standards

This section covers existing and proposed infrastructure for water, wastewater, electricity and telecommunications. For information on stormwater management and flood risk refer to the *Stormwater Management Plan and Flood Risk Assessment*.

3.1 Water

3.1.1 Existing Infrastructure

The potable water and wastewater service provider for the site is Urban Utilities (UU). Preliminary investigations, including Before You Dig Assessment (BYDA) searches, have confirmed that there is currently no trunk water main or sewer infrastructure within the site or adjacent to the site boundary.

An existing DN375 ductile iron (DI) water main runs along the alignment of Beaudesert Boonah Road, terminating east of the site at Waste Facility Road. This main was constructed in 2018 in anticipation of future industrial connections within the Bromelton area. However, no active customer connections have been established to date, and UU has since disconnected the main near Helen Street, limiting its current functionality.

3.1.2 Water Demand

Ramboll have developed a water balance for the BERC project Refer Appendix C. The overall philosophy guiding the water balance is as follows:

- There shall be zero process wastewater discharge from the EfW facility area.
- Rainwater collected from roofs shall be captured and reused to reduce demand for raw potable water.
- Daily buffer tanks will provide intermediate water storage to accommodate hourly variability in process water demand and effluent generation.
- Buffer tank design will account for non-routine conditions such as start-up, shutdown, and maintenance activities, where equipment drainage is necessary for inspection or servicing.
- Where feasible, greywater from staff amenities will be managed separately from sewage wastewater originating from toilets and kitchen areas. Subject to confirmation from technology suppliers, this greywater will be used as make-up water to the EfW recycled water tank, thereby reducing reliance on fresh potable water.

The overall nominal water demand for the site is estimated to be 502.4m³/day (5.8 l/s). This is a combined water demand for all processes, including boiler makeup water, flue gas treatment, IBA maturation, APCr stabilisation, general and sanitary use and an allowance for rainwater capture and use.

3.1.3 Proposed Infrastructure

Discussions with UU have outlined the proposed water connection strategy as follows:

- UU has conducted hydraulic modelling and confirmed that there is sufficient capacity within the existing DN375 main on Beaudesert Boonah Road to accommodate the full operational water demand from the site.
- The existing main extends approximately 500 m east of the site but is currently capped and non-operational. The connection strategy involves extending this main along Beaudesert Boonah Road to the site boundary to establish the site connection.
- The main is currently planned to be operational by 2031 as part of the trunk infrastructure outlined in the NetServ Plan.
- Given the main's period of inactivity, it is anticipated that quality assurance testing, including bacterial sampling, will be necessary during commissioning to ensure water quality compliance.

Refer to Appendix D for UU Service Advice Note.

TMR in its review of the preliminary documentation, has advised that all public utility installations must comply with the requirements of the Non-Transport Utility Management and Design Manual.

TMR's position is that utilities are not to be installed on bridge structures. This position reflects ongoing maintenance considerations and the need to avoid conflicts with existing and future road planning along Beaudesert Boonah Road. Accordingly, the proposed watermain extension requires further review to identify an appropriate installation route that enables connection to BERC while avoiding any encroachment on the rail bridge structure.

It is anticipated that UU will deliver the watermain extension. Cleanaway will continue to work collaboratively with UU and TMR to investigate installation methodologies that avoid impacts to the bridge structure. Options to be explored include trenchless construction techniques, such as Horizontal Directional Drilling beneath the railway corridor, subject to detailed design, technical feasibility assessment, and relevant stakeholder approvals.

3.1.4 Dual Water Supply Option (Potable and Recycled Water)

UU has indicated a strategic interest in partnering with industrial customers to supply treated wastewater effluent as part of their broader goal to achieve zero discharge to the environment.

Cleanaway has explored options for using recycled water with QUU in both 2024 and 2025. UU has confirmed that a Class C recycled water network is available to the Beaudesert Boonah Road and Beaudesert House Road intersection (refer Figure 3).

