SHIRE OF MERREDIN
HEART OF THE WHEATBELT

APPLICATION FOR PLANNING APPROVAL

LOCAL PLANNING SCHEME No. 6 - SCHEDULE 6 - (CLAUSE. 9.1.1)

OWNERS DETAILS

Name/s:	Sunshine United Developments Pty Ltd ACN 130 855 828				
Address:	[redacted]			Post Code:	6165
Phone work:		Phone home:		Fax:	
Mobile:	[redacted]	Email:	[redacted]		
Signature:	[redacted]		Date	19th May 2025	
Signature:			Date		

NB: The owner/s signature/s are required for your application to be processed.

APPLICANTS DETAILS

Name:	ACEnergy c/- Urbis				
Address:	[redacted]			Post Code:	6000
Contact person for correspondence:	Cameron Liebgott				
Phone work:	[redacted]	Phone home:		Fax:	
Mobile:		Email:	[redacted]		
Signature:	[redacted]			Date:	06/05/2025

PROPERTY DETAILS

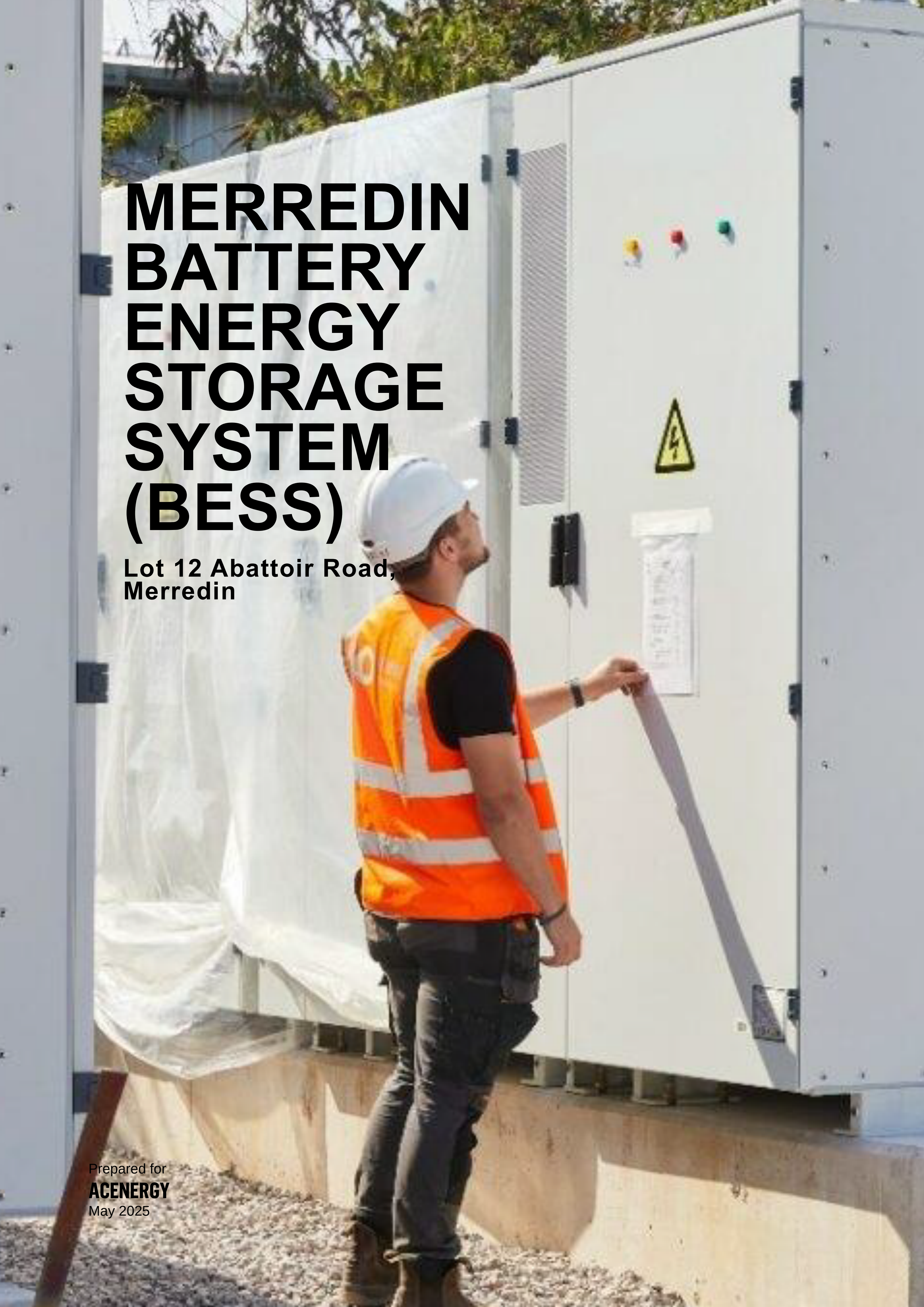
Lot No:	12	House/Street No:		Location No:	
Street name:	Abattoir Road				
Suburb:	Merredin			Post Code:	6415
Nearest street intersection:	Abattoir Rd & O'Connor St				
Diagram or plan:	021792	Certificate of title:	2098	Folio:	388
Title encumbrances (e.g. easements, restrictive covenants)	G410102 EASEMENT TO ELECTRICITY CORPORATION.				

PROPOSED OR EXISTING BUILDING/LAND USE

Description of proposed development and/or land use:	Battery Energy Storage System
Nature of any existing buildings and/or land use:	Vacant
Approximate cost of proposed development:	$ 9 millions
Estimated time of completion:	Q4 2026

OFFICE USE ONLY

Acceptance Officer's initials:	*Date received:*
Local government reference no:	



MERREDIN BATTERY ENERGY STORAGE SYSTEM (BESS)

Lot 12 Abattoir Road, Merredin

Prepared for
ACENERGY
May 2025

URBIS STAFF RESPONSIBLE FOR THIS REPORT WERE:

Director	Peter Fitzgerald
Senior Planner	Cameron Liebgott
Assistant Planner	Elizabeth Collins
Project Code	P0059184
Report Number	Final

Urbis acknowledges the important contribution that Aboriginal and Torres Strait Islander people make in creating a strong and vibrant Australian society.

We acknowledge, in each of our offices, the Traditional Owners on whose land we stand.

CONTENTS

FIGURES

TABLES

1. INTRODUCTION

Urbis is pleased to represent ACEnergy Pty Ltd, the proponent for the proposed distribution-level Battery Energy Storage System (**DBESS**) and associated infrastructure. The proposed facility will be located at Lot 12, Abattoir Rd, Merredin, Western Australia, which is approximately 3 kilometres southeast of Merredin Town Centre.

The proposal represents an innovative renewable energy facility, that aligns wholly with the State's vision for a cleaner more sustainably powered future. Our client has an extensive history with the delivery and provision of modern and efficient renewable energy projects, creating the opportunity for the Shire of Merredin to supply a modern renewable energy storage facility.

This comprehensive report reveals the context of the proposal, underscoring its alignment with appropriate state and local planning frameworks. The report includes the following information in support of the approval to commence development of the proposal:

- Site details and in-depth local and regional context
- Description of the proposed development and contextual background information
- Detailed planning assessment against State and local planning frameworks
- Consideration of broader and relevant State strategic planning frameworks
- Justification and detailed input from technical reports

Table 1 – Summary of Development Site

Property Location:	**Lot 12 Abattoir Road, Merredin WA**
Existing Land Use/s:	Rural Residential – Vacant site.
Total Lot Area:	32.33ha (approx.)
LPS Zoning:	Rural Residential (Proposed Light Industrial)
Local Planning Scheme:	Shire of Merredin Local Planning Scheme 6

The application is supported by:

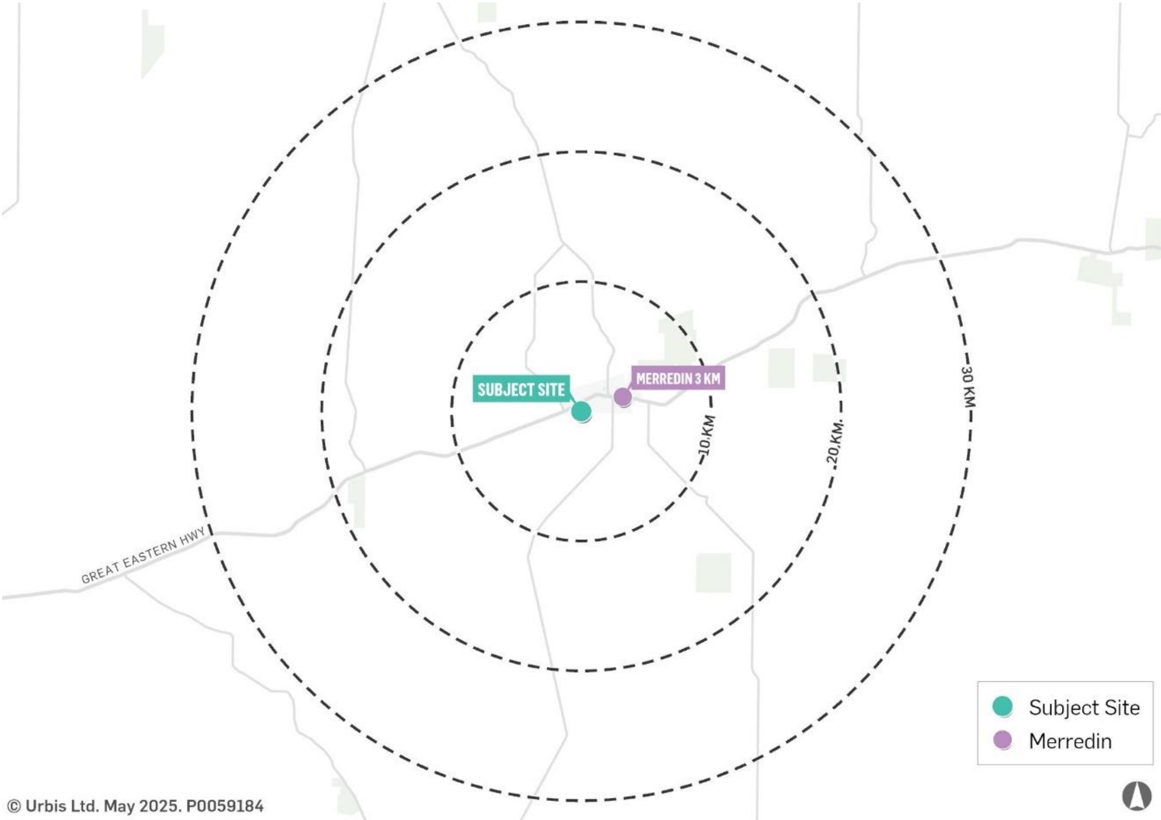
- Appendix A Certificate of Title
- Appendix B Development Plans
- Appendix C Traffic Impact Statement
- Appendix D Environmental Noise Assessment
- Appendix E Bushfire Risk Assessment
- Appendix F Landscape Plan
- Appendix G Stormwater Report
- Appendix H BESS Fire Safety

2. SITE DETAILS

2.1. REGIONAL & DISTRICT CONTEXT

The proposal is located within the locality of Merredin in the Shire of Merredin, a major service and agricultural town in the Wheatbelt Region. The town's strategic location along the Great Eastern Highway and railway line provides connections to Perth and Kalgoorlie, which positions it as a vital transport and logistics hub within the Region. Implementing and encouraging the development of innovative and sustainable energy resources such as the proposed BESS facility will aid in facilitating sustainable development in the region.

Figure 1 – District Map



2.2. LOCAL CONTEXT

The subject site is situated approximately 3 kilometres southeast of Merredin’s Town Centre in the Shire of Merredin and is comprised of cleared undeveloped land (see **Figure 2**).

The situated along Abattoir Road, which directly connects to the greater regional road network, including Great Eastern Highway to the northeast. The site is surrounded by rural lands predominantly cleared of development.

ACEnergy has secured ~0.65ha of land nearby key Western Power transmission infrastructure, for the purpose of developing BESS infrastructure.

Figure 2 - Aerial Imagery

2.3. LOT DETAILS

The following table details the key lot particulars relevant to the subject site.

Table 2 - Lot Details

Lot	Plan	Area (ha)	Vol/Folio	Proprietor
12	P021792	32.33ha (approx.)	2098/388	Sunshine United Developments Pty Ltd of 34 Lionel Street, Naval Base

Figure 3 - Cadastre Plan

3. PROPOSED DEVELOPMENT

3.1. BACKGROUND

The proposed DBESS will be wholly situation on Lot 12, Abattoir Road, Merredin. Urbis understands that the subject site was selected by ACEnergy due to its proximity to Western Power Transmission network infrastructure capable of supporting a 10 megawatts/40 mega-watt hours (10MW/40MWh) battery.

The proposed DBESS and supporting infrastructure will be situated within the north-eastern portion of the lot and will have a footprint of approximately 0.65 hectares on the 32-ha lot. The proposal will aim to support the efficiency of the electrical network of Merredin and its surrounds by charging from the grid during periods of low demand and discharging back to the grid during periods of higher demand.

Although DBESS infrastructure is relatively small in scale, it will greatly enhance the Town's renewable energy resources, aligning with the State's growing sustainable energy vision.

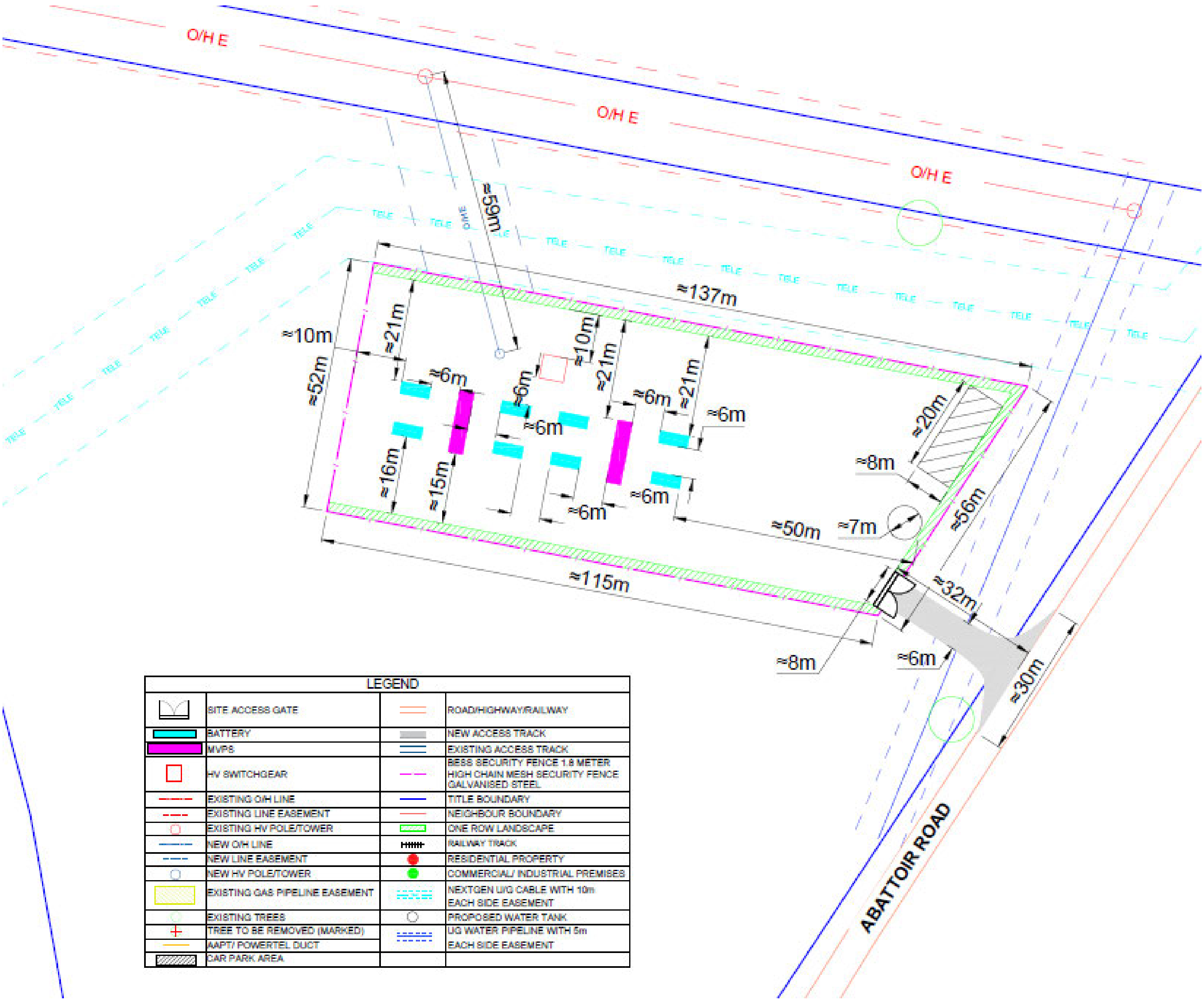
3.2. SUMMARY OF DEVELOPMENT

Figure 4 is an extract from the attached Development Plans at **Appendix B** and depicts the proposed BESS site overview, including the layout of the facility and associated infrastructure. As detailed in the layout map, the BESS facility is in the north-eastern portion of the lot covering approximately 0.65ha of land.

The proposal will comprise of the following supporting infrastructure:

- The installation of a new driveway from Abattoir Road leading to a gated entry to the BESS.
- Security fencing and landscaping around the BESS.
- Sufficient landscaping to screen the development from surrounding development.
- Electrical components of the BESS, including approximately eight (8) battery containers; two medium voltage power stations (MVPS) and high voltage switchgear; and
- Ancillary electrical transmission lines to connect the BESS to the existing powerlines to the north.

Figure 4 - Site Plan (refer to Appendix B – Development Plans)



3.3. OPERATION

The proposed BESS will be a utility-scale lithium iron phosphate (**LFP**) solution designed for grid-scale applications. This containerised system, resembling a standard 20-foot shipping container, ensures efficient transport and installation. The BESS will be manufactured offsite to then be delivered to the subject site as a pre-assembled unit, facilitating streamlined installation and commissioning.

The system features modular battery units with liquid cooling technology to optimise thermal management and enhance performance. The proposal will be equipped with a comprehensive fire detection and suppression system, including thermal sensors, gas detection, and automated suppression mechanisms to mitigate any fire risks.

4. STATE PLANNING ASSESSMENT

4.1. LEGISLATIVE CONSIDERATIONS

4.1.1. Planning and Development Act 2005

The use and development of land across Western Australia is regulated by the *Planning and Development Act 2005* (PD Act). In relation to the Proposal, the PD Act facilitates the implementation of State Planning Policies and the Shire's local planning framework.

4.1.2. Environmental Protection (Noise) Regulations 1997

The *Environmental Protection (Noise) Regulations 1997* serve to regulate and control noise emissions to protect the well-being and comfort of individuals and communities in Australia. They establish permissible noise levels, outline procedures for noise assessment, and provide guidelines for noise management and mitigation.

An Acoustic Impact Assessment has been prepared to demonstrate the extent of predicted compliance with the Noise Regulations as set out in the act and is contained within **Appendix D**. The Acoustic Assessment demonstrates compliance with the *Environmental Protection (Noise) Regulations* (EPNR) assigned noise levels at all industrial receivers, for all periods of the day with maximum duty cycle operation mode. When the BESS and MVPS units need to operate at night, they will be programmed to limit their duty cycle to 40-50% between 10pm and 7am (or 9am on Sundays and public holidays), as long as this limitation does not impact their performance.

4.2. STATE STRATEGIC FRAMEWORK

4.2.1. State Planning Strategy 2050

The *State Planning Strategy 2050* outlines context and basis for the integration and coordination of land-use planning and development across state, regional and local jurisdictions. The strategy explains the context, principle and goals for land use planning in Western Australia.

The strategy undertakes particular focus on the renewable energy sector, highlighting the increase in global demand and continued diversification of Western Australia's economic base, as core drivers for the increasing demand for renewable energy generation and technology.

The proposal directly aligns with *State Planning Strategy 2050* by providing additional renewable energy storage capacity capable of supporting the State's increasing renewable energy generation on the grid.

4.2.2. Western Australia Future Battery Industry Strategy Western Australia

The Western Australian Future Battery Industry Strategy outlines the state's plan to develop a sustainable and globally competitive battery industry. The plan is designed to leverage Western Australia's plentiful supply of essential minerals to create a thriving sector focused on the production and manufacturing of battery materials.

There are several focus areas identified across the Strategy that this proposal directly aligns with, including:

- The proposal provides significant opportunity for regional/domestic integration of renewable, battery energy storage systems.
- The proposal's location within a planned industrial area provides opportunity for future battery maintenance, management and other associated industrial uses to be located within close proximity.

4.2.3. Energy Transformation Strategy

Western Australia's Energy Transformation Strategy outlines the State's plan to shift focus towards the transition to cleaner and more renewable energy technologies. The energy sector in Western Australia is experiencing a significant transformation, with renewable technologies becoming more cost-effective and consumers increasingly generating their own electricity through rooftop solar PV systems. Battery systems are also improving, offering efficient energy storage solutions.

The strategy sets out a detailed action plan across four key themes, including modernising energy systems, decarbonising energy supply, optimising energy use and empowering consumers. This proposal wholly aligns with the vision of this Strategy, specifically:

- Provision of a decarbonised energy storage solution, reducing energy sector carbon emissions
- Ensuring the provision of a dependable energy supply
- Increasing the State's transition towards cleaner, more renewable energy storage

The proposal will also contribute to the objectives of this Strategy through:

- Utilising proven grid-following technology to ensure reliable performance and inertial response to the transition from coal fired power generation and firming the supply of intermittent renewable energy sources
- The development of the proposed BESS at this specific location will maximise system utilisation and minimise the need for the augmentation of the existing network, supporting the affordable supply of energy to households and businesses
- Provide much needed capacity and support for a growing renewable energy sector within the region
- Provide additional job opportunities and training for skilled workers in the region, which will ultimately be required to further support the States energy transition into the future

4.2.4. Position Statement – Renewable Energy Facilities

This document presents the Western Australian Planning Commission's (WAPC) guidelines for the consistent development and provision of renewable energy facilities in Western Australia, replacing the 2004 Guidelines for Wind Farm Development. It outlines assessment measures to ensure renewable energy facilities are developed in areas that balance environmental and urban impact with energy production and operational efficiency.