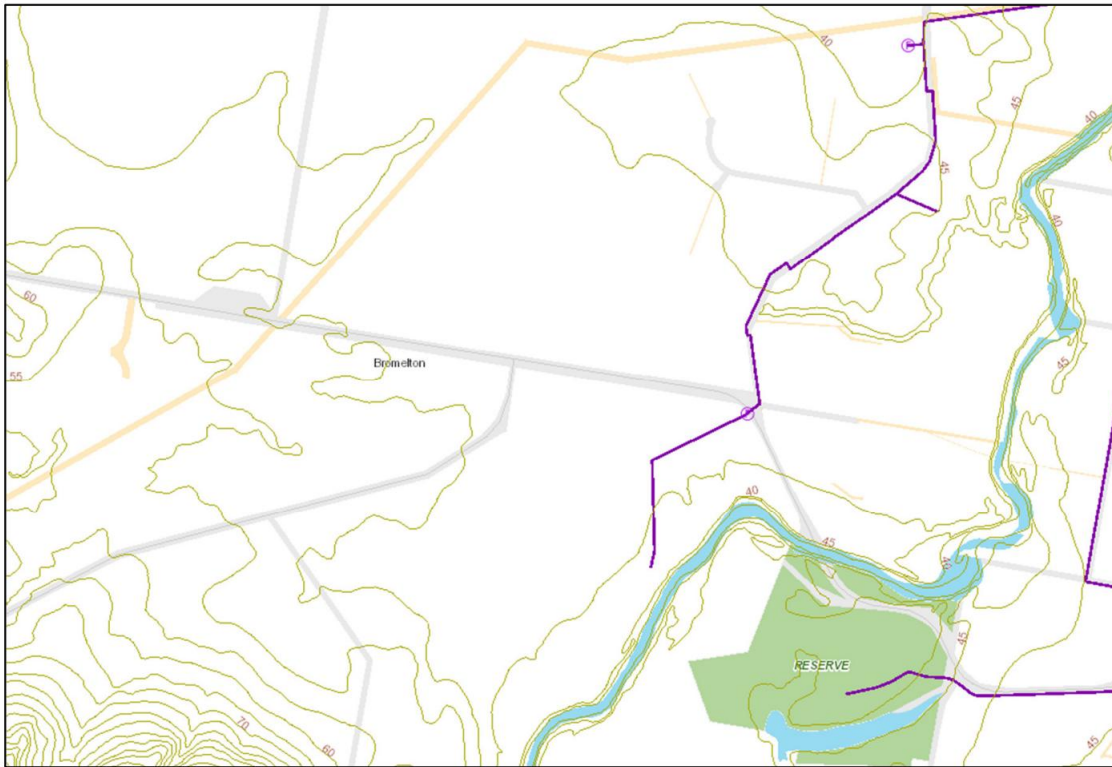


Figure 3: Existing Recycled Water Network

Class C recycled water is the lowest quality of recycled water supplied by UU. It is defined by UU as ‘generally produced to meet effluent discharge requirements set out in sewage treatment plant environmental licenses. Class C water may not be suitable for many industrial purposes and can be utilised only for limited irrigation purposes.’

Energy from waste plants require both potable water and good quality water (e.g. at least Class A) for make-up to firewater storage and demineralised water to prevent scaling and corrosion in boilers, turbines and piping, ensuring equipment longevity and efficient operation. High-purity water also supports consistent process control and helps meet strict environmental and emissions standards. Potable water will be further treated to meet these quality standards. At present, the only recycled water that could potentially be utilised in the energy from waste process is Class A.

Cleanaway acknowledges the benefits of having a recycled water network within the State Development Area particularly given the high water use of proposed industries in the area. Should a viable recycled water network become available, Cleanaway would be open to explore opportunities to integrate it into the facility, which could help reduce overall potable water demand and support catchment management objectives.

All water used in the facility is reused within the process, and no process water is discharged from the site, ensuring minimal impact on the surrounding environment and catchment.

3.1.5 Firefighting Infrastructure

The BERF will be provided with a comprehensive fire protection system designed in accordance with relevant Australian Standards and the requirements of global insurers. Separate sprinkler and hydrant ring mains will be installed around the perimeter of the facility, with branches extending to serve key operational areas and equipment. Each system will be supported by dedicated external water storage tanks sized to meet the required firefighting demands.

The firewater flow rate and water storage capacity for the sprinkler system have been determined based on the following key design assumptions:

- Ceiling-mounted sprinkler systems throughout the main process areas.
- A deluge system above the boiler fuel bins.

- Automatic water cannons incorporated as part of a fire-engineered solution for bunker fire protection.
- A dual water supply system, comprising two firewater storage tanks, each providing a minimum of two-thirds of the required storage capacity to ensure system redundancy.

This configuration results in two 572 kL firewater storage tanks. The tank filling system is designed to completely refill one tank within 18 hours, corresponding to a flow rate of approximately 8.9 L/s.

For the hydrant system, two 18 kL tanks are proposed.

Firewater containment and environmental protection:

To prevent contaminated firewater runoff from entering the stormwater network or adjacent waterways, the site drainage system will include isolation valves and containment areas. The waste bunker and process areas will be bunded to contain firewater for controlled removal and treatment following an incident. This will be developed at future design stages.

System reliability and monitoring:

The fire systems will be integrated with the facility's Building Management System (BMS) for automatic monitoring of pump operation, tank levels and sprinkler activation. Backup power will be provided to ensure continuous operation during an emergency.

Access and maintenance:

Hydrant locations will be designed to provide adequate access for firefighting appliances, with hardstand areas maintained clear for emergency vehicle access. Routine testing and maintenance procedures will be implemented to ensure system reliability and compliance with AS 2419 and AS 2118.

3.2 Sewer

3.2.1 Existing Infrastructure

There is currently no formal sewerage infrastructure available for connection surrounding the site. It is understood from discussions with Seqwater that existing, surrounding developments are serviced by either sewer holding tanks or septic tanks.

3.2.2 Sewer Demand

The flue gas treatment process does not have any process effluent discharge during normal operation, as the facility itself will be designed to reuse all process water during normal operation. Therefore, the only wastewater from the BERC will be domestic sewage from the administration buildings.

3.2.3 Proposed Infrastructure

Preliminary discussions with UU confirm that there are no immediate plans to construct a trunk sewer along Beaudesert Boonah Road. The below outlines the ultimate, interim and future opportunities related to waste water.

3.2.3.1 Ultimate Design Solution

The ultimate design solution for BERC wastewater is connection to the extended UU wastewater network.

UU's wastewater master plan assumes development in this area would not occur until post-2031, with a new treatment facility proposed for the Bromelton area to service future growth. This new treatment facility is intended to support both residential and industrial expansion and would be delivered once capacity at the existing Beaudesert plant is exhausted. The BERC site is included in the ultimate service catchment.

3.2.3.2 Interim Design Solution

Prior to the connection to the UU wastewater network an on site sewer holding tank system has been designed. On-site sewer holding tanks are proposed to cater for sewage wastewater (kitchen, toilets) for each of the buildings which will house staff (EfW building and IBA admin). These retention systems will be fully

contained, sized for seven days capacity, with no overflow to landscaped areas. Effluent will be transported off-site as required when these sewer holding tanks approach capacity.

The concept design provisions for a 25,000 L sewer holding tank capacity serving the EfW building and a 5,000 L sewer retention capacity serving the IBA sorting building. These sewer holding tanks, as shown in concept engineering drawing BERC-ARU-BNE-CICW-DRG-1801, have been positioned a minimum 100 m clear of the mapped Stream Order 1 hydro-lines and are compliant with performance outcomes P02 and P07 of Seqwater's Development Guideline.

The exact position and size of the sewer holding tanks will be finalised as part of detailed design but will remain beyond the minimum offset distances stipulated by Seqwater.

3.2.3.3 Opportunities to explore at the next design stage

At future design stages landscape irrigation utilising treated wastewater may be explored, subject to the necessary site assessments and approvals. Where feasible, greywater from staff amenities will be managed separately from sewage wastewater originating from toilets and kitchen areas. Subject to confirmation from technology suppliers, this greywater will be used as make-up water to the EfW recycled water tank, thereby reducing reliance on fresh potable water.

3.3 Electricity

3.3.1 Existing Infrastructure

There is no existing power connection to the site.

3.3.2 Nominal Power Estimates

Ramboll has developed the energy recovery performance estimates using their bespoke Waste-to-Energy (WtE) modelling tool, RAMsteam. The nominal performance represents the expected net power output from the facility under design conditions, including an ambient temperature of 20°C.

Table 2 summarizes the main performance results at nominal load (i.e. 100% thermal input) for the proposed energy recovery solution. Results are presented based on the nominal Lower Heating Value (LHV) of the fuel. The nominal net power production is estimated at 73.2 MWe.