The document delivers an outline of a framework for assessing and determining renewable energy projects. This includes guidelines for construction, site selection, design and operation. This proposal considers these Guidelines and remains clearly consistent with the document's intentions, including the development of infrastructure and contextual impact of site selection. This has been done by facilitating early stakeholder engagement with stakeholders, specifically the Shire, proposing sufficient landscaping to screen the BESS from adjoining landowners/development and effective land selection in order to reduce environmental impacts and visual impact.

4.3. STATE PLANNING POLICIES

4.3.1. State Planning Policy 2.0 – Environmental and Natural Resources Policy

State Planning Policy 2.0 (SPP2.0) outlines the following as core objectives:

- Integrate environment and natural resource management with broader land use planning and decision-making.
- Protect, conserve and enhance the natural environment.
- Promote and assist in the wise and sustainable use and management of natural resources.

The proposal considers and adheres to the intentions of these policies throughout the entirety of the development process. The assessment concludes that the proposal is wholly consistent with the objectives of SPP2.0, with particular focus on the conservation of the natural environment and the natural resources. The proposal is a renewable energy project which has been contextually selected due to the land being cleared. This has been determined appropriate to be compliant with the policy and is deemed a low impact development site.

4.3.2. State Planning Policy 2.5 – Rural Planning

SPP2.5 outlines policy objectives aimed at safeguarding rural land resources, recognising their significant contributions to the economy, natural resource management, food production, environmental conservation, and landscape aesthetics.

The site is currently used for Rural purposes, which will result in a loss of rural land, however the site is earmarked under the Local Planning Strategy to be rezoned to light industry. As such this proposal will have no impact or loss on rural land, deeming it compliant with the Policy.

4.3.3. State Planning Policy 3.7 – Planning in Bushfire Prone Areas

SPP 3.7 directs how land use should address bushfire risk management in Western Australia. It applies to all land designated as bushfire prone by the Fire and Emergency Services (DFES) Commissioner. It applies to all higher order strategic planning documents, strategic planning proposals, subdivision and development applications located in designated bushfire prone areas.

None of the site is located within a bushfire prone area, therefore no Bushfire Management Plan (BMP) has been prepared. However, a Bushfire Attack Level (BAL) Assessment Report (refer **Appendix E**) has been prepared in support of the proposal, and to demonstrate the proposal's consistency with the provisions of SPP 3.7. The BAL concludes that the proposed BESS is sited appropriately to ensure that the radiant heat exposure of renewable energy assets during a bushfire is reduced so that it does not exceed 10 kW/m2 at a flame temperature of 1090 K, which is considered best practice in Western Australia.

5. LOCAL PLANNING ASSESSMENT

5.1. SHIRE OF MERREDIN (DRAFT) LOCAL PLANNING STRATEGY

The Shire has prepared a draft local planning strategy, which was advertised for public comment in December 2024.

The Shire's Draft Local Planning Strategy (**DLPS**) considers a variety of strategic planning considerations at a regional level to determine the planning direction and objectives for the Shire's development. Aiming to be consistent with the broader State Planning Frameworks, the DLPS highlights unresolved planning challenges and proposes necessary actions to resolve them. The strategy additionally offers a broad roadmap for land use planning in the Shire for the upcoming 10-15 years.

The strategy emphasises crucial planning considerations, such as the increased demand for industrial infrastructure within the Merredin Town Centre, and the sustainable use of land and water resources, in ensuring planning accommodates future needs and that decisions create opportunities to enhance local attributes.

The DLPS identifies a number of sites within the municipality that are well suited to support industrial infrastructure, which encompasses the subject site. As identified in Figure 2 'Lots 12 and 13 Abattoir Road' of the DLPS, it is proposed that the subject lot will be designated to 'Light Industrial/Commercial' uses as opposed to its current 'Rural Residential' due to its proximity to Western Power and Water Corporation Infrastructure.

The proposal introduces significant opportunity for planning to accommodate future energy needs. The provision of sustainable energy storage directly addresses the State and regions' future need for a more renewable, decarbonised system of energy storage. The proposal brings opportunities for job creation during both the construction and operational phases within the Shire and the broader district. The emergence of new business, industrial, and employment possibilities could have a multiplying effect on the economic activity in Merredin and its neighbouring regions. It is overall submitted that the proposal greatly aligns with the broader strategic planning objectives of the DLPS.

5.2. SHIRE OF MERREDIN LOCAL PLANNING SCHEME NO.6

Pursuant to the Shire of Merredin Local Planning Scheme No.6 (**LPS6**) the subject site is zoned 'Rural Residential'. Although this is the current zoning of the site, it is understood that the Shire is intending to rezone the site to 'Light Industrial' in accordance with the draft DLPS and replicated within the Shire's new Local Planning Scheme. Given that the Local Planning Strategy has been advertised, it is now a seriously entertained document, and it is entirely appropriate that the objectives of 'Light Industry' is applied to the land. The proposed development is consistent with the objectives of the proposed zone and an assessment of the objectives are as follows:

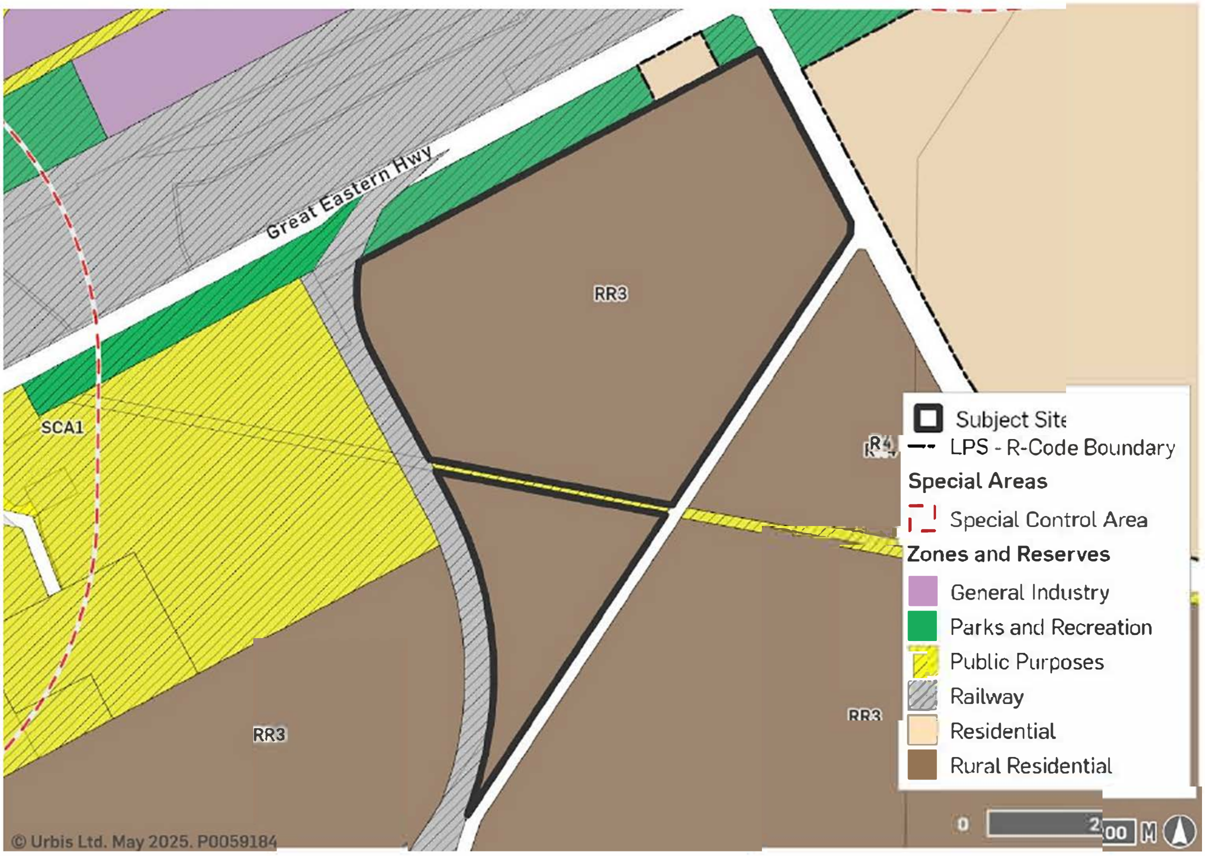
Table 3 - Objectives Assessment

Objective	Response
To provide for service industries and light industries that will not have a detrimental effect on nearby residential or other sensitive uses;	The proposal covers a minimal area on a currently rural site (proposed to change to light industry) and there are no sensitive land uses within proximity, other than an unused resident at Lot 11 to the East. Additionally, the proposal has been supported by an Acoustic Assessment outlining its compliance with the Noise Regulations. A landscape plan has been prepared to effectively screen the BESS with vegetation
To provide for home business type uses where caretakers' dwellings may be permitted;	Not applicable to this application

Objective	Response
To provide for a range of employment opportunities;	The BESS will facilitate 2 maintenance personnel which attend site every fortnight over its lifetime
To preclude the storage of bulky and unsightly goods where they may be in public view; and	N/A, no storage of bulky goods are proposed
To ensure the appropriate use of setback areas and the provision of landscaping to the local government's satisfaction; and	The BESS development is effectively setback from all lot boundaries and adjoining development. In addition to this, the development has been supported with a Landscape Plan demonstrating effective use of landscaping to screen the development.
To allow light and service industries that are compatible with nearby uses; and	Noted, currently will be the first development within the re zoned light industry area.
To provide areas with easy access and parking; and	One crossover is proposed along Abattoir Road and will easily accommodate the proposed capacity for workers accessing the site.
To minimise land use conflicts and address environmental impacts.	The proposal complies with Federal and State objectives to deliver renewable energy without impacting the environment.

It is submitted that the proposal aligns with the objectives of the 'Light Industry' zone as it will provide a service industry, particularly with the provision of sustainable energy, without being a detriment to surrounding land uses.

Figure 5 – LPS2 Map



5.2.1. Land Use Permissibility

The proposal's primary land use function is the provision of electricity storage. This involves the development of associated infrastructure to control and distribute energy to the grid as required.

As there is no land use zone that describes the proposed works outlined in this proposal, it is submitted that the proposed BESS facility is considered as a 'Use not Listed' within Table One – Zoning Table. However as noted the proposal aligns with the objectives of the 'Light Industry' zone and on this basis, it should be considered under clause 3.4.2 of the scheme, which allows the local authority to approve unlisted uses subject to advertising. The BESS infrastructure does not align with any land use classifications within the scheme, with 'wind farm or wind energy facility' being the closes, being consistent with a renewable energy facility. The Renewable Energy Facility Position Statement outlines that this classification should be replaced within planning schemes, to "Renewable Energy Facility'. The current scheme is yet to be updated/amended to be consistent with the current renewable policies.

5.2.2. Zone Development Requirements

Schedule 4 of LPS2 outlines further general zone development requirements. While there are no development requirements for 'Light Industry' zones, clause 4.7.1 sets out the following:

Where requirements for a particular use are not set out in this Scheme, the development shall conform to the provisions for the predominant use of the zone in which it is situated, as determined by the local government. Where such provisions are inappropriate, development shall conform to such requirements as the local government shall determine. For the purposes of this Clause, the predominant uses in zones and local reserves shall be deemed to be as outlined in their respective objectives.

It is considered that the provisions of clause 4.7.1 shall be applicable to the proposed development. The proposal is supported by sufficient and relevant technical information from certified specialists, informing provisions of detailed design and development. The development is consistent with the Light Industrial objectives as mentioned above, deeming it appropriate to be located within the Light Industrial zone. Given the above the technical reporting assisted the placement of the BESS posing sufficient setbacks being approx. 32m from Abattoir Road and approx. 59m from the adjoining norther lot. Additionally, the landscaping has been informed by the height of the BESS, with a 5m height covering the infrastructure effectively.

6. TECHNICAL CONSIDERATIONS

6.1. TRAFFIC IMPACT STATEMENT

Traffic Impact Statement prepared by Level 5 Design (Appendix C)

A Transport Impact Statement (TIS) has been prepared by Level 5 Design to consider the traffic and transport impacts of the proposed development on the adjacent transport network with a detailed focus on vehicle access, car parking, service vehicles and traffic management. The findings of the report demonstrate the that subject site is suitable of accommodating the vehicle movements required during construction. Once constructed and operational, the development will generate little or no traffic.

The TIS concludes the following:

- The existing traffic volumes are estimated to be less than 50 vehicles a day and the roads are operating within their traffic capacity.
- The proposed development has been designed to be accessed during construction by standard B-Double trucks up to a maximum length of 27.5 metres, weight and dimensions falling within the allowable limits of the road network.
- A crossover is proposed on Abattoir Road to enable forward entry. This will be designed as a minimum with MRWA rural driveway requirements for light vehicles. The driveway will be installed prior to battery delivery and installation.
- During operation the site will generate an average of 1 light vehicle per week.
- During construction, traffic generation will be as follows:
  (i) Max No. trucks per hour = 1
  (ii) Max. No. light vehicles per hour = 6
- During operation the surrounding road network and access points are appropriately equipped to manage the level of traffic

It is concluded that the proposed design for the Site fully satisfies the requirements for safe vehicular access and parking, and it is forecast to have negligible traffic impact on the surrounding road network.

6.2. ENVIRONMENTAL NOISE ASSESSMENT

Environmental Noise Assessment prepared by Acoustics Consultant Australia (Appendix D)

Acoustics Consultant Australia have prepared an environmental noise assessment to report any potential impact and considerations with regard to noise emissions generated from the construction and operation of the Merredin BESS facility. The development's compliance is assessed using the requirements from the *Environmental Protection (Noise) Regulations 1997*.

The assessment identifies the following results:

- Compliance with the *Environmental Protection (Noise) Regulations* (EPNR) assigned noise levels at all industrial receivers, for all periods of the day with maximum duty cycle operation mode.
- Compliance with the EPNR assigned noise levels at all highly sensitive receivers:
  - Running at maximum duty cycle for all days between 7am and 10pm; and
  - Running at a reduced duty cycle for periods between 10pm and 7am the following day (or 9am for Sundays or public holidays),
- With noise barriers 2.8 m high built around the BESS and MVPS compound, the predictions indicate compliance with the EPNR assigned noise levels at adjacent lots, should future residential development take place on such lots.

It is noted that the operation of the BESS and MVPS units, running at maximum duty cycle, either after 10pm or before 7am, is highly unlikely as temperatures in the project area would drop by at least 10 degrees Celsius during night-time in the worst-case scenario (winter). This means that maximum duty cycle ventilation of the units during night-time is unreasonable to assume. Thus, a 40%-50% duty cycle has been adopted in this assessment as a reasonable operational assumption.

The noise emitted by the BESS and MVPS units will generally be low. Measures to ensure compliance with noise criteria will be confirmed and included in the final project design. The assessment is based on preliminary equipment selections, and the actual noise mitigation measures will be finalised once the specific products are confirmed. These measures—such as noise barriers, noise reduction kits, or cooling load adjustments—will be implemented as needed, subject to the capabilities of the selected equipment, to ensure that operational noise levels remain consistent with the outcomes presented in the noise assessment. Noise predictions for Scenarios 1A and 2A, with noise barriers in place, show that noise levels at the boundaries of adjacent lots are within acceptable limits for both day and night, meeting EPNR requirements. Scenario 1, without barriers, indicates a compliance zone for night-time noise, particularly around highly sensitive buildings like residential dwellings.

6.3. BUSHFIRE ATTACK LEVEL ASSESSMENT

Bushfire Attack Level Report prepared by Western Environmental (Appendix E)

Western Environmental has prepared a Bushfire Attack Level (BAL) Assessment Report for the proposal. The proposed Battery Energy Storage System (BESS) is strategically sited to limit radiant heat exposure to renewable energy assets during a bushfire, ensuring it does not exceed 10 kW/m2 at a flame temperature of 1090 K. This placement also aims to prevent fires originating from the infrastructure from spreading to nearby vegetation. This approach is recognised as best practice in Western Australia. A comprehensive assessment against the relevant Guidelines and Country Fire Authority (CFA) Guidelines will be conducted if required by the Shire as a condition of development approval. The facility is capable of meeting these requirements and is recommended for approval, provided a Bushfire Management Plan (BMP) is prepared to ensure the design minimises risks to operators, firefighters, and the community.

The BESS is also supported by a BESS Fire Safety FAQ, provided by ACEnergy, found in Appendix H. The proposed battery system prioritises safety using stable lithium-iron phosphate (LFP) chemistry and rigorous fire safety testing. Key features include a containerised design, in-built fire suppression, and a comprehensive Battery Management System (BMS) that continuously monitors and addresses potential issues early. Measures to mitigate fire risks within the BESS container include adequate separation distances, an Asset Protection Zone, dedicated water supply, emergency access, and a Bushfire and Fire Management Plan. The system meets international safety standards and ensures minimal air quality impacts in the event of a fire.

6.4. LANDSCAPE CONCEPT PLAN

Landscape Plan prepared by Ground Control (Appendix F)

Ground Control prepared a Landscape Concept Plan for the Merredin Distribution BESS which provides one row of screening via landscape to each of the north, south and east sides of the proposed BESS. Each row is proposed to be 2m wide and includes the 200 plants total, including:

- 28 small trees
- 86 large shrubs
- 58 medium shrubs
- 28 small shrubs

The row of planning is proposed to be a minimum of 10 meters from the BESS as per DFES requirements. Small trees will occasionally achieve a maximum height of 5-6m and shrubs to generally reach 3-3.5m, which will effectively screen the BESS.

6.5. STORMWATER DRAINAGE STRATEGY

Stormwater Drainage Strategy prepared by Premise (Appendix G)

Premise prepared a Stormwater Drainage Strategy and associated calculations/drawings to support the proposed BESS. The drainage calculations demonstrate the robustness of the drainage system. Premise is confident that this strategy will effectively manage flood risk while maintaining pre-development flow paths.

It is advisable for the Contractor to ensure that, upon topsoil stripping, the finished surface level for the BESS Infrastructure Pad is 150mm above the existing surface level.

For detailed calculations and plans, please refer to the diagrams and strategy sections.

7. CONCLUSION

The proposed Merredin BESS is an important renewable energy project which will contribute to the State’s renewable energy future. The site has been selected based on detailed investigations and the site’s current land use. The proposal wholly aligns with local, State and objectives and vision.

The proposal has been considered at a detailed level and this report demonstrates that it complies with all relevant technical and planning legislation and frameworks

It is respectfully requested that this application be approved, subject to fair and reasonable conditions.

8. DISCLAIMER

This report is dated 19 May 2025 and incorporates information and events up to that date only and excludes any information arising, or event occurring, after that date which may affect the validity of **Urbis Ltd** opinion in this report. Urbis prepared this report on the instructions, and for the benefit only, of ACEnergy for the purpose of **Development Application Report** and not for any other purpose or use. To the extent permitted by applicable law, Urbis expressly disclaims all liability, whether direct or indirect, to the Instructing Party which relies or purports to rely on this report for any purpose other than the Purpose, and to any other person which relies or purports to rely on this report for any purpose whatsoever (including the Purpose).

In preparing this report, Urbis was required to make judgements which may be affected by unforeseen future events, the likelihood and effects of which are not capable of precise assessment.

All surveys, forecasts, projections and recommendations contained in or associated with this report are made in good faith and on the basis of information supplied to Urbis at the date of this report, and upon which Urbis relied. Achievement of the projections and budgets set out in this report will depend, among other things, on the actions of others over which Urbis has no control.

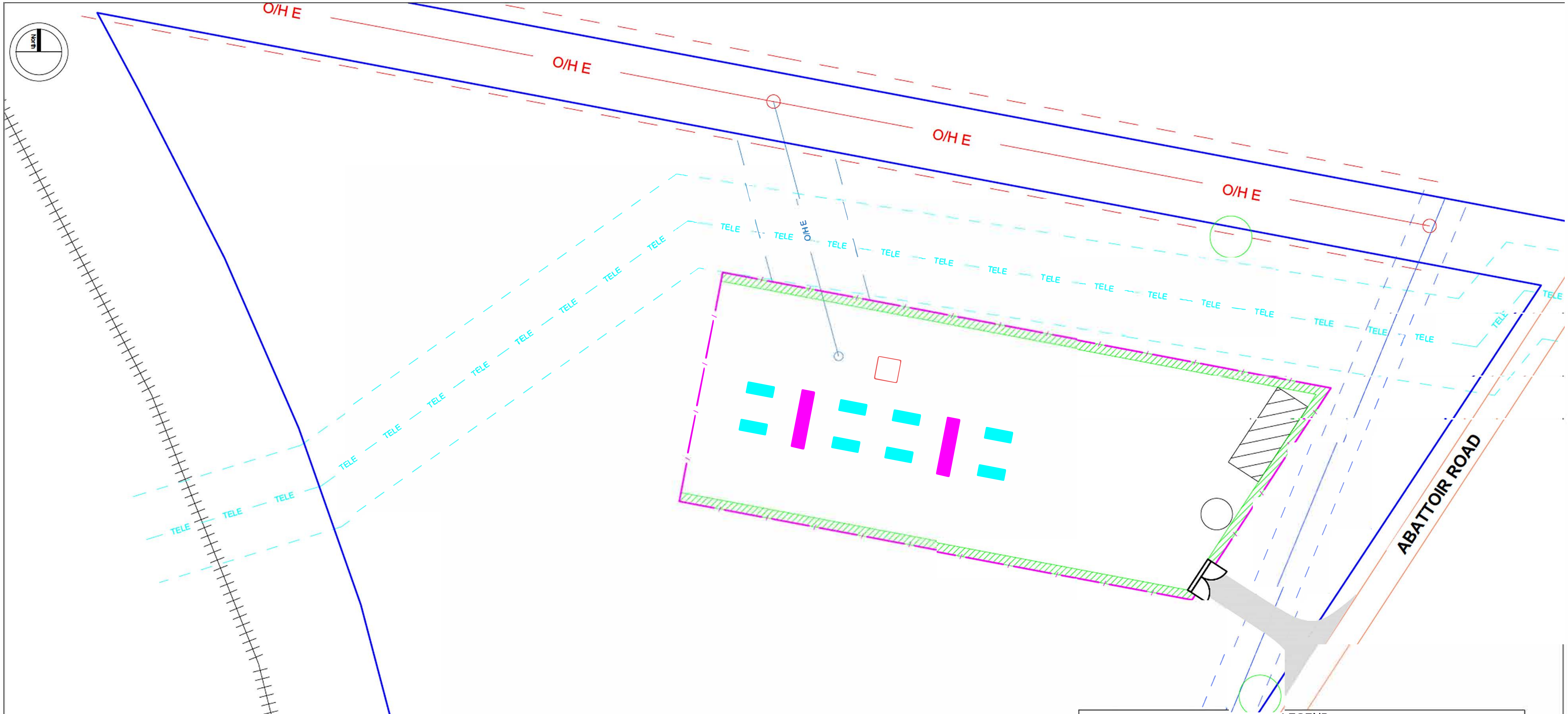
In preparing this report, Urbis may rely on or refer to documents in a language other than English, which Urbis may arrange to be translated. Urbis is not responsible for the accuracy or completeness of such translations and disclaims any liability for any statement or opinion made in this report being inaccurate or incomplete arising from such translations.

Whilst Urbis has made all reasonable inquiries it believes necessary in preparing this report, it is not responsible for determining the completeness or accuracy of information provided to it. Urbis (including its officers and personnel) is not liable for any errors or omissions, including in information provided by the Instructing Party or another person or upon which Urbis relies, provided that such errors or omissions are not made by Urbis recklessly or in bad faith.

This report has been prepared with due care and diligence by Urbis and the statements and opinions given by Urbis in this report are given in good faith and in the reasonable belief that they are correct and not misleading, subject to the limitations above.

APPENDIX A CERTIFICATE OF TITLE

APPENDIX B DEVELOPMENT PLANS



NOTE:

- DETAIL INFORMATION FOR SITE PLAN DIMENSIONS REFER TO "G-1.2_023179"
- DETAIL INFORMATION FOR LOCALITY REFER TO "G-2.1_023179" TO "G-2.2_023179"
- DETAIL INFORMATION FOR CENTRAL INVERTER REFER TO "G-3.0_023179"
- DETAIL INFORMATION FOR ENERGY STORAGE CONTAINER REFER TO "G-4.0_023179"
- DETAIL INFORMATION FOR SECURITY FENCE AND LANDSCAPED AREA REFER TO "G-5.0_023179"

LEGEND

	SITE ACCESS GATE		ROAD/HIGHWAY/RAILWAY
	BATTERY		NEW ACCESS TRACK
	MVPS		EXISTING ACCESS TRACK
	HV SWITCHGEAR		BESS SECURITY FENCE 1.8 METER HIGH CHAIN MESH SECURITY FENCE GALVANISED STEEL
	EXISTING O/H LINE		TITLE BOUNDARY
	EXISTING LINE EASEMENT		NEIGHBOUR BOUNDARY
	EXISTING HV POLE/TOWER		ONE ROW LANDSCAPE
	NEWO/H LINE		RAILWAY TRACK
	NEW LINE EASEMENT		RESIDENTIAL PROPERTY
	NEW HV POLE/TOWER		COMMERCIAL/ INDUSTRIAL PREMISES
	EXISTING GAS PIPELINE EASEMENT		NEXTGEN U/G CABLE WITH 10m EACH SIDE EASEMENT
	EXISTING TREES		PROPOSED WATER TANK
	TREE TO BE REMOVED (MARKED)		UG WATER PIPELINE WITH 5m EACH SIDE EASEMENT
	AAPT/ POWERTEL DUCT		
	CAR PARK AREA		

REVISIONS

REV	STATUS	DESCRIPTION	DATE	D.B.	C.B.
A	FA	INITIAL DESIGN	01/04/2025	FA	AJ

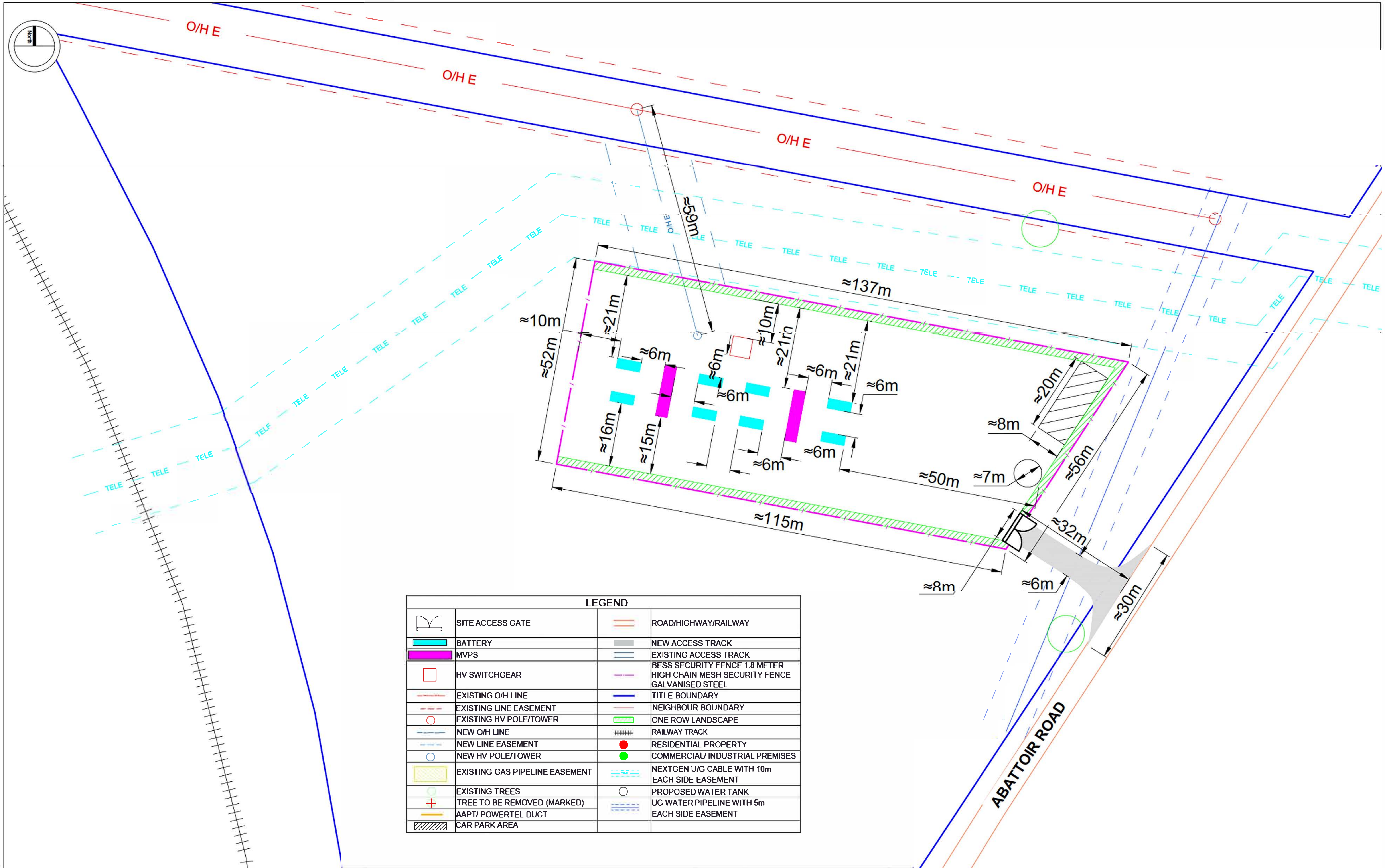
PROJECT DETAILS: MERREDIN DISTRIBUTION BESS
ABATTOIR ROAD, MERREDIN, WA 6415
-31.4325736703, 118.25178645

CLIENT DETAILS: ACENERGY PTY LTD

DRAWING TITLE: SITE PLAN 1 OF 2

DRAWING NR: G-1.1_023179		
DRAWN BY: FA	APPROVED BY: AJ	PROJECT MGR: LZ
SCALE: AS INDICATED	ISSUE: FOR APPROVAL	ISSUE DATE: 01/04/2025
SHEET SIZE: A3	PROJECT NO: 023179	REV. NO: A

ACENERGY



LEGEND

	SITE ACCESS GATE		ROAD/HIGHWAY/RAILWAY
	BATTERY		NEW ACCESS TRACK
	MVPS		EXISTING ACCESS TRACK
	HV SWITCHGEAR		BESS SECURITY FENCE 1.8 METER HIGH CHAIN MESH SECURITY FENCE GALVANISED STEEL
	EXISTING O/H LINE		TITLE BOUNDARY
	EXISTING LINE EASEMENT		NEIGHBOUR BOUNDARY
	EXISTING HV POLE/TOWER		ONE ROW LANDSCAPE
	NEW O/H LINE		RAILWAY TRACK
	NEW LINE EASEMENT		RESIDENTIAL PROPERTY
	NEW HV POLE/TOWER		COMMERCIAL/ INDUSTRIAL PREMISES
	EXISTING GAS PIPELINE EASEMENT		NEXTGEN U/G CABLE WITH 10m EACH SIDE EASEMENT
	EXISTING TREES		PROPOSED WATER TANK
	TREE TO BE REMOVED (MARKED)		UG WATER PIPELINE WITH 5m EACH SIDE EASEMENT
	AAPT/ POWERTEL DUCT		
	CAR PARK AREA		

REVISIONS

REV	STATUS	DESCRIPTION	DATE	D.B.	C.B.
A	FA	INITIAL DESIGN	04/04/2025	FA	AJ

PROJECT DETAILS: MERREDIN DISTRIBUTION BESS
ABATTOIR ROAD, MERREDIN, WA 6415
-31.4925736703, 118.25178645

CLIENT DETAILS: ACENERGY PTY LTD

DRAWING TITLE: SITE PLAN 2 OF 2

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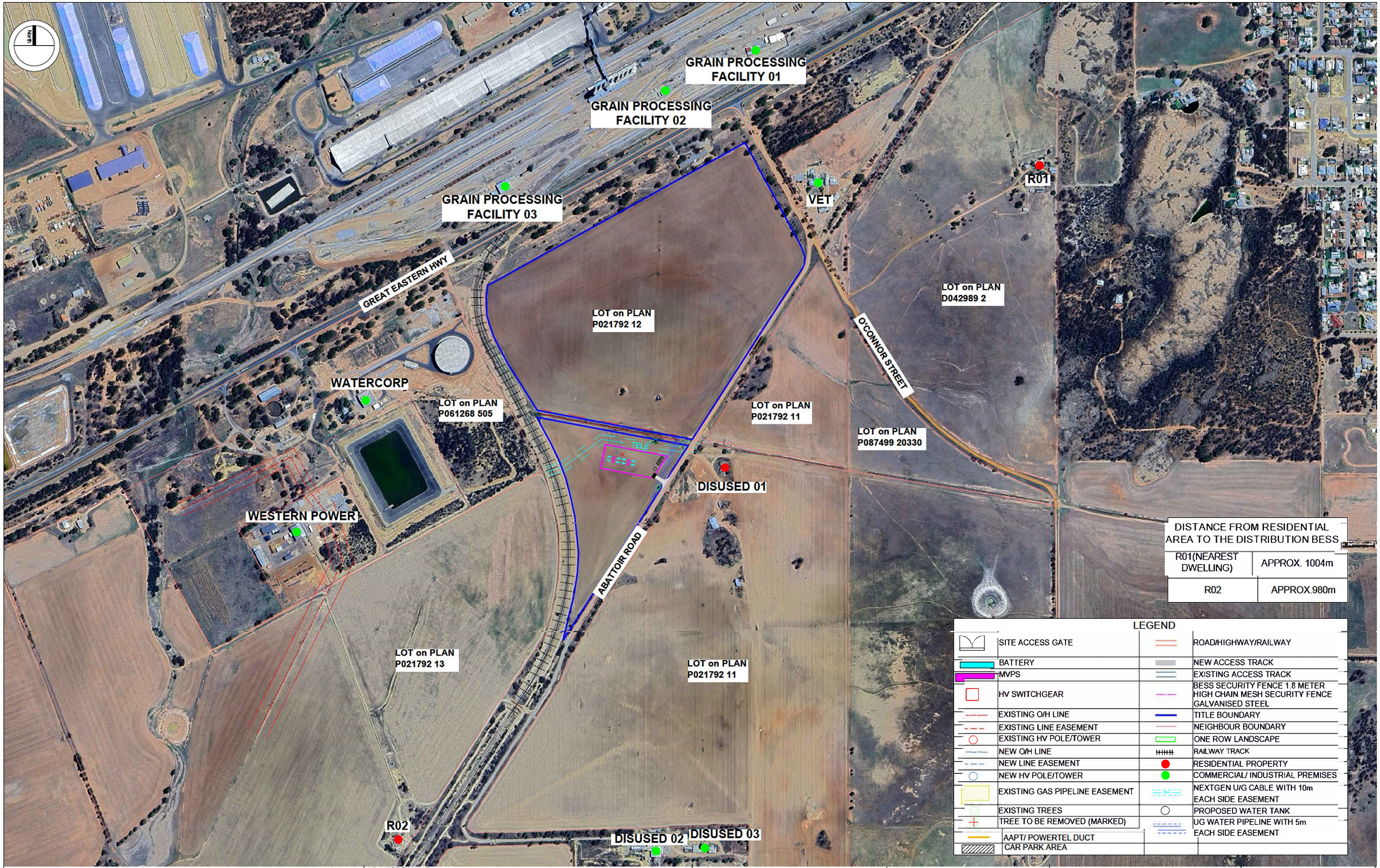

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A	FA	INITIAL DESIGN	04/04/2025	FA	AJ

PROJECT DETAILS: MERREDIN DISTRIBUTION BESS
ABATTOIR ROAD, MERREDIN, WA 6415

CLIENT DETAILS: ACENERGY PTY LTD

DRAWING TITLE: LOCALITY DIAGRAM 1 OF 2

DRAWING NR: G-2.1_023179

DRAWN BY :	APPROVED BY :	PROJECT MGR :
FA	AJ	LZ
SCALE : AS INDICATED	ISSUE : FOR APPROVAL	ISSUE DATE : 04/04/2025
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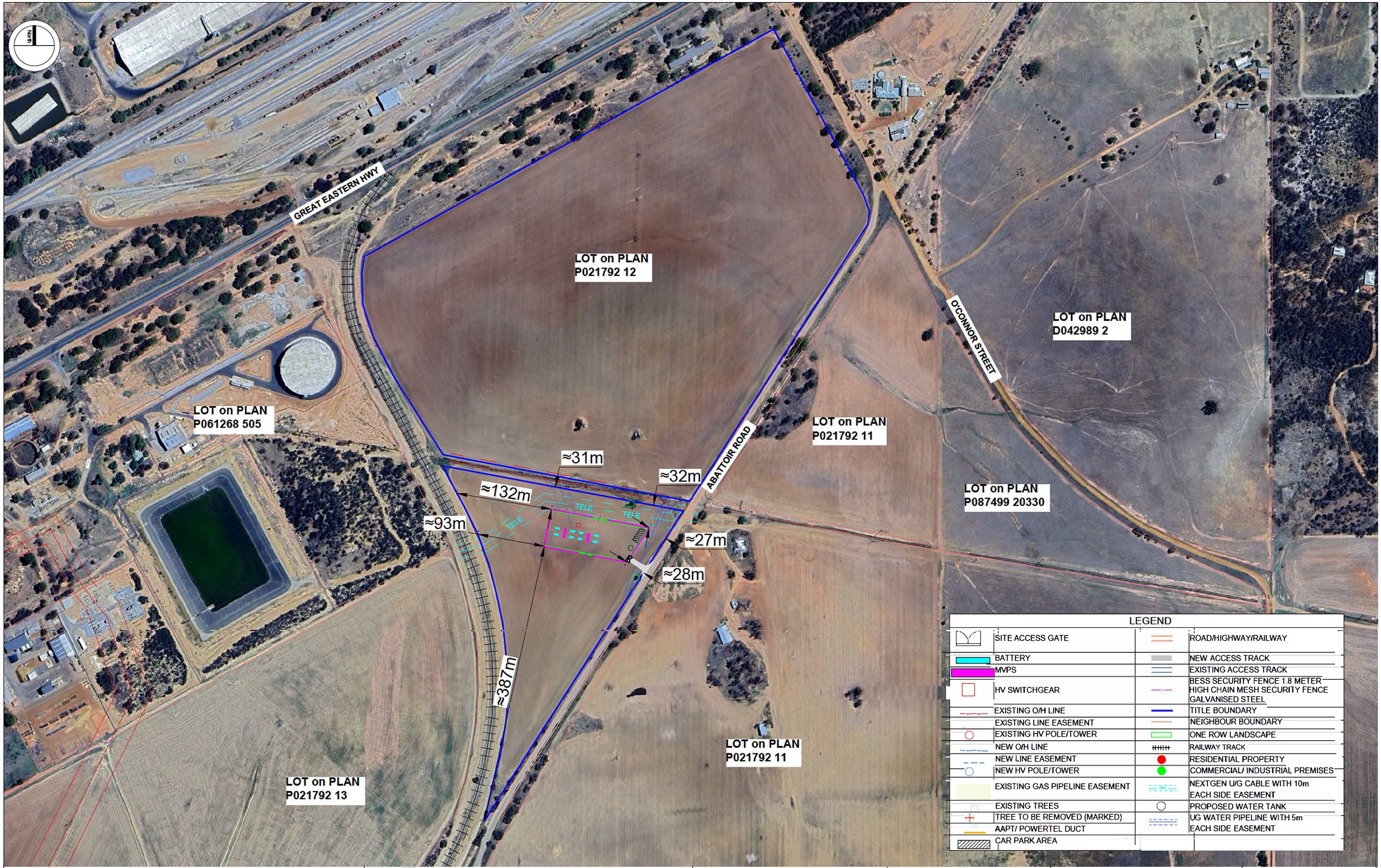

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A	FA	INITIAL DESIGN	04/04/2025	FA	AJ