Table 3: Nominal Power Estimate (reproduced from REN2021N00922-RAM-ME-00024 / Version 2.0)

Parameter	Value	Units
Fuel Heating Value (LHV)	10.6	GJ/tonne
Power Output (Gross)	84.6	MWe
Power Output (Gross)	890	kWh/tonne fuel
Parasitic Load / Own Consumption (incl. IBA and APCr treatment facilities and a provision for Point of Connection losses)	11.3	MWe
Power Output (Net)	73.2	MWe
Power Output (Net)	771	kWh/tonne fuel

3.3.2.1 Parasitic Load

Parasitic load refers to the internal power consumption of the facility required to operate auxiliary systems such as fans, pumps, control equipment, and other supporting infrastructure. This load represents energy consumed onsite that is not available for export or external use.

The facility's own power consumption to drive such equipment is typically expected to range between 50–100 kWh per tonne of treated waste. For the proposed 760,000 tonnes per annum (tpa) Energy-from-Waste (EfW) plant capacity, this corresponds to a parasitic load of approximately 4.75 to 9.5 MW electric (MWe) during nominal operation with two boilers. This estimate excludes additional power requirements for APCr stabilization, Incinerator Bottom Ash (IBA) sorting, and point of connection losses.

Assuming 8,000 hours of operation per boiler annually, the annual internal energy consumption is projected to be between 38,000 and 76,000 MWh/year.

The net power estimates provided by Ramboll are based on a nominal total parasitic load of 11.3 MWe, which includes provisions of:

- 1.0 MWe for IBA treatment and APCr stabilization area consumption, and
- 1.5 MWe for point of connection (POC) losses, such as those associated with the generator step-up transformer (GSUT) and 110 kV switchgear.

3.3.3 Proposed Infrastructure

3.3.3.1 Grid Connection

The BERC will generate electricity as part of its operations and therefore requires connection to the electricity network to enable export of power to the grid. Establishing an appropriate grid connection is a key component of the project, ensuring reliable operation, compliance with network standards and the ability to supply energy to the broader electricity system. Several connection options have been identified and assessed to determine the most suitable and efficient approach.

The single line diagram depicting existing Energex network feeders is presented in Figure 4. The Global Positioning System (GPS) map view of these feeders and the project location (indicated as Lot 1) is shown in Figure 5.