PROJECT DETAILS: MERREDIN DISTRIBUTION BESS
ABATTOIR ROAD, MERREDIN, WA 6415
-31.4325736703, 118.25178645

CLIENT DETAILS: ACENERGY PTY LTD

DRAWING TITLE: LOCALITY DIAGRAM 2 OF 2

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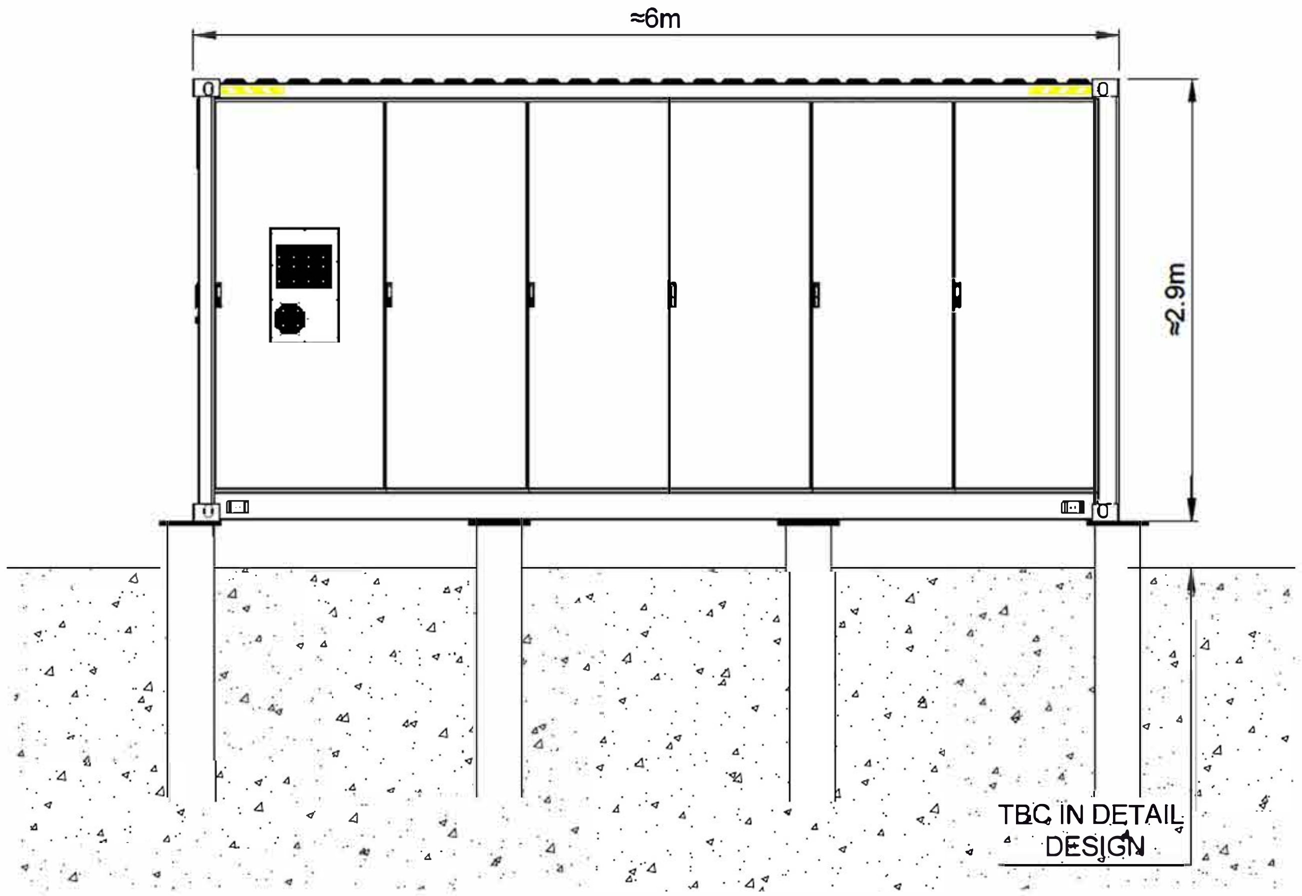
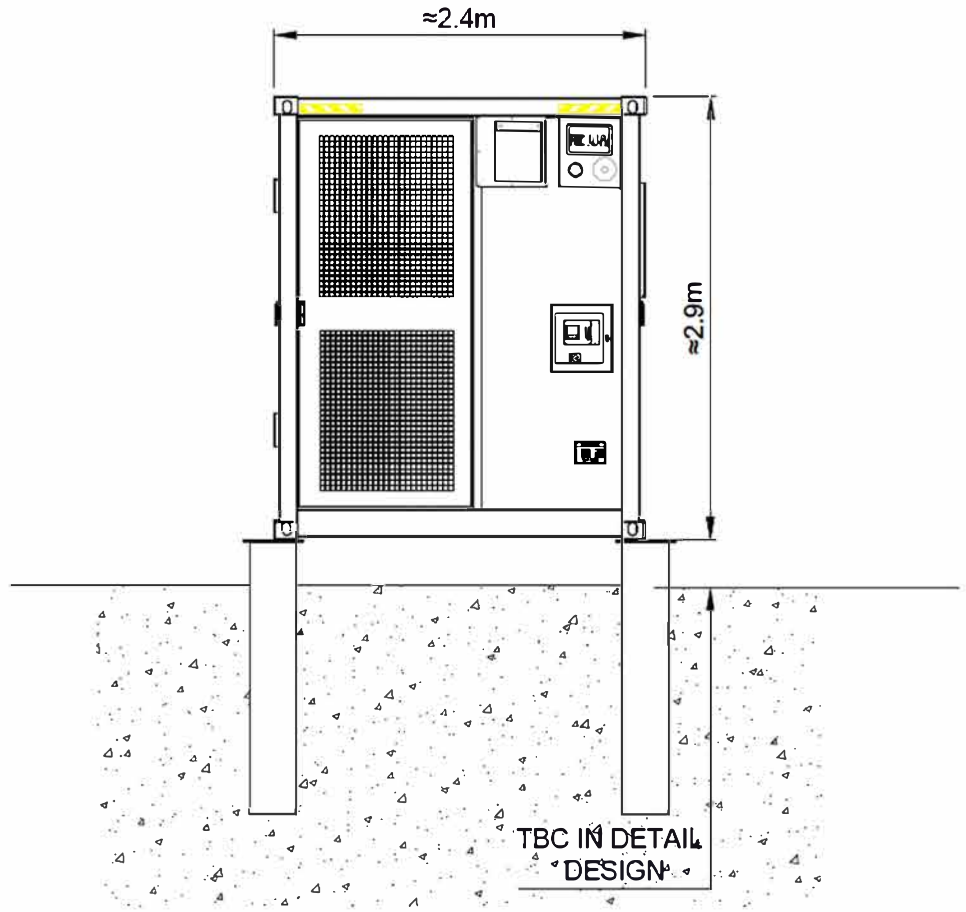
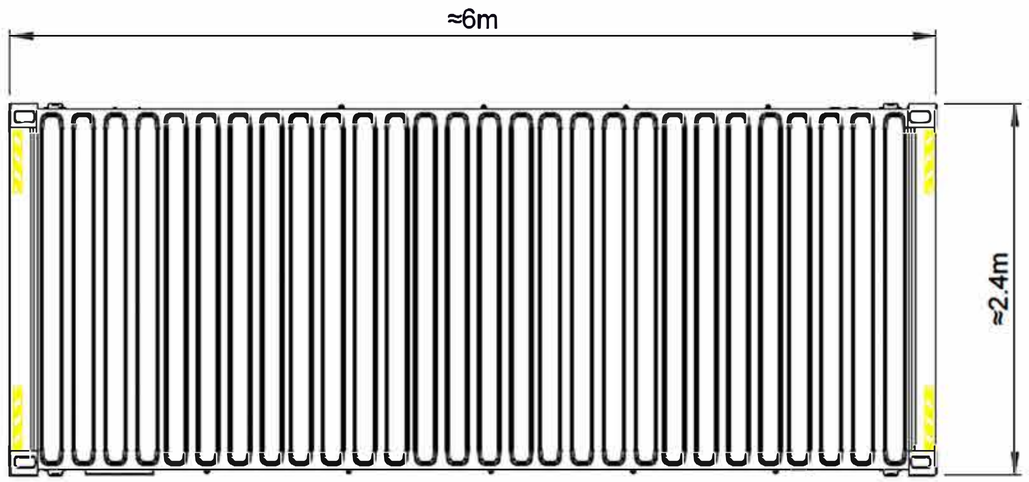
SHEET SIZE: A3	PROJECT NO: 023179	REV. NO: A



FRONT VIEW



SIDE VIEW



TOP VIEW

TYPICAL ENERGY STORAGE CONTAINER

REVISIONS					
REV	STATUS	DESCRIPTION	DATE	D.B.	C.B.
A	FA	INITIAL ISSUE	01/04/2025	FA	AJ

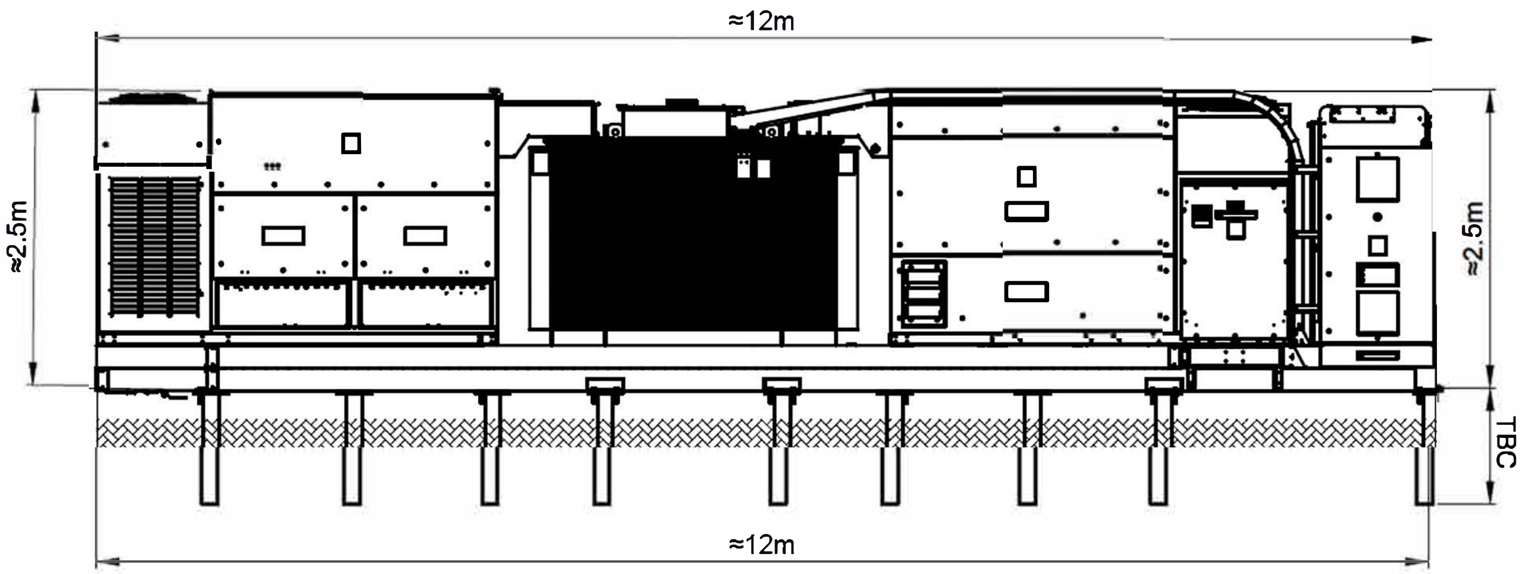
PROJECT DETAILS: MERREDIN DISTRIBUTION BESS
ABATTOIR ROAD, MERREDIN, WA 6415
-31.4925736708, 118.25178645

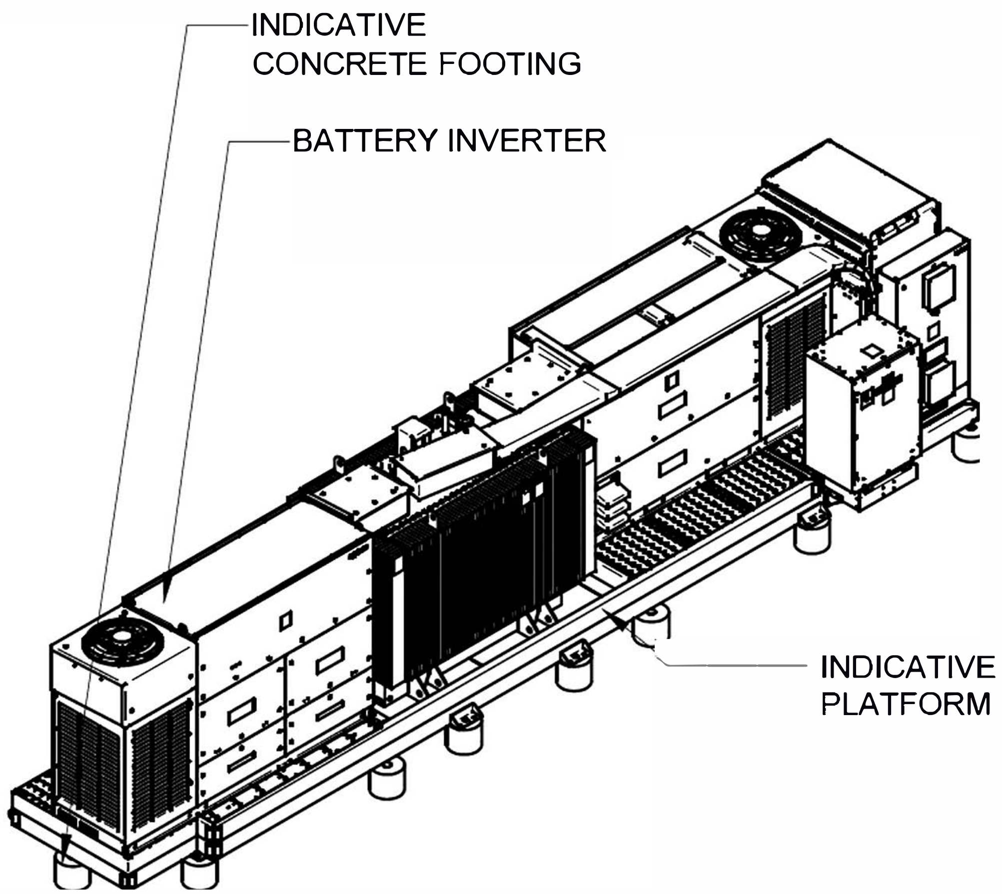
CLIENT DETAILS: ACENERGY PTY LTD

DRAWING TITLE: ENERGY STORAGE CONTAINER ELEVATIONS

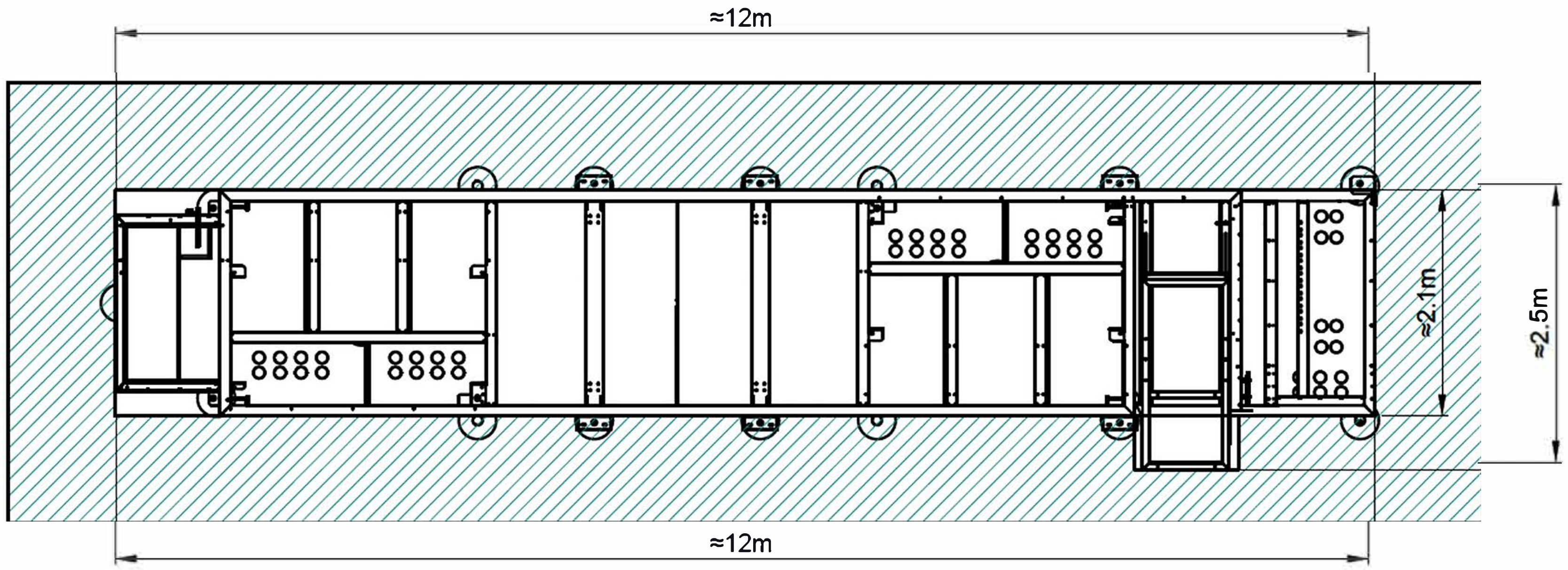
DRAWING NR: G-3.0_023147		
DRAWN BY: FA	APPROVED BY: AJ	PROJECT MGR: LZ
SCALE: AS INDICATED	ISSUE: FOR APPROVAL	ISSUE DATE: 01/04/2025
SHEET SIZE: A3	PROJECT NO: 023147	REV. NO: A

MVPS FRONT VIEW

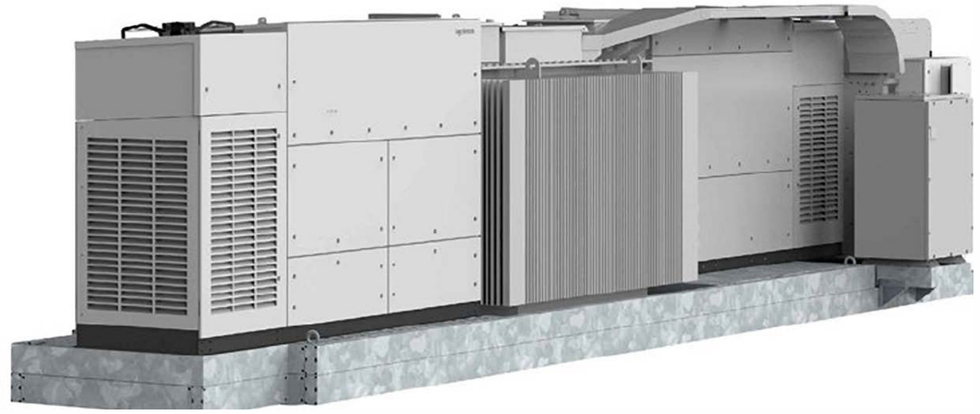




MVPS TOP VIEW



TYPICAL MVPS



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A	FA	INITIAL ISSUE	01/04/25	FA	AJ

PROJECT DETAILS: MERREDIN DISTRIBUTION BESS
ABATTOIR ROAD, MERREDIN, WA 6415

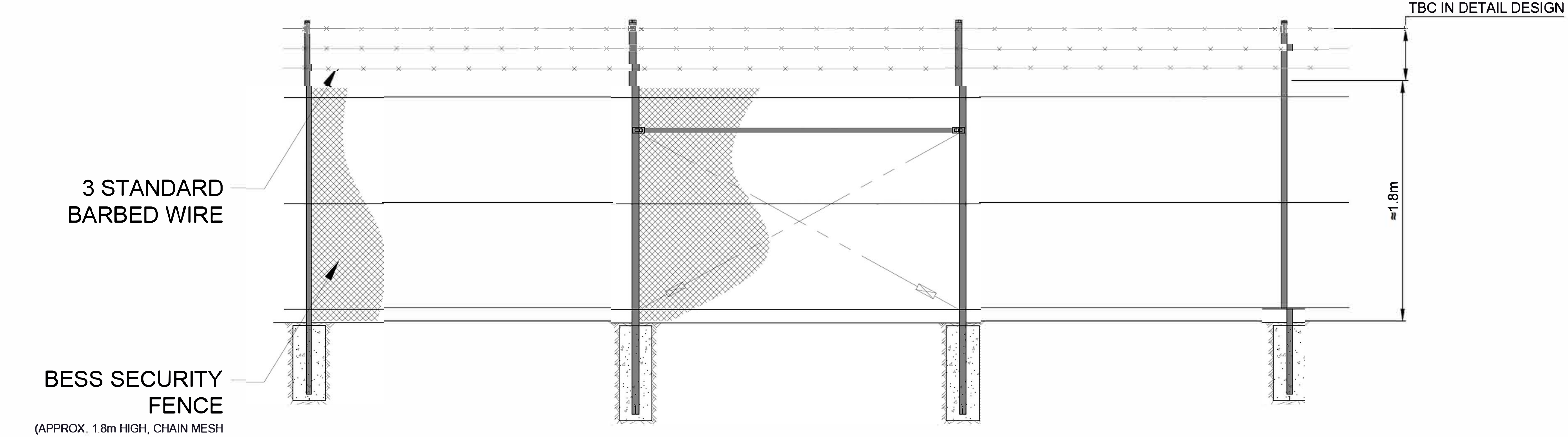
CLIENT DETAILS: ACENERGY PTY LTD

DRAWING TITLE: MVPS ELEVATIONS

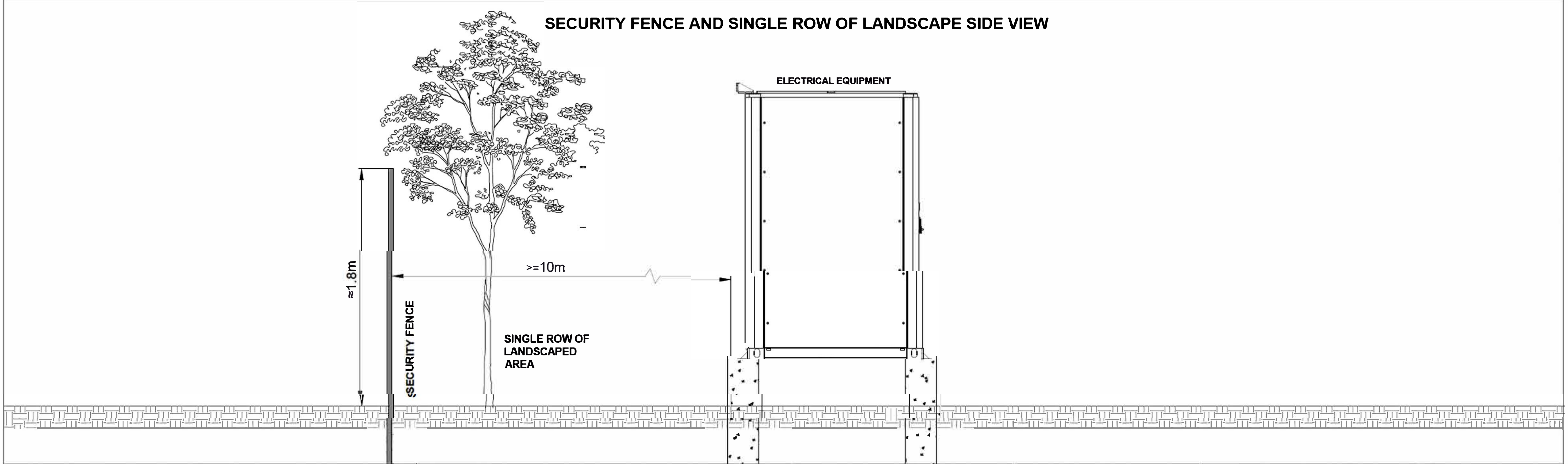
DRAWING NR: G-4.0_023179		
DRAWN BY: FA	APPROVED BY: AJ	PROJECT MGR: LZ
SCALE: NOT SCALE	ISSUE: FOR APPROVAL	ISSUE DATE: 01/04/2025
SHEET SIZE: A3	PROJECT NO: 023179	REV. NO: A

ACENERGY

SECURITY FENCE FRONT VIEW



SECURITY FENCE AND SINGLE ROW OF LANDSCAPE SIDE VIEW



REVISIONS

REV	STATUS	DESCRIPTION	DATE	D.B.	C.B.
A	FA	INITIAL ISSUE	04/04/25	FA	AJ

PROJECT DETAILS: MERREDIN DISTRIBUTION BESS
ABATTOIR ROAD, MERREDIN, WA,6415
-31.4925736703, 118.25178645

CLIENT DETAILS: ACENERGY PTY LTD

DRAWING TITLE: SECURITY FENCE & LANDSCAPE ELEVATIONS

DRAWING NR: G-5.0_023147		
DRAWN BY: FA	APPROVED BY: AJ	PROJECT MGR: LZ
SCALE: AS INDICATED	ISSUE: FOR APPROVAL	ISSUE DATE: 04/04/2025
SHEET SIZE: A3	PROJECT NO: 023147	REV. NO: A

APPENDIX C TRAFFIC IMPACT STATEMENT

1 May 2025

Jane Bai
Senior Project Development Engineer
ACENERGY Pty Ltd
Level 3, 689 Burke Road
Camberwell, VIC 3124
c/o [redacted]

Re: Battery Energy Storage, Merredin – Transport Impact Statement

I am pleased to respond to your request to review the traffic impact and access arrangements for the proposed development at Abattoir Road in Merredin (the 'Site') - see Figure 1.