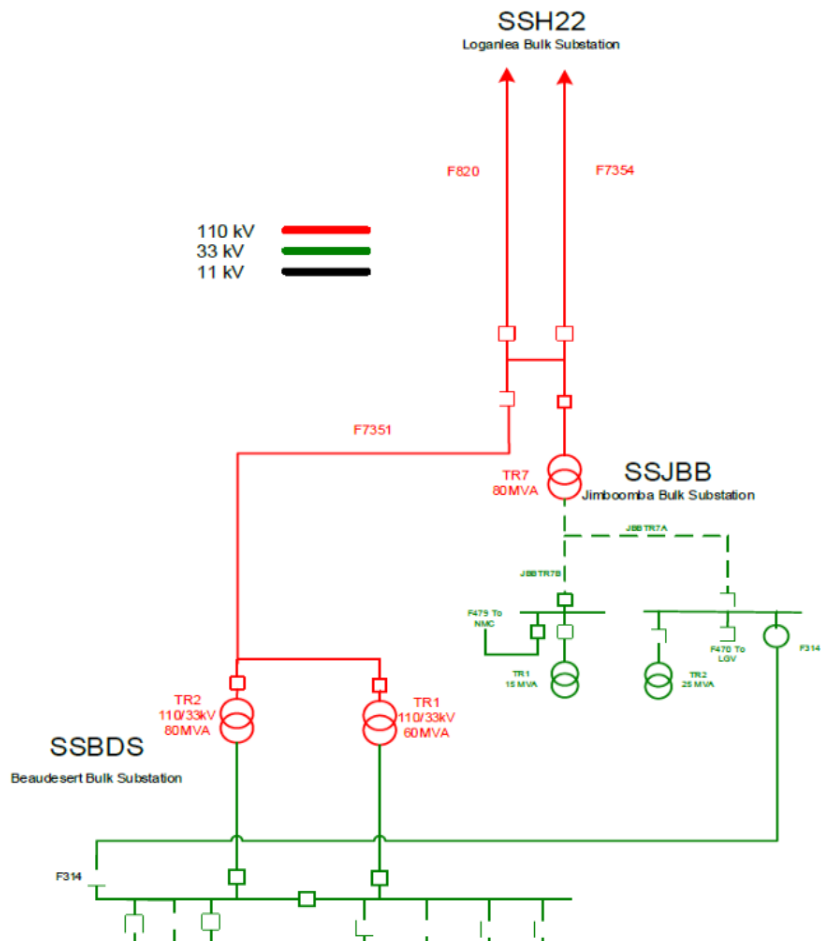


Figure 4: Single line diagram of Beadesert and Jimboomba substations

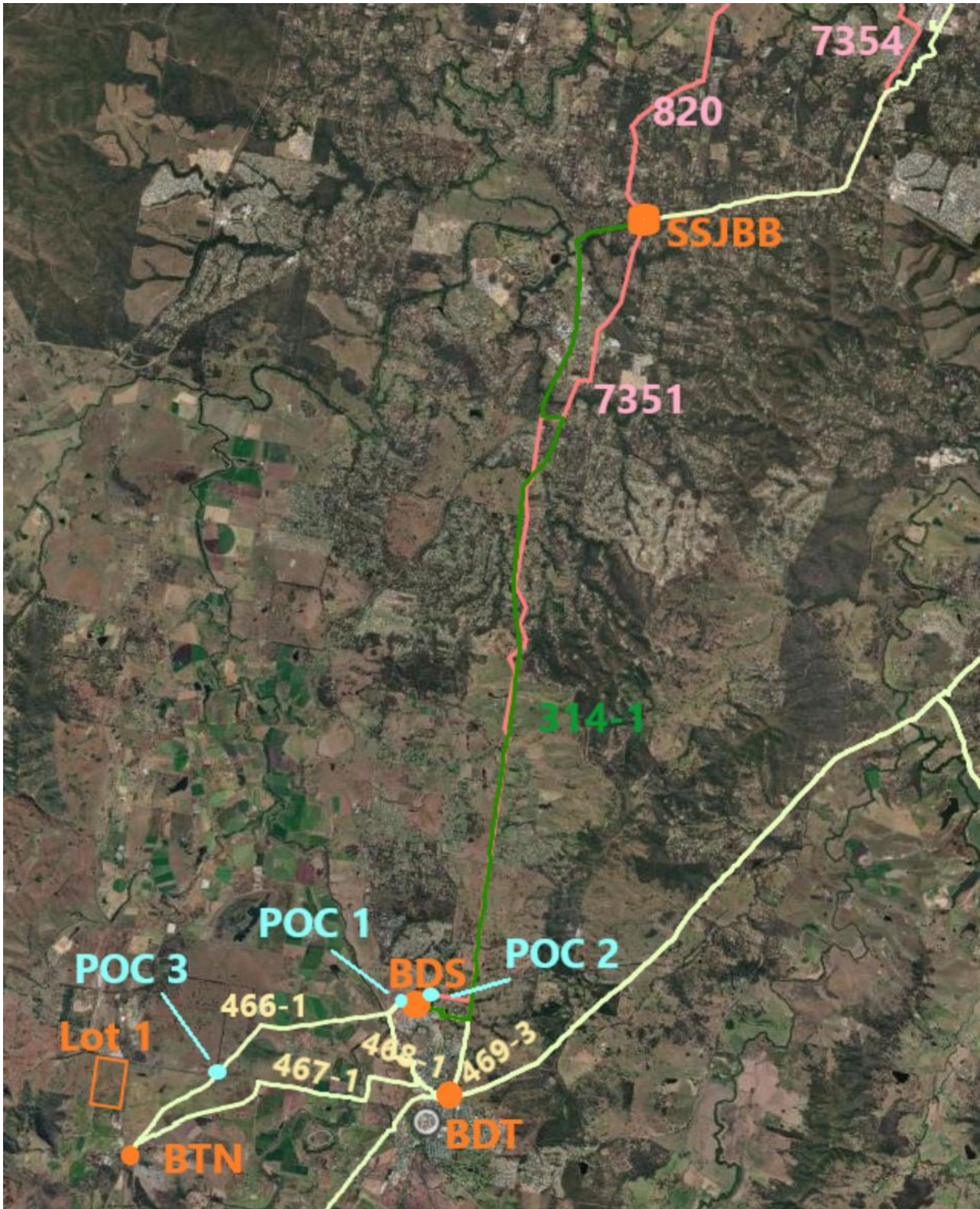


Figure 5: Nearby 33kV and 110kV network

3.3.3.2 *Engagement with Energex*

3.3.3.2.1 **Preliminary Enquiry**

In March 2022, Energex provided a preliminary response to a connection enquiry for a 60MW synchronised generator.