This assessment has been conducted in accordance with the Department of Planning, Lands and Heritage (DPLH) and Western Australian Planning Commission (WAPC) *Transport Impact Assessment Guidelines for Developments: Volume* 4 - Individual *Developments* (2016). The Guidelines promote a three-level assessment process, where the required level of assessment is dependent on the likely level of impact. The traffic generated by the Site has been determined to be less than 10 vehicle trips in the peak hour, which equates to a low impact. While no assessment is typically required where the impact is assessed as low, an abridged 'Transport Impact Statement' in accordance with Volume 4 Part B of the Guidelines has been prepared to confirm the proposals are safe and functional to support the Development Application (DA).

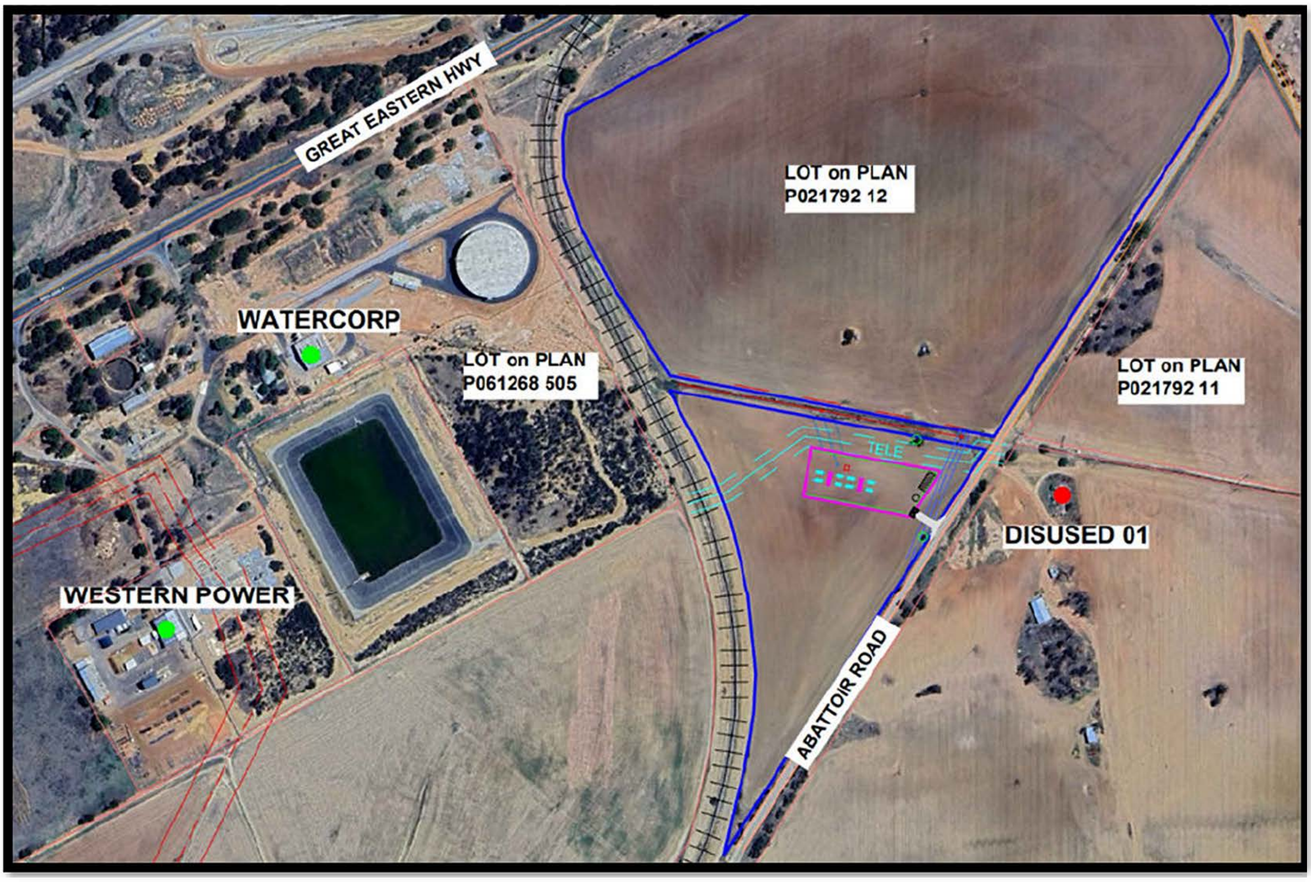
Site Overview

The property consists of an industrial battery energy storage facility at Lot 12 on Plan 21792 on Abattoir Road in Merredin, Western Australia.

These proposed buildings sit on a small parcel of land of approximately 6,500 m² on a 32.33 ha site.

An aerial image of the Site is shown in Figure 1. Additional site plans are given in Appendix A and B.

Figure 1 Existing subject site



Source: ACEnergy

Existing Road Network

The existing road network within the vicinity of the site is shown in Figure 2. This figure also illustrates the road hierarchy and history of road crashes in the surrounding area.

Table 1 summarises the characteristics of the adjacent road network.

Abattoir Road is a formed but unsealed road that runs 1.74 km south from O'Connor Street in Merredin. There is an unformed track at its end. It provides access to several other properties / farm paddocks in the vicinity of the Site.

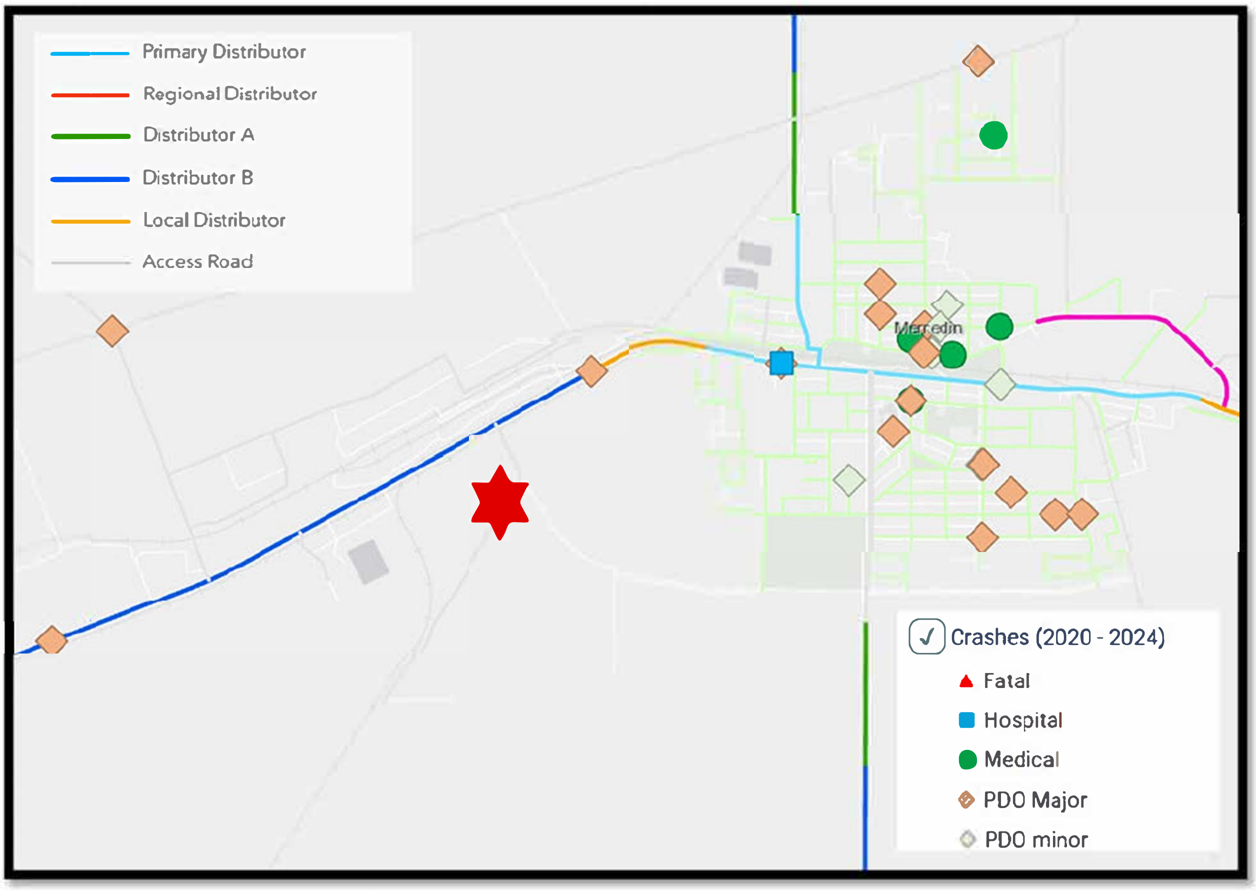
O'Connor Street is an unsealed road that provides an existing connection between Great Eastern Highway and Abattoir Road and serves as access to several farm paddocks.

Table 1 - Road network characteristics

Road Name	Road Hierarchy	No. of Lanes (each way)	Posted Speed (km/h)
Abattoir Road	Access Road	1- lane unsealed	50
O'Connor Street	Access Road	1- lane unsealed	50

Source: MRWA Road Information Mapping System (April 2025)

Figure 2 Existing subject site



Source: Main Roads Road Information Mapping System

Existing Traffic Volumes

Existing traffic volume data in the area surrounding the Site is limited. Traffic volumes on O'Connor Street and Abattoir Road are estimated to be less than 50 vehicles per day and these roads are therefore operating well within their environmental traffic capacity.

The Development Proposal

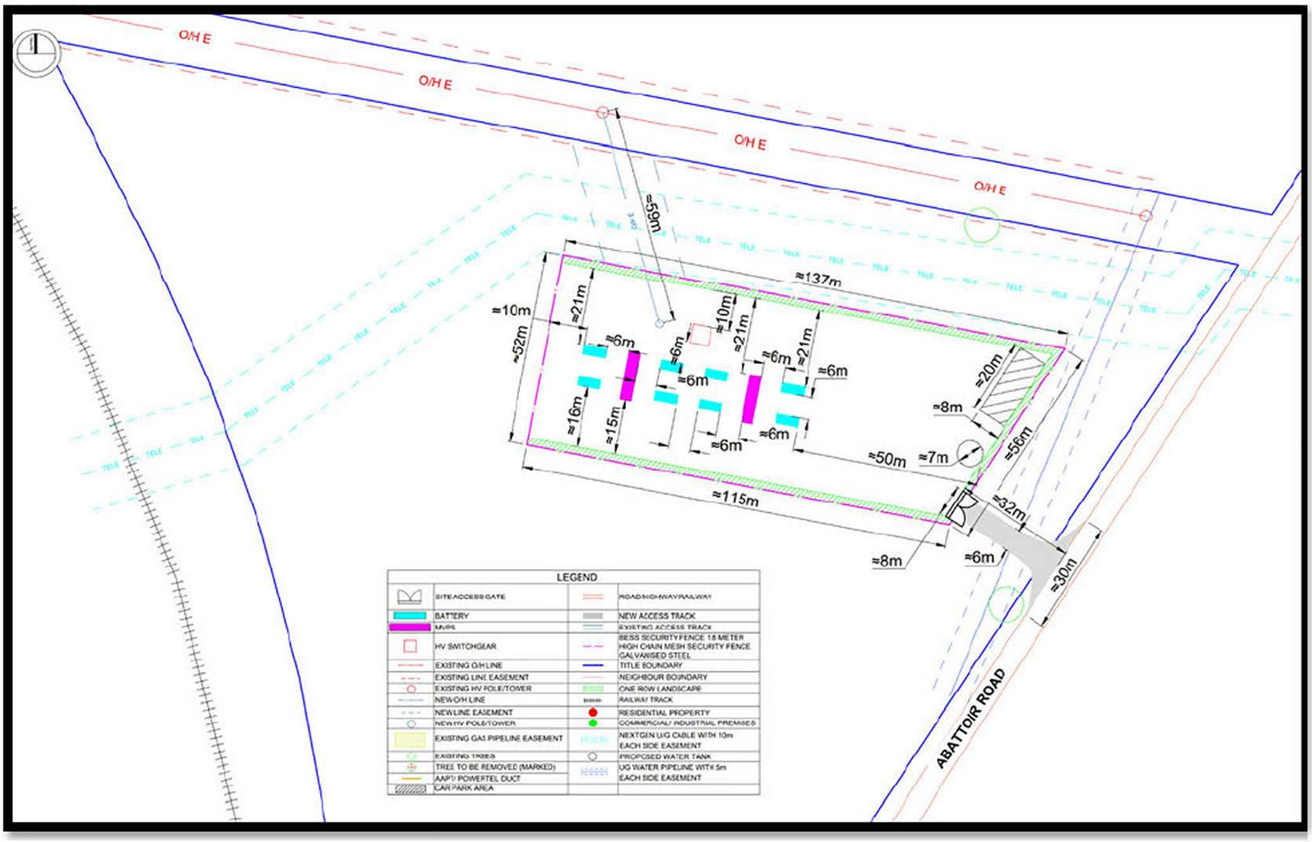
The proposed development by ACEnergy involves the creation of a battery energy storage facility – a BESS plant. This plant requires 8 x 5 MWh 20' battery containers plus inverters / transformers, switchroom, HV kiosk and pole plus a water tank.

The busiest period for the development is forecast to be during construction. Afterwards, during the operation phase (involving a 27 + 27 yr lease), it will be run as an unmanned site, remotely monitored, that is visited only periodically, i.e. two light vehicles per fortnight for maintenance and service call outs subject to fluctuations driven by specific operational demands.

Proposed Site Access Arrangements

The site layout has been designed to optimise access and safety. Figure 3 shows the proposed access point to the development from Abattoir Road. This access includes a driveway primarily for access by cars, vans and small utilities for site maintenance purposes during normal operations.

Figure 3 Proposed site layout



Source: ACEnergy

Restricted Access Vehicle Movement

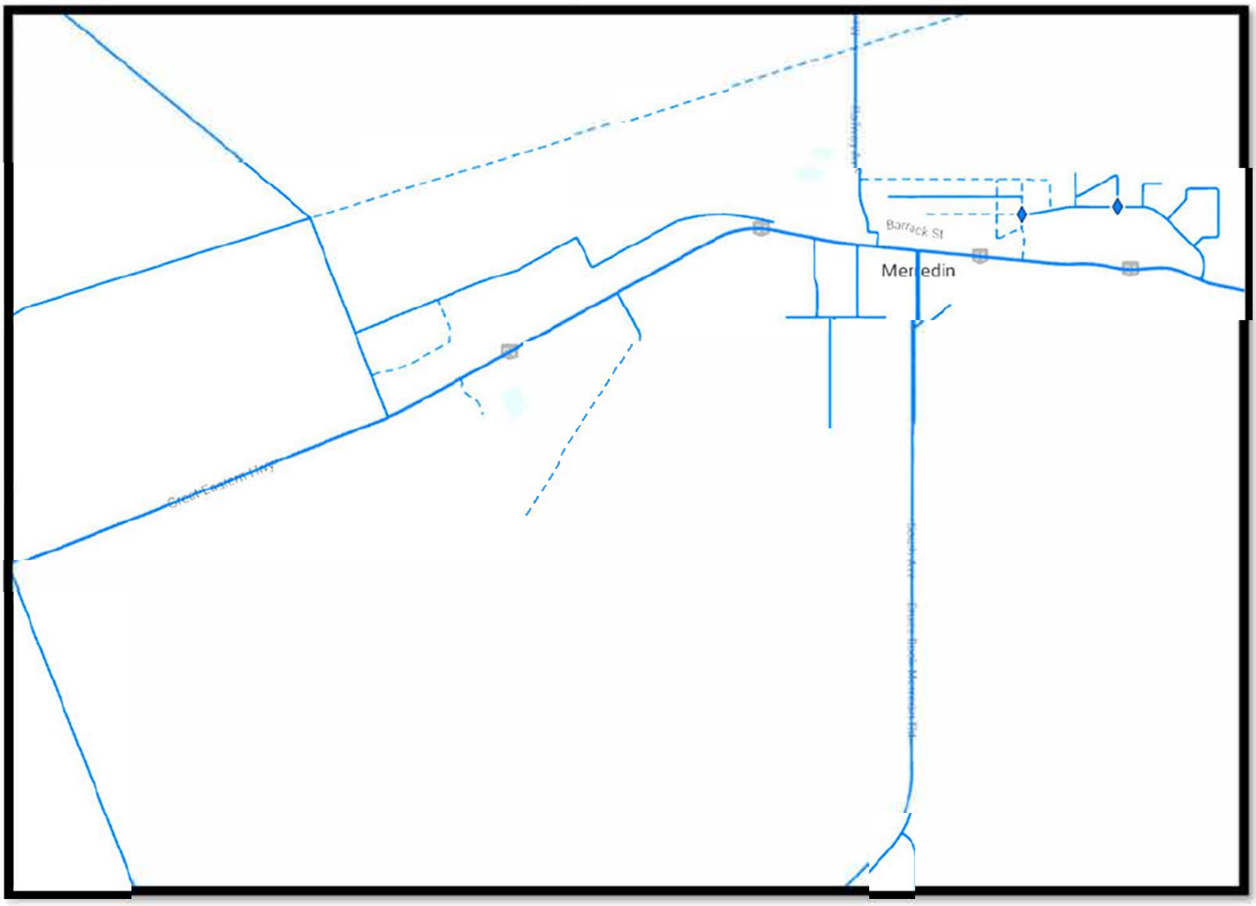
Figure 4 illustrates the existing approved Restricted Vehicle Access (RAV) network in the vicinity of the Site. The current approved RAV access network allows B-Doubles (RAV 4).

Table 4 - Maximum heavy vehicles allowed N2/N4

Maximum Truck Allowed	Dimensions
27.5 m B/A–Double (N2/4 Drive)	• Max width: 2.55 m • Max length: 27.50 m • Mass: 88.5 t

The proposed development has been designed to be accessed during construction by standard B-Double trucks up to a maximum length of 27.5 metres. The loaded container mass will be in the order of 45 t plus the truck tare weight. These weights and dimensions fall within the maximum allowed limits of the road network. Swept path analyses have been conducted, verifying that a N2/4 B-Double truck will be able to manoeuvre into and out of Abattoir Road to access the Site (see Appendix C).

Figure 4 Main Roads Approved RAV Network (Suitable for 27.5m N2/4 B-Doubles and A-Doubles)



Source: Main Roads HVS Network Map (April 2025)

Crossover Design

A new crossover is proposed on the eastern side of the site on Abattoir Road (see Figure 3) to enable the forward entry, manoeuvring and exit for light vehicles. As a minimum this crossover shall be designed in accordance with the MRWA rural driveway requirements for light vehicles – one way (see Appendix D).

Trucks will only require access to the Site during construction. The driveway shall be installed prior to battery component delivery and installation.

Crash Risk Assessment

A review of the MRWA Reporting Centre was conducted to obtain traffic crash data for the immediate area of the Site, covering the period from 1 January 2020 to 31 December 2024. The search (see Figure 2) revealed no crashes on Abattoir Road or O'Connor Street during the specified timeframe.

Both Abattoir Road and O'Connor Street are formed unsealed roads with clear sight lines and low traffic volumes.

A sightline assessment of the Site and proposed access points was carried out, confirming that visibility from both directions meets the required minimum standards for safe ingress and egress, with no identified issues.

Operational Traffic

ACEnergy provided operational data derived from comparable facilities they currently manage. During operation the proposed development is projected to generate an average of one light vehicle trip per week subject to fluctuations driven by specific operational demands.

Construction Traffic

During construction it is forecast that traffic generated will be as follows:

- Max. No. trucks per hour: 1
- Max. No. light vehicles (cars/vans/utilities) per hour: 6

B-Double trucks will be required to move key BESS plant during construction due to tonnage carrying requirements. In addition, the development will accommodate movements by smaller light vehicles entering and exiting the facility.

The proposed construction work hours are 7 am to 7 pm Monday to Saturday. No construction work will occur on Sundays or Public Holidays.

Traffic Impact to Surrounding Network

During operation the proposed development is projected to generate an average of one light vehicle trip per week, which is considered negligible. It is therefore unlikely to have any material impact on the operation of the surrounding road network.

During construction there will be slightly higher volumes of traffic generated for an isolated period of time. Nonetheless, it is anticipated that less than 10 vehicle movements will occur in any one hour. In line with the *WAPC Transport Impact Assessment Guidelines, Vol. 4 – Individual Developments*, this volume qualifies as a 'low impact' on the surrounding network.

The intersection of Great Eastern Highway and O'Connor Street is expected to handle the additional projected traffic effectively. The WAPC guidelines specify that "any intersection would generally be considered to be materially affected if flows on any leg increase by more than 10% or any individual movement by 20%." Given the comparatively low volume of traffic generated by the development, the forecasted peak traffic increase is expected to fall below these thresholds, resulting in no material impact to the intersection.

In summary, the surrounding road network and access points are appropriately equipped to manage this level of traffic, supporting efficient and safe traffic flow within the area.

Parking Demand and Supply Requirements

There is sufficient space available so that all parking for operational needs can occur on Site.

Safe Vehicle Manoeuvres

Swept paths of vehicle movements were simulated and assessed, and illustrations are shown in Appendix C. In all cases vehicles can safely access and manoeuvre while operating in forward gear.

Pedestrian, Cycling and Public Transport Use

The Site is not well serviced by public transport, pedestrian or cycling facilities. The area is a regional farming area and therefore there are limited facilities available. The Site will have a very low staff and contractor visitation rate, and all will access the site by car/utility post construction.