Two potential options for connecting the proposed 60 MW generation facility at Bromelton to the Energex distribution network were identified in the preliminary response from Energex. Both options involved

connection to the Beaudesert Bulk Supply Substation (SSBDS), located approximately 7 km from the proposed site.

Option 1 – 33 kV Connection:

Involved constructing a new 7 km 33 kV feeder from SSBDS to the site. Standard construction enables ~40 MVA, so detailed assessment is required to confirm feasibility for 60 MW. Some substation upgrades including a new feeder bay, protection, and communication works would be required.

Option 2 – 110 kV Connection:

Involved a new 7 km 110 kV feeder from SSBDS to the site. Expected to accommodate the full 60 MW capacity with associated substation, protection, and communication upgrades.

Due to the increase of generation capacity to 73 MW Option 1 is no longer considered to be viable.

3.3.3.2 Detailed Enquiry

Energex has undertaken a Site Specific Connection Assessment and confirmed that a viable grid connection can be achieved via a 110 kV connection to the Beaudesert Bulk Supply Substation (SSBDS). This involves the construction of a new 110 kV feeder from the Beaudesert Substation to the proposed site, over an approximate distance of 7–8 km. Works would include upgrades within the substation, installation of connection and isolation equipment, and associated protection, communications, and system management infrastructure to ensure safe and reliable operation.

3.3.3.3 On site Substation

The site will include an on-site substation to facilitate the necessary on-site HV switchgear and protection systems to ensure safe and reliable integration with the local electricity network. This on-site substation has been positioned near the northern boundary of the site, clear of main operational areas and closer to the off-site electrical easement.

3.3.3.4 Earthing and Lighting Protection

The earthing system shall be designed to achieve safe step and touch voltages at the site and vicinity when there is a fault at the 110kV system. The maximum fault current and primary and back up fault clearing times at the BDS will be taken from Energex.

3.3.3.5 Essential Services (Emergency Power Supply)

The BERC design includes provision for a least one 5 MW emergency diesel generator (EDG) to maintain critical systems and bring the facility to a safe shutdown in the event of a power failure and the plant is not operating in Power Island mode (Note: Specific redundancy requirement for the EDG to be assessed during Basic Design). The EDG(s) is sized to supply all essential safety, environment protection and plant preservation systems such as boiler feedwater pumps, air compressor, ID fan auxiliary motor, bottom ash vapour extraction fans, Uninterruptible Power Supply (UPS) batteries etc. independently of the external power network. In addition, the Distributed Control System (DCS) and CEMS will be connected via the UPS.

In addition to the EDG(s), the BERC power generation system will be designed to operate in Power Island mode, when technically feasible to do so. In general, this enable the BERC facility to disconnect from the external grid and continue operating using its own steam turbine generator to meet the internal electrical demand.

In combination with system/equipment redundancy provisions, these measures will enable the BERC facility to maintain safe operation, environmental compliance and protection of personnel and assets in the event of grid disturbance or loss of supply.

3.4 Communications

3.4.1 Existing Infrastructure

There is no existing communication connection to the site. Telstra cabling is present along Beaudesert Boonah Road.

3.4.2 Proposed Infrastructure

NBN connection is available to the site via sky muster satellite. This would require the installation of a roof satellite dish on the premises. Communications connection will be defined further by the detailed designer.

An NBN connection is available to the site via the Sky Muster satellite service. Establishing this connection would require the installation of a satellite dish on the building roof. The final communications strategy, including connection type and location, will be confirmed during the detailed design phase.

Although Telstra cabling is present along Beaudesert Boonah Road, the suitability of a direct connection to the site is currently unknown. As such, a satellite NBN connection is recommended at this stage.

3.5 Gas

No gas service is required for the construction or operation of the proposed facility. Back-up services will be diesel powered with proposed diesel tanks shown on the site plan.

4. Roadworks

4.1 Internal Roads

The internal road network has been designed to facilitate safe and efficient access throughout the BERC facility site. This network will accommodate the movement of staff, waste and service vehicles associated with facility operations.

The main site access point is located at the north-western corner of the site adjoining Beaudesert Boonah Road. Upon entry onto the site, the internal road network provides direct connections to the visitor and staff carpark and the operational areas of the facility (limited access). The site arrangement establishes a ring-road layout that facilitates the desired sequencing of on-site operational arrangements. This arrangement promotes the safe and efficient movement of vehicles from the main entry and through the site. Additionally, the site arrangement avoids where practicable conflict points between service/waste trucks, employees, visitors and pedestrians.

To enhance traffic flow and safety, one-way movement has been prioritised throughout the internal road network. Additionally, the design incorporates separation of light and heavy vehicles where feasible to minimise conflict points and improve operational efficiency.

Vehicle tracking analyses have been undertaken to ensure the road design accommodates the largest anticipated design vehicles for critical sections of the network. These assessments confirm that turning radii, lane widths, and road alignments are suitable for safe manoeuvring of waste delivery trucks and other heavy vehicles.

Key road and cross-section parameters are provided in Table 4.

Table 4: Road Design Criteria

Design Criteria	Requirement
Design Vehicle	B-Double (checking for A doubles)
Design Speed	20 km/hr
Posted Speed	10 km/hr
Road Width (Main Access Road)	6.0 m typical lane width + curve widening where necessary using vehicle tracking Min 6.0 m width around perimeter of EfW building.
Parking Aisle Width	Min 6.2 m
Parking Bays	Min 5.4 m long x 2.5m wide
Footpath provision	Min 1.5 m width adjacent to parking spaces and pedestrian routes
Earthworks Batters	Typically 3H:1V un-reinforced slope unless noted otherwise

Road layout, typical cross sections, long sections, vehicle tracking and pavement details are provided in the infrastructure drawing package. Road designs and site grading will be further developed and optimised as part of the detailed design process.

4.1.1 Parking

Parking provisions for the BERC have been based on anticipated staff numbers provided by Cleanaway. Further allowances have been made for visitor car parking. It has been assumed that most visitors will be part of educational groups who will arrive via private coach or bus. The parking provisions are summarised in Table 5.

Table 5: Parking Provision

Building	Vehicle Type	Parking Provision
Main facility	Car	60 spaces
	Shuttle bus / Coach	1 space (drop/off-pick-up)
Adjacent to Administration Building	Car	8 spaces including 3 accessible
IBA area	Car	7 spaces including 2 accessible
APCr area	Car	5 spaces
Decoupling area	Car	10 spaces
Substation	Car	3 spaces

Parking spaces are min 5.4 m long x 2.5 m long in accordance with AS 2890.1.

4.2 Site Access

The Project has sole frontage to Beaudesert Boonah Road (State-controlled road). A new signalised intersection is proposed at Beaudesert Boonah Road and Recycling Street (refer Figure 6). Access is obtained via the north-western corner of the site to facilitate safe vehicle movements to the site and the broader SDA. The establishment of the intersection will ultimately reduce the speed limit along the fronting section of Beaudesert Boonah Road to 70 km/h.

The location and design of the proposed signalised access arrangement is in alignment with the preliminary engagement with TMR. It is considered the most suitable solution due to the sufficient provision of sight distance and turning lane requirements, and the allowance for potential future widening of Beaudesert Boonah Road. Importantly, the provision of the signalised intersection allows for future consolidation of access points along Beaudesert Boonah Road, providing a benefit to the SDA precinct.

Please refer to the *Traffic Impact Assessment* prepared by Arup for further information.