Conclusions

Based on the findings of our assessment, it is concluded that the proposed design for the Site fully satisfies the requirements for safe vehicular access and parking, and it is forecast to have negligible traffic impact on the surrounding road network.

Trucks are able to safely access the Site during construction, and during the operational phase only two light vehicles will visit the Site on average every fortnight to conduct general maintenance and call outs. Swept path simulations both within the Site and on the adjacent road network illustrate sufficient space for manoeuvrability including stopping and turning.

I trust our professional advice satisfies your requirements. If you have any questions, then please do not hesitate to contact me.

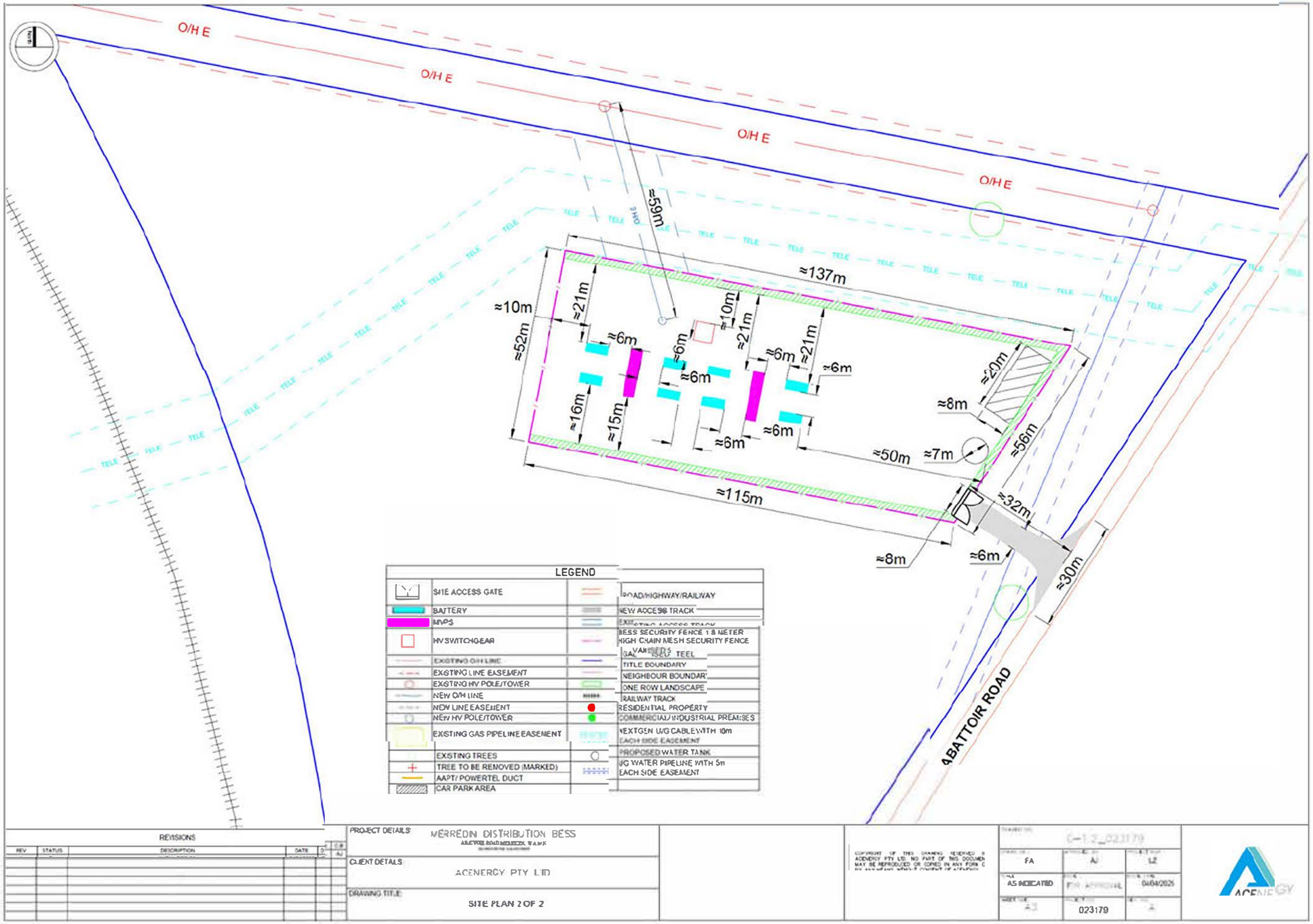
Yours sincerely

[redacted]

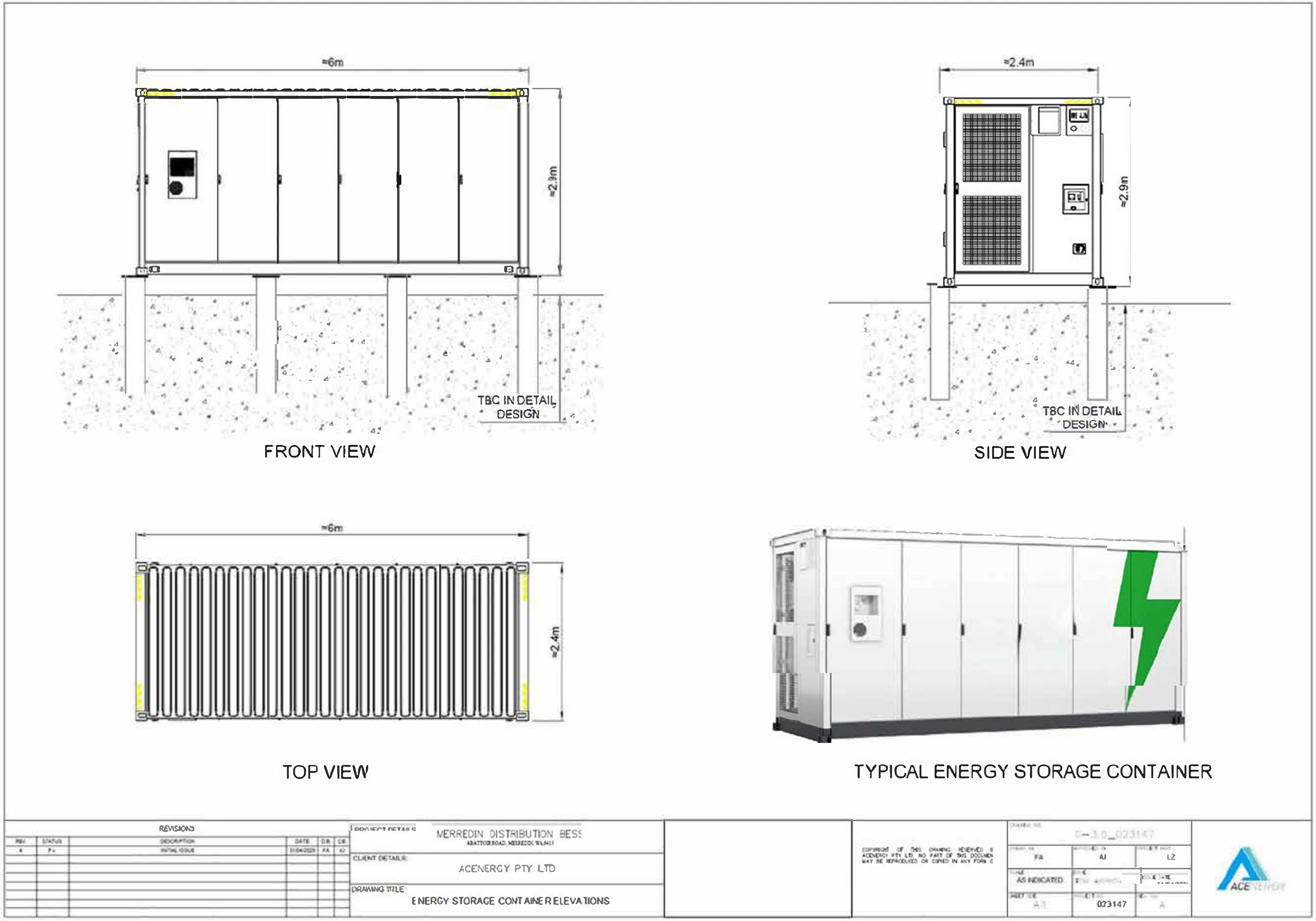
PETER DAMEN
Managing Director
Level 5 Design Pty Ltd

Web: Level5design.com.au
Connect with us on: LinkedIn
Inspiring Innovation in Transport

Appendix A: Proposed Site Layout

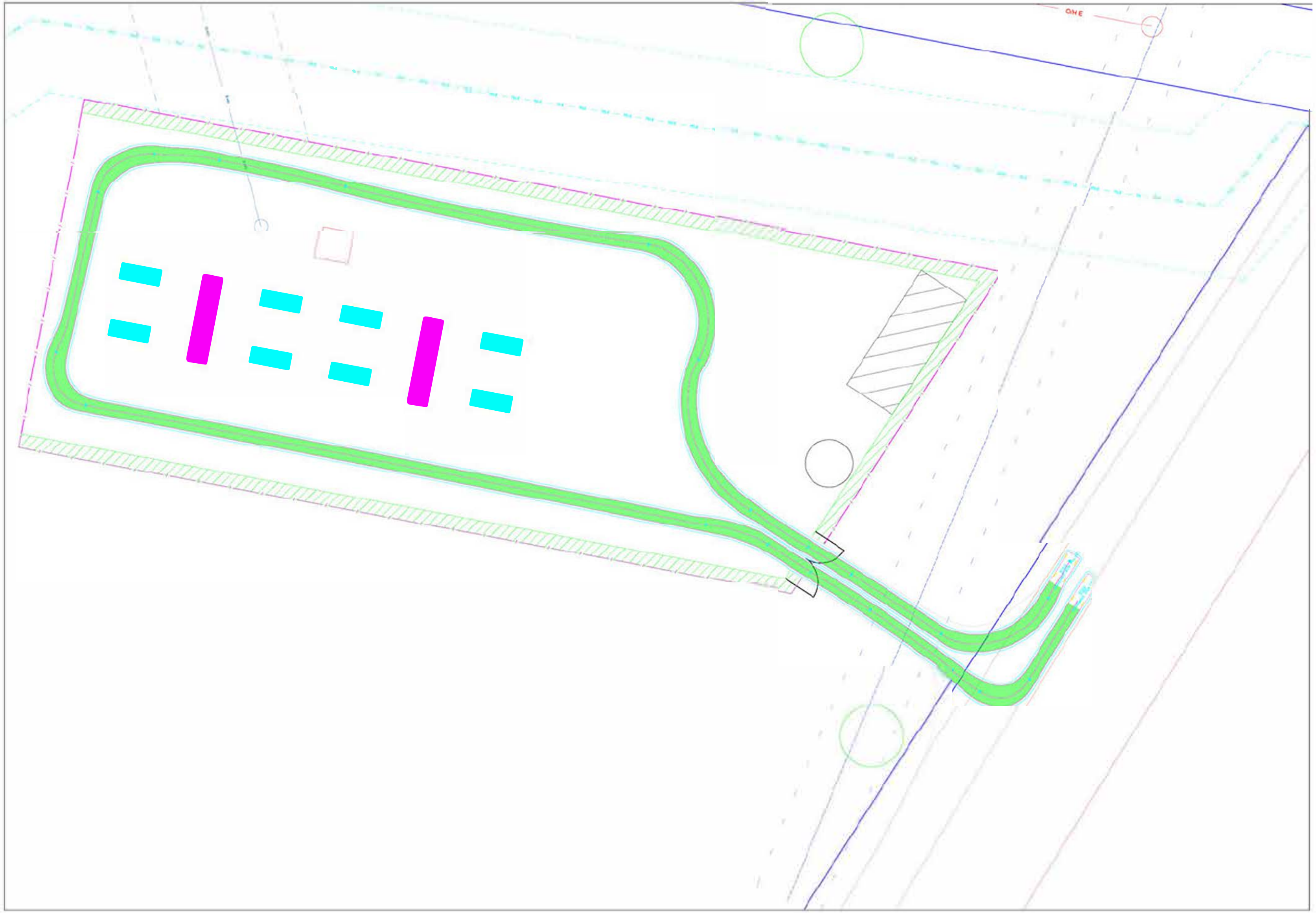


Appendix B: Typical Site Elevations

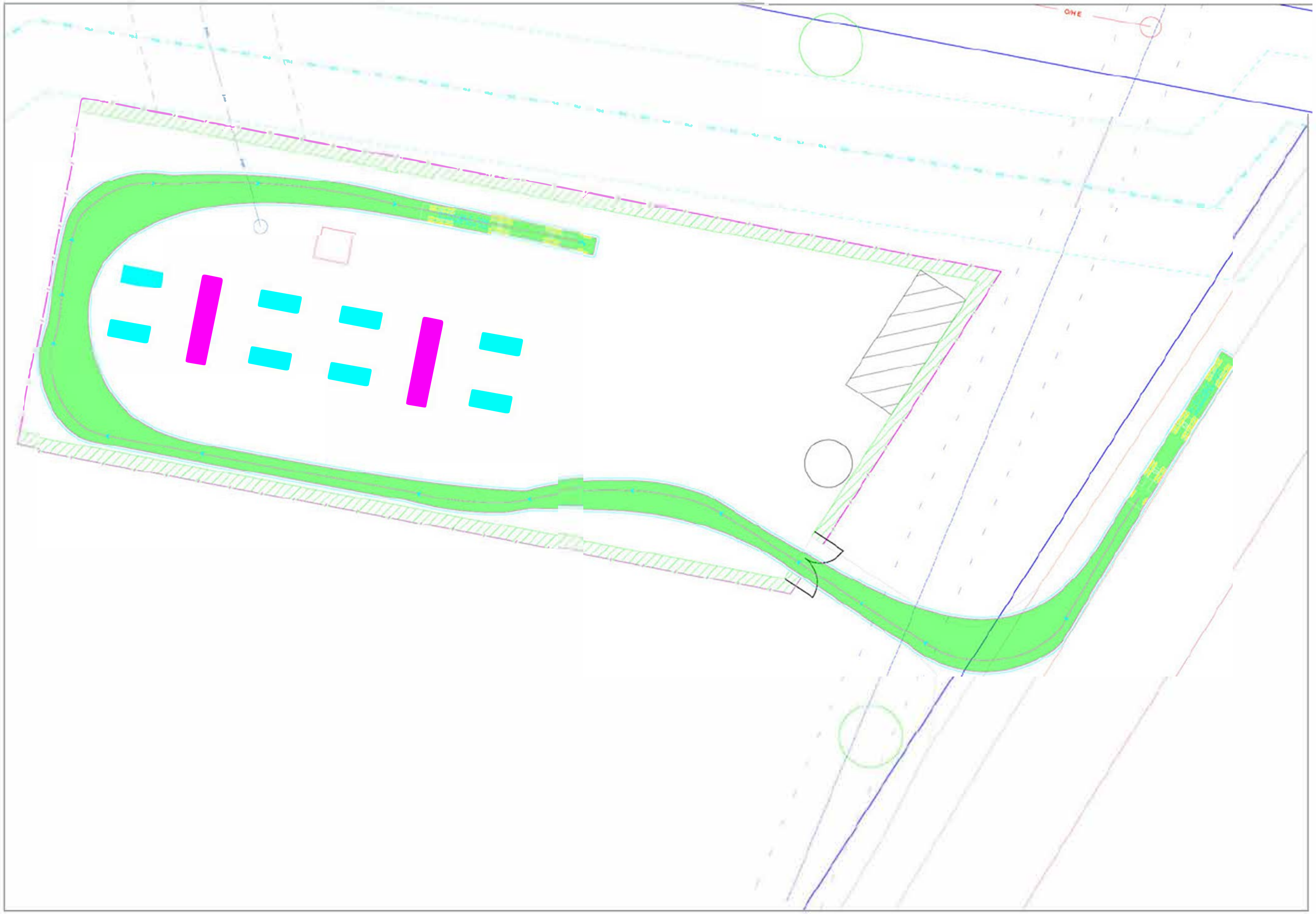


Appendix C: Swept Paths

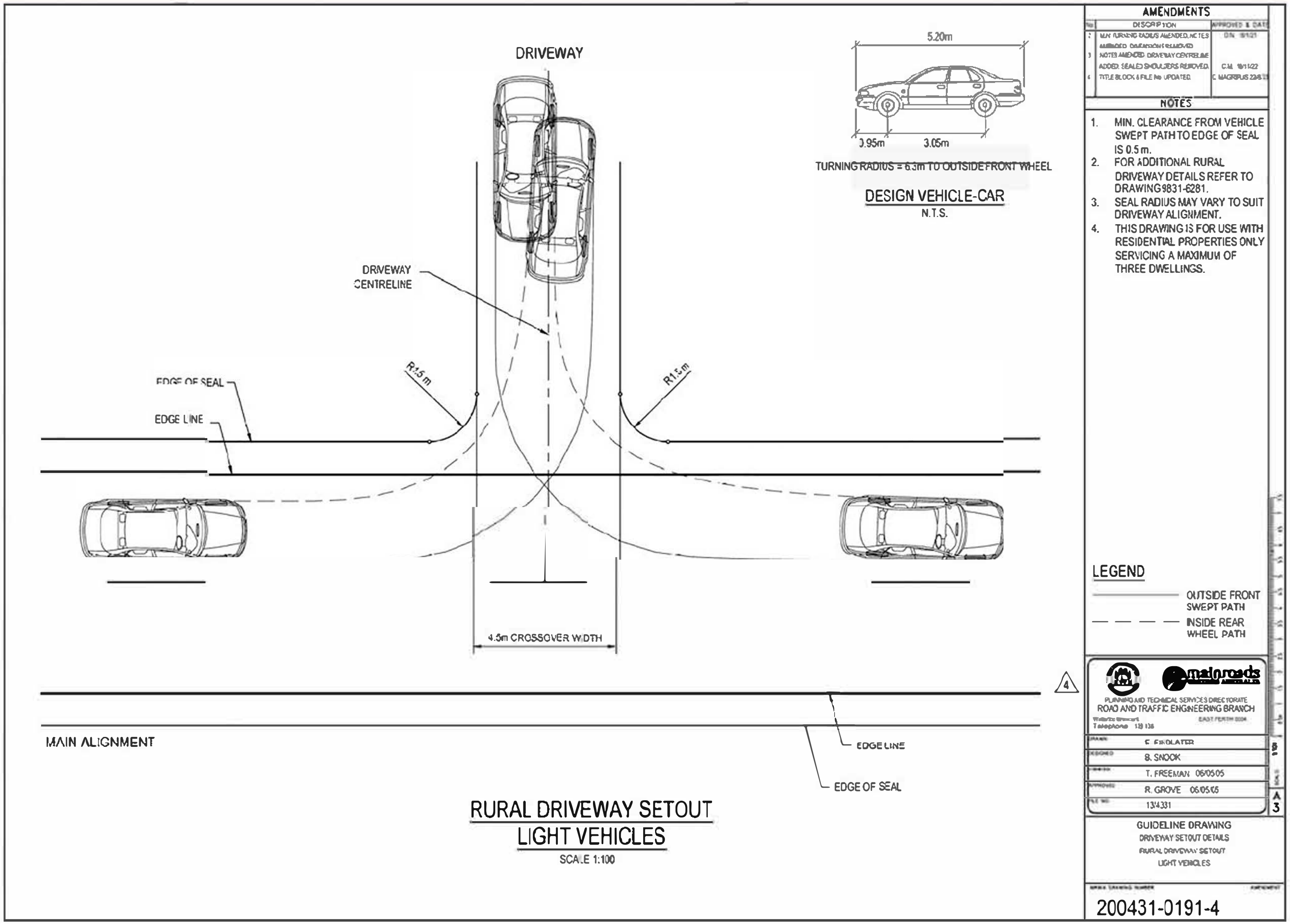
Swept Paths B99 Car Site Entry and Exit to Abattoir Rd



Swept Paths – 27.5 m B-Double Access Abattoir Rd



Appendix D: MRWA Rural Driveway Requirements



APPENDIX D ENVIRONMENTAL NOISE ASSESSMENT

BATTERY ENERGY STORAGE SYSTEM, MERREDIN ENVIRONMENTAL NOISE ASSESSMENT

Report 10.00875R-01
Prepared on 14/05/2025

REPORT PREPARED BY

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ABN 25 646 422 899
ARESS **Suite 25, 443 Albany Highway ▸ Victoria Park, WA 6100**
PHONE **(08) 6186 4122**
EMAIL **perth@acousticsconsultants.com.au**

BASIS OF REPORT

This report has been prepared by **Acoustics Consultants Australia (ACA)** with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with the Client. Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from ACA. ACA disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

REFERENCE	DATE	STATUS / UPDATES	PREPARED	REVIEWED	AUTHORISED
10.00875R-01	15/04/2025	Draft	SS	MdlM	MdlM
10.00875R-01	13/05/2025	DA Application	SS	MdlM	[redacted] Miguel de la Mata (M.A.A.S.)

CONTENTS

PHONE (08) 6186 4122 EMAIL perth@acousticsconsultants.com.au
ADDRESS Suite 25 / 443 Albany Highway ▸ Victoria Park, WA 6100

EXECUTIVE SUMMARY

Acoustics Consultants Australia (ACA) has been appointed to provide acoustic consultancy services for a proposed battery energy storage system (BESS) site located at Lot 12 on Plan 21792 Abattoir Road, Merredin, WA 6415.

The proposal is located in a section of the lot that is approximately 6,500 m^2 in area. The BESS area comprises 8 containerised CATL EnerX 0.25P BESS units and two Ingecon battery inverter (MVPS) units for a 10 MW/40 MWh (4-hour storage configuration).

The Shire of Merredin has requested an acoustic report as part of the site's planning application in order to satisfy the requirements of the *WA Environmental Protection (Noise) Regulations 1997* (EPNR). ACA conducted a noise modelling assessment of the proposed site operations, in accordance with the EPNR, which identified the BESS and MVPS units' ventilation/cooling systems as the dominant noise source for the proposal. The manufacturers provided tested noise data with various mechanical cooling duty cycle modes (percentages), where 20% duty cycle would present the quietest noise emissions and 80% would generate the loudest mode.