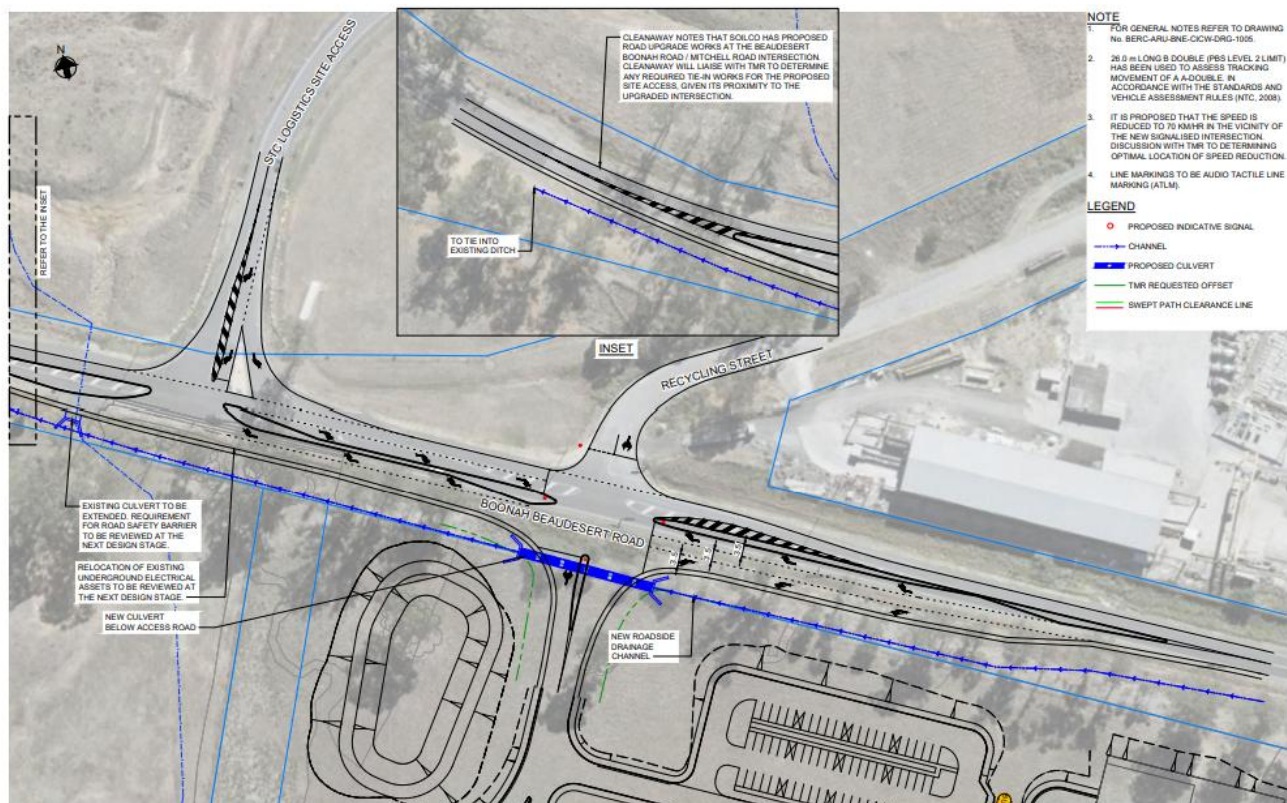


Figure 6: Site Access

5. Conclusion

This Engineering Report has provided key information relevant to the engineering design of the BERC, covering earthworks, infrastructure servicing, and road design. It is intended to be read alongside the *Stormwater Management Plan and Flood Risk Report* and *Traffic Impact Assessment*.

The key engineering outcomes include:

- **Bulk Earthworks:** A balanced cut and fill approach tailored to the site's varied topography, with engineered batters, retaining walls, and revegetation ensuring slope stability and erosion control.
- **Water Supply:** Connection to an extended Urban Utilities' DN375 water main with integrated provisions for rainwater reuse.
- **Wastewater Management:** On-site sewer holding tanks are proposed due to the absence of nearby sewer infrastructure, with future connection to Urban Utilities' precinct gravity sewer identified as the preferred long-term solution.
- **Electricity:** The facility will be supported by a 110 kV grid connection and on-site substation, providing an estimated net power output of 73.2 MWe, supplemented by emergency generators and fault protection systems.
- **Communications:** Satellite NBN is the recommended connectivity solution, with Telstra cabling as an alternative subject to further assessment.
- **Gas Infrastructure:** No gas services are required for the site.
- **Internal Road Network:** Designed to ensure safe and efficient traffic movement. The design includes dedicated parking for staff and visitors.
- **Site Access:** Access to the facility will be via a new four-way signalised intersection at Recycling Street. Refer to the *Traffic Impact Assessment* for additional information.

These findings support the feasibility and practical design of the BERC project, aligning with operational requirements and site constraints.

Appendix A Topographic Survey

Appendix B Infrastructure Design Drawings

Appendix C Water Balance

Appendix D UU Service Advice Note

Appendix D1 2023 SAN