The land around the project site is generally 'Rural Residential' with industrial use land within 250 m northwest of the site. Nine representative noise sensitive receivers were identified around the project site, including six rural residential dwellings (highly sensitive), a Western Power site and a Watercorp site (industrial). Noise criteria were calculated in accordance with the EPNR for each receiver type and the assigned noise levels were determined. It is noted that lots of vacant land are available around the site and this assessment comments on potential noise impacts on such lots should residential development is considered in the future.

A three-dimensional model was developed to predict noise levels at all nearby external receivers and consequently assess the predictions against the applicable noise criteria. Unit noise emission characteristics such as tonality and directivity, as well as meteorological and topographical conditions were considered.

The assessment results indicate:

- Compliance with the EPNR assigned noise levels at all industrial receivers, for all periods of the day with maximum duty cycle operation mode.
- Compliance with the EPNR assigned noise levels at all highly sensitive receivers:
    - Running at maximum duty cycle for all days between 7am and 10pm; and
    - Running at a reduced duty cycle for periods between 10pm and 7am the following day (or 9am for Sundays or public holidays),

- With noise barriers 2.8 m high built around the BESS and MVPS compound, the predictions indicate compliance with the EPNR assigned noise levels at adjacent lots, should future residential development take place on such lots.

It is noted that the operation of the BESS and MVPS units, running at maximum duty cycle, either after 10pm or before 7am, is highly unlikely as temperatures in the project area would drop by at least 10 degrees Celsius during night-time in the worst-case scenario (winter). This means that maximum duty cycle ventilation of the units during night-time is unreasonable to assume. Thus, a 40%-50% duty cycle has been adopted in this assessment as a reasonable operational assumption.

As an overall note regarding compliance with EPNR, it is recommended that the following measures are applied:

- Where the BESS and MVPS units are required to operate during night-time, the units shall be programmed to limit the duty cycle to 40-50% between 10pm and 7am (or 9am on Sundays and public holidays), provided that the limiting does not affect performance of the unit;

- A 2.8m high noise barrier would prevent exceedances on potential future development within vacant adjacent rural lots. Details are further developed in the report;

Numerical noise assessment is presented in **Table 6** of the report and noise modelling contours are presented in **Appendix B**.

Where recommendations and assumptions adopted in this report are thoroughly followed, full compliance with the EPNR assigned noise levels is expected from the proposed BESS facility.

1. INTRODUCTION

ACA has been commissioned to undertake an environmental noise assessment for a proposed battery energy storage system (BESS) site located at Lot 12 on Plan 21792 Abattoir Road, Merredin, WA 6415.

The proposal is a battery energy storage system (BESS). The BESS comprises 8 containerised CATL EnerX 0.25P BESS units and two Medium Voltage Power Stations (MVPS) Ingecon battery inverter units for a 10 MW/40 MWh (4-hour storage configuration). The site will also feature a switchyard and associated ancillary spaces.

Noise associated with the new BESS and MVPS units has been identified as a potential source of impact to nearby noise sensitive receivers. The site is within close proximity to a number of rural residential premises.

The Shire of Merredin requires an acoustic report as part of the project's planning application. Noise emissions associated with the new BESS and MVPS units has been determined to quantify their potential impact.

The acoustic report shall include the assessment of noise emissions generated by the site operations in accordance with the EPNR.

The key stages of the noise assessment detailed in this report are as follows:

- Identification of the primary sources of noise associated with the project proposal and the nearest noise sensitive receivers;
- Noise assessment conducted based on a three-dimensional noise prediction model; and
- Noise mitigation measures identified and detailed to minimise potential impacts.

The methodology and standards used to conduct the assessment, as well as the numerical assessment results are presented in the following sections of this report.

Acoustic terms used in this report are defined in the Glossary of **Appendix A**.

2. BACKGROUND INFORMATION

The Shire of Merredin requires an acoustic report as part of the site's planning application in order to satisfy the statutory requirements. The purpose of the acoustic report is to address environmental noise emissions associated with the addition of eight BESS and two MVPS units and its potential impact on nearby noise sensitive premises.

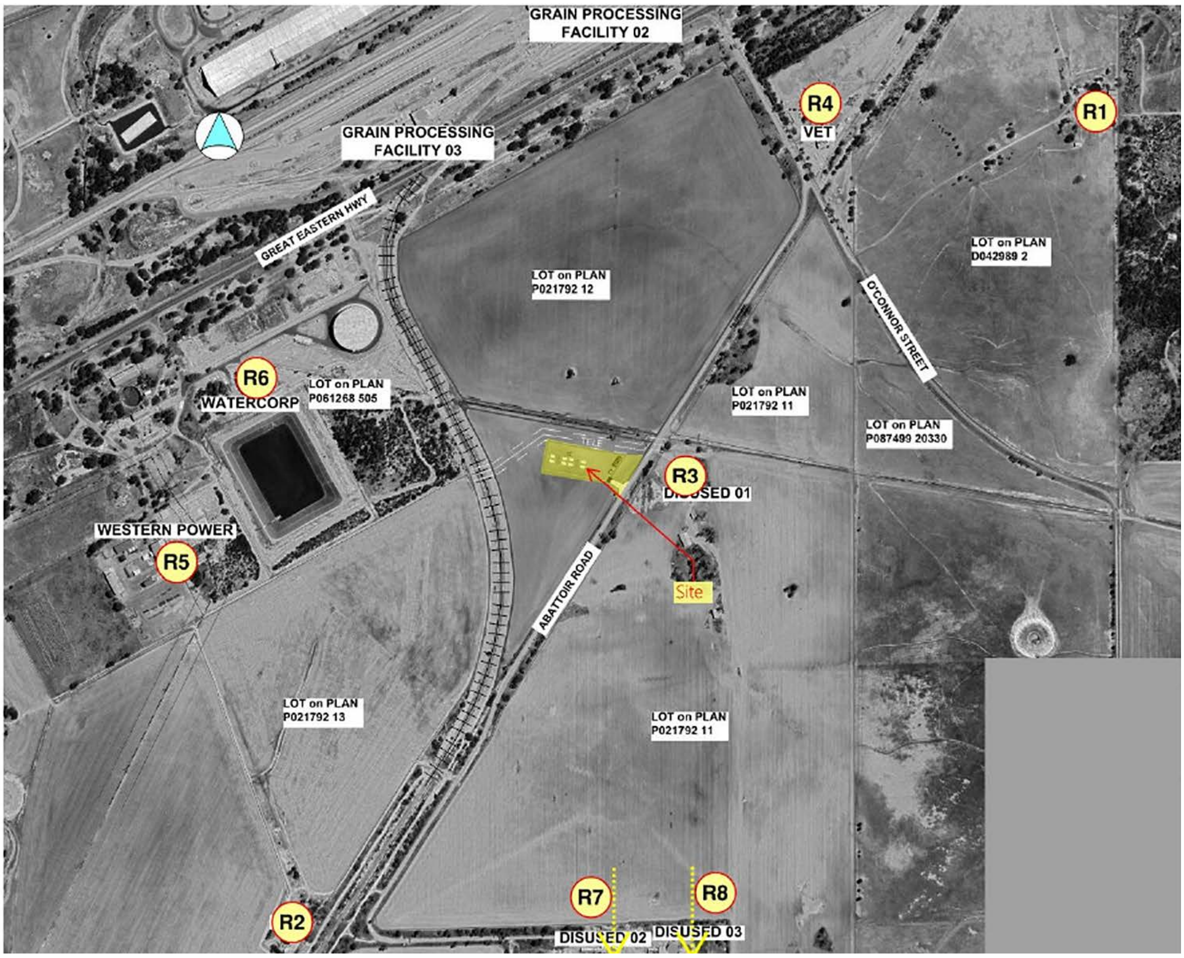
2.1. Location

The site is located in the South West Merredin locality within an area primarily of rural nature. The site is immediately bound by undeveloped land to the south, east and north, a Western Power and WaterCorp facilities are located to the west and further north railway stow roads and industrial land.

2.2. Nosie Sensitive Receivers

The nearest identified noise sensitive receivers are existing residential dwellings mainly to the east and south. Some of the dwellings have been identified by the developer as 'disused', nonetheless, assessment has been carried out taking into consideration such dwellings. **Figure 1** presents an annotated aerial view of the site in relation to the nearest sensitive receivers and wider site context.

Figure 1 Site location and nearest identified noise sensitive receivers



Details of the nearest identified noise sensitive receivers are presented in **Table 1**.

Table 1 Nearest identified noise sensitive receivers

Noise sensitive receiver	Receiver details / EPNR classification
R1	Residential dwelling / Noise sensitive premises: highly sensitive area
R2	Residential dwelling / Noise sensitive premises: highly sensitive area
R3	Residential dwelling / Noise sensitive premises: highly sensitive area
R4	Commercial
R5	Industrial (Western Power)
R6	Industrial (Water Corp)
R7	Commercial
R8	Commercial

Should noise be controlled to minimise impacts at the receivers listed above, it is considered that levels would also be suitably controlled at receivers further away due to increased distance attenuation and shielding from other buildings.

2.3. Operations and Site Description

The project proposal comprises a battery energy storage system site and associated ancillary equipment. The BESS area comprises eight containerised CATL EnerX 0.25P BESS units and two Ingecon battery inverter (MVPS) units for a 10 MW/40 MWh (4-hour storage configuration).

Noise emissions produced by all the units depend largely on the duty cycle required by their cooling systems. The CATL EnerX 0.25P BESS units also have an option for further sound reduction 'Sound Cover', which reduces approximately 5 dB of noise breakout.

Figure 2a presents the site plan of the development and **Figure 2b** presents the proposed BASS and MVPS units.

Figure 2a **Overall plant layout (*Drawing no. SIPL-BD-SAT-DWG-0002 version 03 28/01/2025*)**

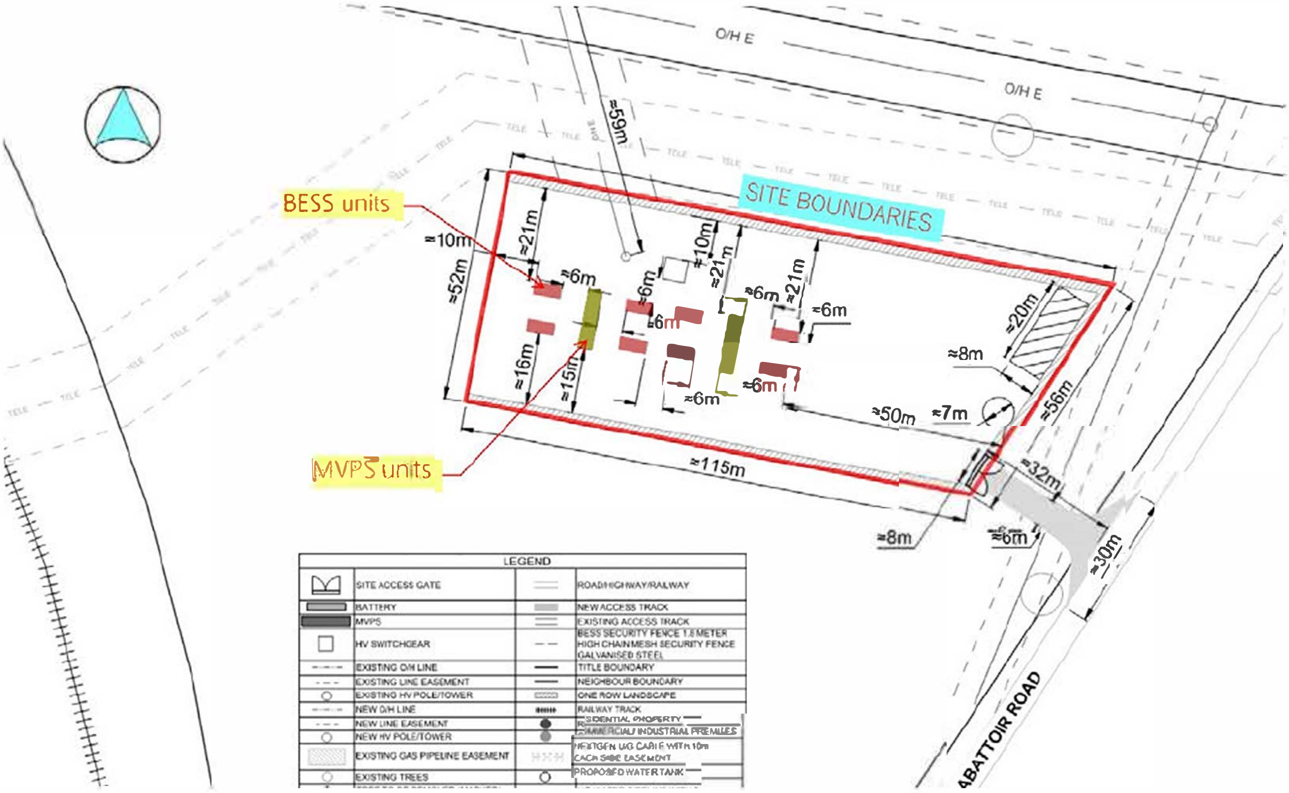
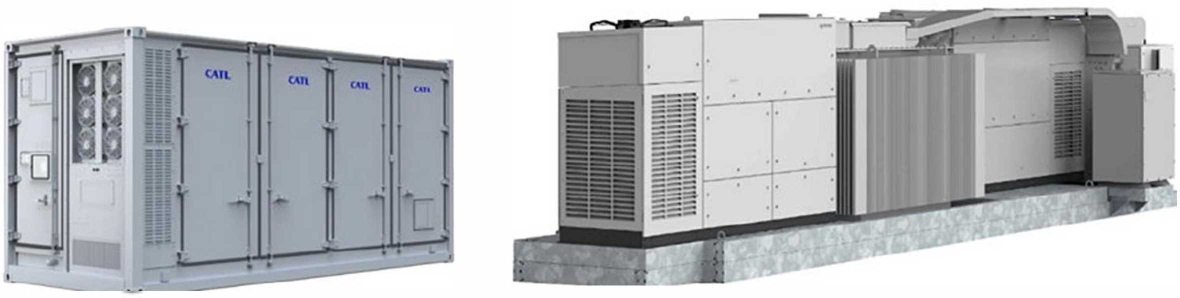


Figure 2b **BESS: CATL EnerC +306 (Left) / MVPS: Ingecon C690 (Right)**



ACA understands the BESS units operate continuously, and therefore, the hours of operation will fall within the day and night-time period as defined by the EPNR Noise Regulations (**Section 3**).

2.4. Operational Scenarios

The BESS unit's thermal system fans can operate at various duty cycles A worst-case noise level pertains to the maximum thermal system operation i.e. rated at 79.5%. The duty cycles will alternate based on ambient temperature i.e. a lower duty cycle is expected during the night-time period when the ambient temperature decreases.

Scenario 1: The following 'Night-time' operational scenario has been considered for assessment purposes:

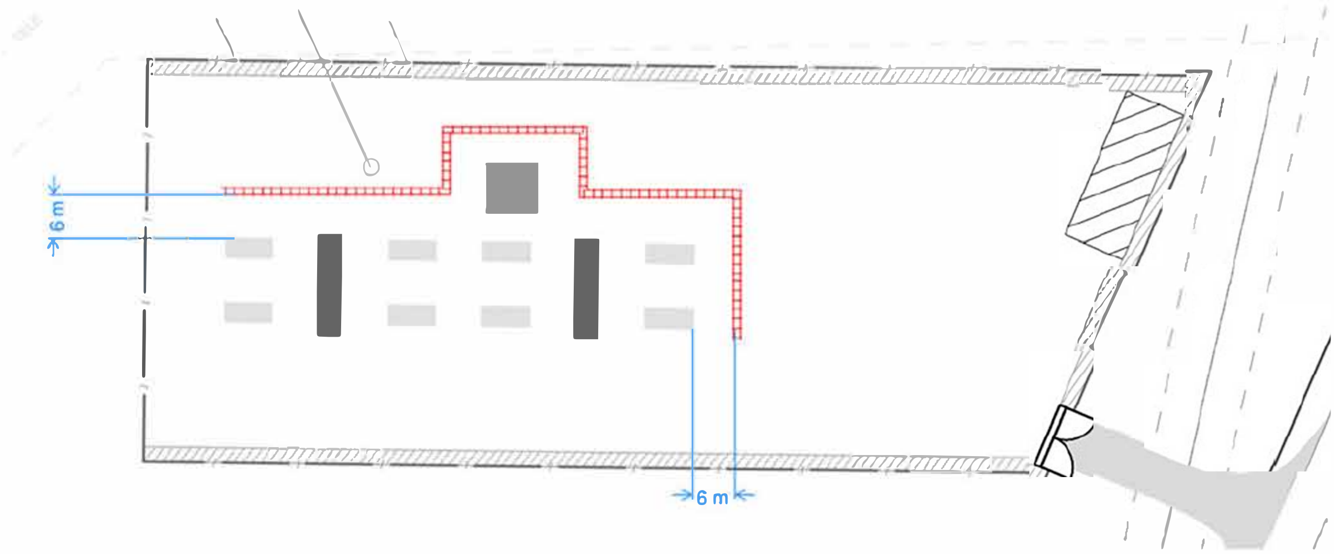
- Noise emissions generated by all BESS units operating simultaneously at 'medium' (50%) duty cycle.
- Noise emissions generated by all MVPS units operating simultaneously at 'medium' (CONF 1 setting, 50% generation, 50% fans) duty cycle.

Scenario 2: Worst-case 'Daytime' operational scenario has been considered:

- Noise emissions generated by all BESS units operating simultaneously at a 'maximum' (79.5%) duty cycle.
- Noise emissions generated by all MVPS units operating simultaneously at a 'maximum' (CONF 4 setting, 100% generation, 100% fans) duty cycle.

Further, an iteration of the scenarios described above has been tested with and without noise barriers as defined in **Figure 3**. The noise barriers tested are 2.8 m high and with either a minimum surface density of 20 kg/m^2 or certified for a sound reduction index of R_w 30 dB.

Figure 3 **Noise barriers**

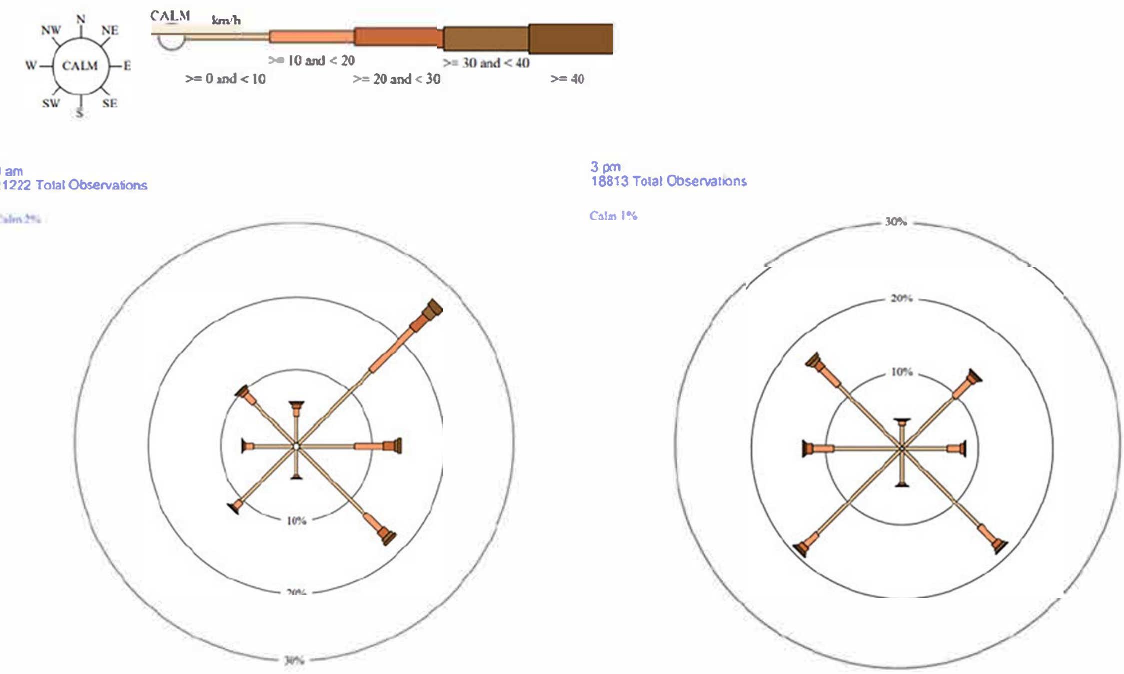


BESS units will operate continuously over all periods, the above scenarios will be assessed under the L_{A10} metric.

2.5. Site Meteorological Conditions

Long-term wind statistics data for a location nearest to the site (Merredin) was extracted from the BOM website. Wind roses are presented in **Figure 4**.

Figure 4 **Wind roses (annual): Merredin**



The wind roses presented in **Figure 4** infer the following prevailing wind conditions:

- Morning wind is predominantly north-easterly with wind speeds less than 20 km/h observed 20-30 % of the time.
- Afternoon wind is predominantly southerly and south-westerly, with wind speeds less than 20 km/h observed 50 % of the time (southerly).

For distances of 250 m to 1 km (i.e. between source and receiver) typically a 2 dB increase can be applied. For noise assessment purposes, considering the sensitive receivers are located all around the site, a correction of + 2 dB will be applied to assessment results to account for downwind conditions.

In all cases, the following are also considered:

- Temperature 10 °C
- Relative Humidity 70%

Precipitation has a negligible effect on noise propagation. Inversions may occur during the night-time period i.e the air at a higher level is warmer than ground level. This can give the effect of noise ‘carrying’ over distance. Therefore, noise levels during the night-time at noise sensitive premises may be slightly higher than predicted for further receiver. During the daytime, a ‘lapse’ condition may occur, whereby the air is warmer near the earth’s surface but gets cooler at higher altitude. At a certain distance, sound waves can bend upwards, thereby reducing noise levels. Therefore, predicted noise levels during the daytime at noise sensitive premises may be slightly lower than predicted.

3. NOISE CRITERIA

Criteria have been determined in accordance with the Western Australia *Environmental Protection (Noise) Regulations 1997* (EPNR).

3.1. WA Environmental Protection (Noise) Regulations 1997

Noise emissions from commercial/industrial premises received at nearby sensitive receivers are covered by state noise policy in the form of the EPNR. To achieve compliance with this policy, noise levels at nearby receivers are not to exceed defined limits. These limits are determined from consideration of prevailing background noise levels and 'influencing factors' that consider the level of commercial and industrial zoning in the locality.

The influencing factor considers zoning and road traffic volumes surrounding the sensitive receiver of interest, within 100 m and 450 m radii. Given the rural setting of the locality, the influencing factor calculated and nominated for highly sensitive receivers in this project is 0 dB. Therefore, no adjustment has been made to the baseline WA EPNR assigned noise levels. A summary of the applicable outdoor noise criteria is provided in the following table.

Table 2 WA EPNR Assigned Noise Levels

Type of premises receiving noise	Time of day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises: highly sensitive area	0700 to 1900 hours Monday to Saturday	45	55	65
	0900 to 1900 hours Sunday and public holidays	40	50	65
	1900 to 2200 hours All days	40	50	55
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	35	45	55
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80
Commercial premises	All hours	60	75	80
Industrial premises (other than Kwinana Industrial Area)	All hours	65	80	90

A series of adjustments must be added to the noise source levels if noise received at nearby sensitive premises cannot reasonably be free of intrusive characteristics of tonality, modulation and impulsiveness, and the adjusted level must comply with the assigned level. Definition of these terms (tonality, modulation and impulsiveness) can be read from Regulation 9(1) of the EPNR. **Table 3** summarises the adjustments, as defined by the Regulations.

Table 3 Noise character adjustments

Adjustment where noise emission is not music			Adjustment where noise emission is music	
Where tonality is present	Where modulation is present	Where impulsiveness is present	Where impulsiveness is not present	Where impulsiveness is present
+5 dB	+5 dB	+10 dB	+10 dB	+15 dB

From review of the noise data provided by the BESS and MVPS manufacturers, it was found that both units are tonal and 5 dB noise character adjustment will be applicable for all noise emissions from the project. Conversely, for assessment purposes, this noise study has been conducted with assigned noise levels 5 dB more stringent than those of **Table 2** to allow for the tonal noise sources.

4. ASSESSMENT

The assessment has been conducted based on the following steps:

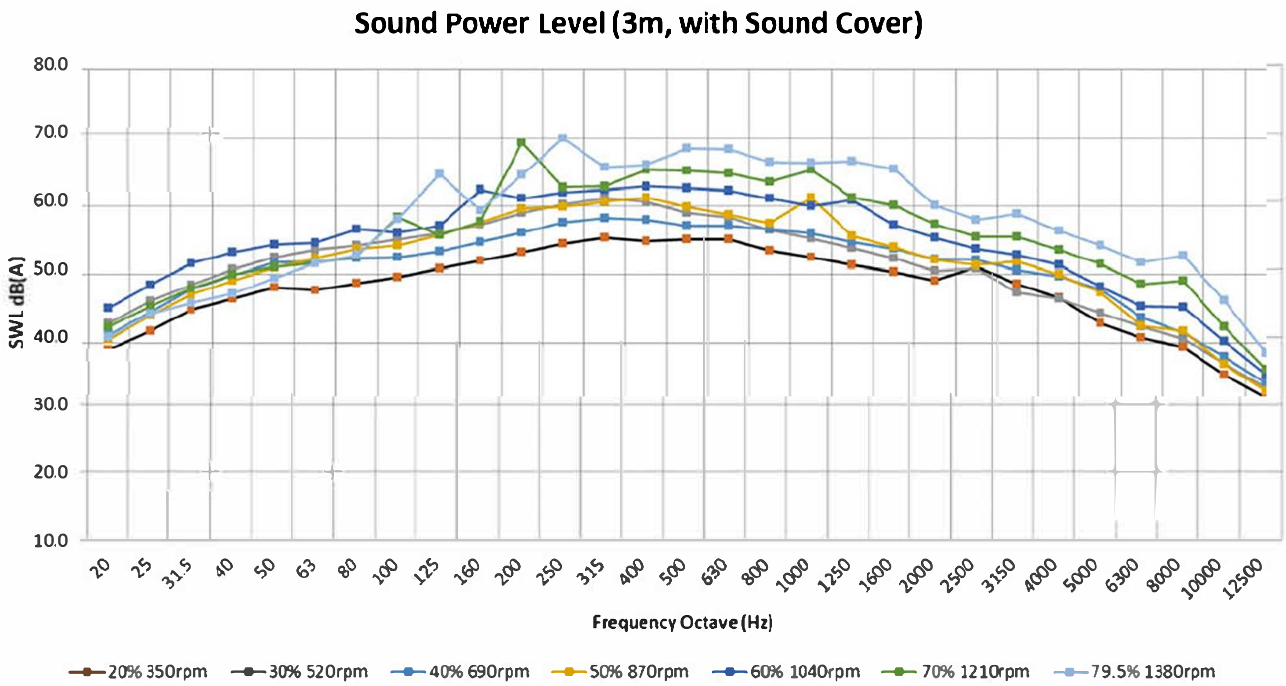
- A review of the product documentation, product sound data information and plant layout drawing to determine noise source location, sound power levels, noise directivity etc;
- 3D computer-aided noise modelling to predict resulting levels at nearby external receivers; and
- Assessment of predictions against the applicable noise criteria.

4.1. Source Noise Levels

ACA reviewed the product sound data documentation[1], which details the measurement methodology and resulting noise levels. All noise level testing was conducted in accordance with ISO3744.

The following chart summarises the measured sound power level of the unit "with sound cover".

Figure 5 Sound Power Levels for various duty cycle % – BESS



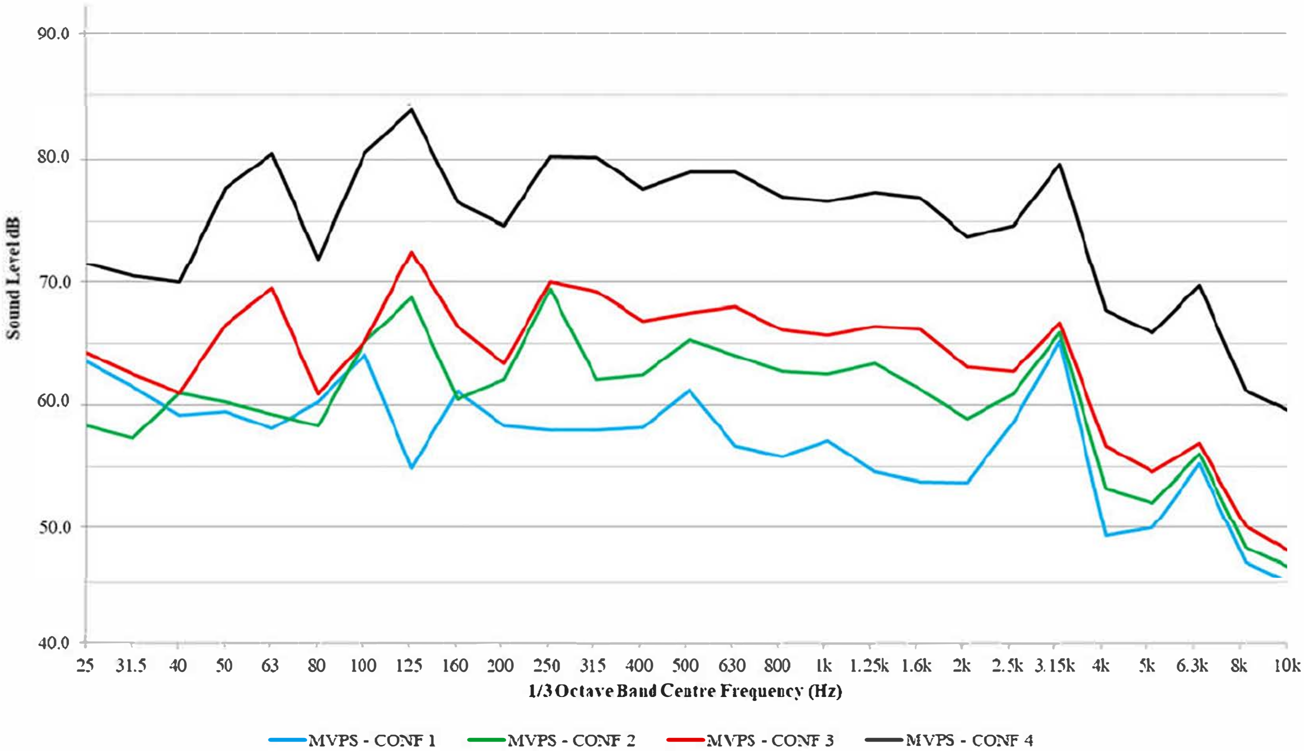
Third octave band sound power levels corresponding to the relevant duty cycle (i.e. 79.5% and 50%) have been inputted into the model.

[1] BESS: CATL Test Report, No CAIT-VI-240659-E, Version 1.0, dated, 31/08/2024
MVPS: Ingecon Sun 3Power C Series Acoustic Emission, dated 12/03/2024

Noise data for the MVPS unit, extracted from the manufacturer testing documentation, is summarised below.

Figure 6 Sound Power Levels for various configurations – MVPS

Configuration	Sound level at 2 m (dBA)	Sound level at 5 m (dBA)	Sound level at 10 m (dBA)
Configuration 1	63.7	55.7	49.7
Configuration 2	67.7	59.7	53.7
Configuration 3	70.7	62.7	56.7
Configuration 4	71.0	63.0	57.0



The BESS containers and MVPS units assessed in this report are based on preliminary product specifications. Should final equipment selections vary prior to construction, these will need to be confirmed with the acoustic consultant to ensure that the operational noise levels remain consistent with the outcomes presented in this assessment.

4.2. Noise Modelling

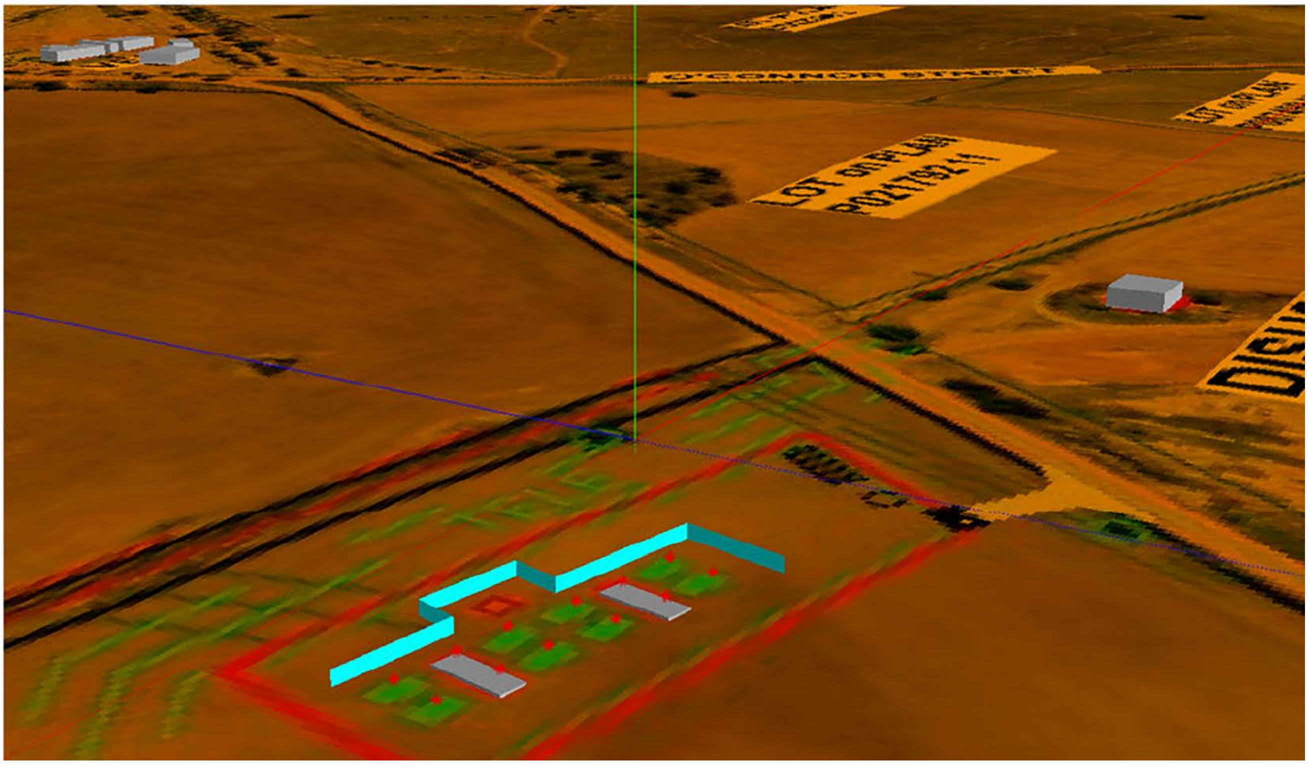
Geometry from the site and surroundings, surfaces, existing buildings, barriers and sound sources from the site were modelled using internationally recognised noise prediction algorithms. A three-dimensional noise model was developed using SoundPLAN Essential V5.1. An adaptation of the algorithm contained within ISO 9613:1996 *Acoustics – Attenuation of sound during propagation outdoors* was used in this instance[2].

The following items are considered:

- Three-dimensional location, height and orientation;
- shielding/reflection effects due to surrounding structures (such as awnings, parapets and roofs);
- meteorological/thermal effects; and
- ground absorption has been set at 0.5 (0 meaning reflective and 1 being absorptive).

Figure 7 presents 3D imagery of the noise model, including the point of assessment (receivers) and the key noise generating sources.

Figure 7 **3D imagery of noise model**



[2] ISO 9613-2:1996 has since been superseded by ISO 9613-2:2024, however, SoundPLAN Essential V5.1 utilises the former.

4.2.1. Modelling Scenarios

The noise modelling scenario described in **Section 2.4** is:

- Scenario 1 – 'Night-time': Noise emissions generated by all units operating simultaneously at 50% duty cycle (L_{A10} assessment).
  - Iteration 1: Scenario 1 – No noise barrier
  - Iteration 2: Scenario 1A – Including noise barrier
- Scenario 2A – 'Daytime': Noise emissions generated by all BESS units operating simultaneously at maximum duty cycle (L_{A10} assessment).
  - Iteration 1: Scenario 1 – No noise barrier
  - Iteration 2: Scenario 1A – Including noise barrier

4.2.2. Results

Noise contour maps have been generated in SoundPLAN Essential V5.1 and are presented in **Appendix B**. The results from the noise model at the external receivers are presented in **Table 4**. A wind correction of + 2 dB has also been applied.

Table 4 Receiver noise level predictions

Receiver	Predicted Noise Levels (L_{A10})			
	Scenario 1: Night-time without barriers	Scenario 1A: Night-time with barriers	Scenario 2: Daytime without barriers	Scenario 2A: Daytime with barriers
R1	< 20 dB	< 20 dB	< 20 dB	< 20 dB
R2	< 20 dB	< 20 dB	< 20 dB	< 20 dB
R3	32 dB	27 dB	38 dB	35 dB
R4	< 20 dB	< 20 dB	22 dB	< 20 dB
R5	< 20 dB	< 20 dB	24 dB	26 dB
R6	< 20 dB	< 20 dB	24 dB	26 dB
R7	< 20 dB	< 20 dB	20 dB	23 dB
R8	< 20 dB	< 20 dB	22 dB	25 dB

4.3. Assessment and Discussion

The results presented above have been assessed against the EPNR calculated assigned noise level criteria (**Section 3**) and are presented in **Table 5**. These are for the scenarios with noise barriers.

It is considered that the noise prediction results are representative of a 'worst case' scenario and it is expected that in reality, noise levels would typically be less than that predicted for the majority of receivers.

Table 5 Assessment of results

Scenario	Receiver	Resultant noise at receiver (dB)	Worst-case adjusted noise criterion (dB)	Difference (dB)
'Daytime' Between *0700 to 2200 hours*	R1	L_{A10} < 20 dB	L_{A10} 35	-15
	R2	L_{A10} < 20 dB		-15
	R3	L_{A10} 35		-
	R4	L_{A10} < 20 dB		-15
	R5	L_{A10} 26 dB		-9
	R6	L_{A10} 26 dB		-9
	R7	L_{A10} 23 dB		-12
	R8	L_{A10} 25 dB		-10
Night-time Between *2200 hours to 0700 house any day, or 0900 hours Sunday and public holidays*	R1	L_{A10} < 20 dB	L_{A10} 30	-10
	R2	L_{A10} < 20 dB		-10
	R3	L_{A10} 27 dB		-3
	R4	L_{A10} < 20 dB		-10
	R5	L_{A10} < 20 dB		-10
	R6	L_{A10} < 20 dB		-10
	R7	L_{A10} < 20 dB		-10
	R8	L_{A10} < 20 dB		-10

The assessment results indicate full compliance of the EPNR when operational conditions are adjusted to the basis of this noise study.

4.4. Recommendations

It is noted that the assessment considers reasonably worst-case operational conditions. The developer, as appropriate and based on final design and manufacturer capability, will be required to implement the following noise mitigation measures:

- Treating the source:
  - ➢ Adjustment of cooling system loads or operational settings. It is understood there is the ability to firmware-limit the fan duty cycle to mitigate the effects of noise, as long as the limiting does not affect performance of the unit. It is recommended that the units are limited up to the 50% duty cycle during the night-time in order to achieve compliance with the EPNR; and
  - ➢ Use of manufacturer-supplied noise reduction kits or acoustic treatment solutions.

- Treating the path:

  Installation of noise walls. A 2.8 m high noise barrier with a minimum surface density of 20 kg/m^2 has been considered for full compliance conditions at all noise sensitive dwellings and receivers and within all vacant lots with potential to be developed as residential in the future.

For the majority of the time, noise emitted by the BESS and MVPS unit(s) would be much lower. The above measures will be confirmed and incorporated into the final project design to maintain compliance with relevant noise criteria.

The noise contours of Scenarios 1A and 2A shown in **Appendix B** provide noise predictions at surrounding land; it is observed that, with noise barriers in place, noise levels at the boundary of the adjacent lots to the north, east and south are within the adjusted/worst-case L_{A10} 30 dB mark for night-time and L_{A10} 35 dB mark for daytime, and thus, compliant with the EPNR requirements.

Further, Scenario 1 noise contours (**Appendix B**) show the effect of no barriers, where a zone of compliance for worst-case night-time is delimited by the 30-32 dB contour zone. It should be noted that this zone applies in the presence of a highly sensitive buildings (a residential dwelling) and this zone does not apply for extended outdoor areas of residential lots or non-habitable buildings such as sheds or the like.

APPENDICES

APPENDIX A: Glossary of Acoustic Terms

1 Sound Level or Noise Level

Sound consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing. Noise is often used to refer to unwanted sound.

The human ear responds to changes in sound pressure over a very wide range. The loudest sound pressure to which the human ear responds is ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable range by using logarithms.

The symbols SPL, L or L_P are commonly used to represent Sound Pressure Level.

The symbol L_A represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2 x 10^{-5} Pa.

2 "A" Weighted Sound Levels

The overall level of a sound is usually expressed in terms of dB(A), which is measured using a sound level meter with an "A-weighting" filter. This is an electronic filter with a frequency response corresponding approximately to that of human hearing.

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4000 Hz), and less sensitive at lower and higher frequencies. Thus, the level of a sound in dB(A) is a good measure of the loudness of that sound. Different sources having the same dB(A) level generally sound about equally loud.

A change of 1 dB or 2 dB in the level of a sound is difficult for most people to detect, whilst a 3 dB to 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB(A) change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels:

Typical noise levels and subjective scale

Sound Pressure Level dB(A)	Noise Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120	Heavy rock concert	Extremely loud
110	Grinding on steel	
100	Loud car horn at 3 m	Very loud
90	Construction site with pneumatic hammering	
80	Kerbside of busy street	Loud
70	Loud radio or television	
60	Department store	Moderate to quiet
50	General Office	
40	Inside private office	Quiet to very quiet
30	Inside bedroom	
20	Recording studio	Almost silent

Other weightings (e.g. B, C and D) are less commonly used than A-weighting in environmental acoustics. Sound Levels measured without any weighting are referred to as "linear" and the units are expressed as dB(Lin) or dB.

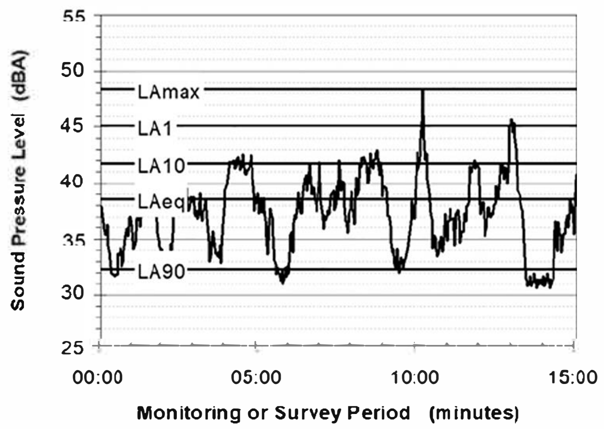
3 Sound Power Level

The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units, and these may be identified by the symbols SWL or L_W. The Sound Power definitions expressed in dB are typically referenced to the acoustic energy unit 10^{-12} W.

4 Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels L_{AN}, where L_{AN} is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the L_{A1} is the noise level exceeded for 1% of the time, L_{A10} the noise exceeded for 10% of the time.

The following figure presents a hypothetical 15-minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

L_{A1} The noise level exceeded for 1% of the 15-minute interval.

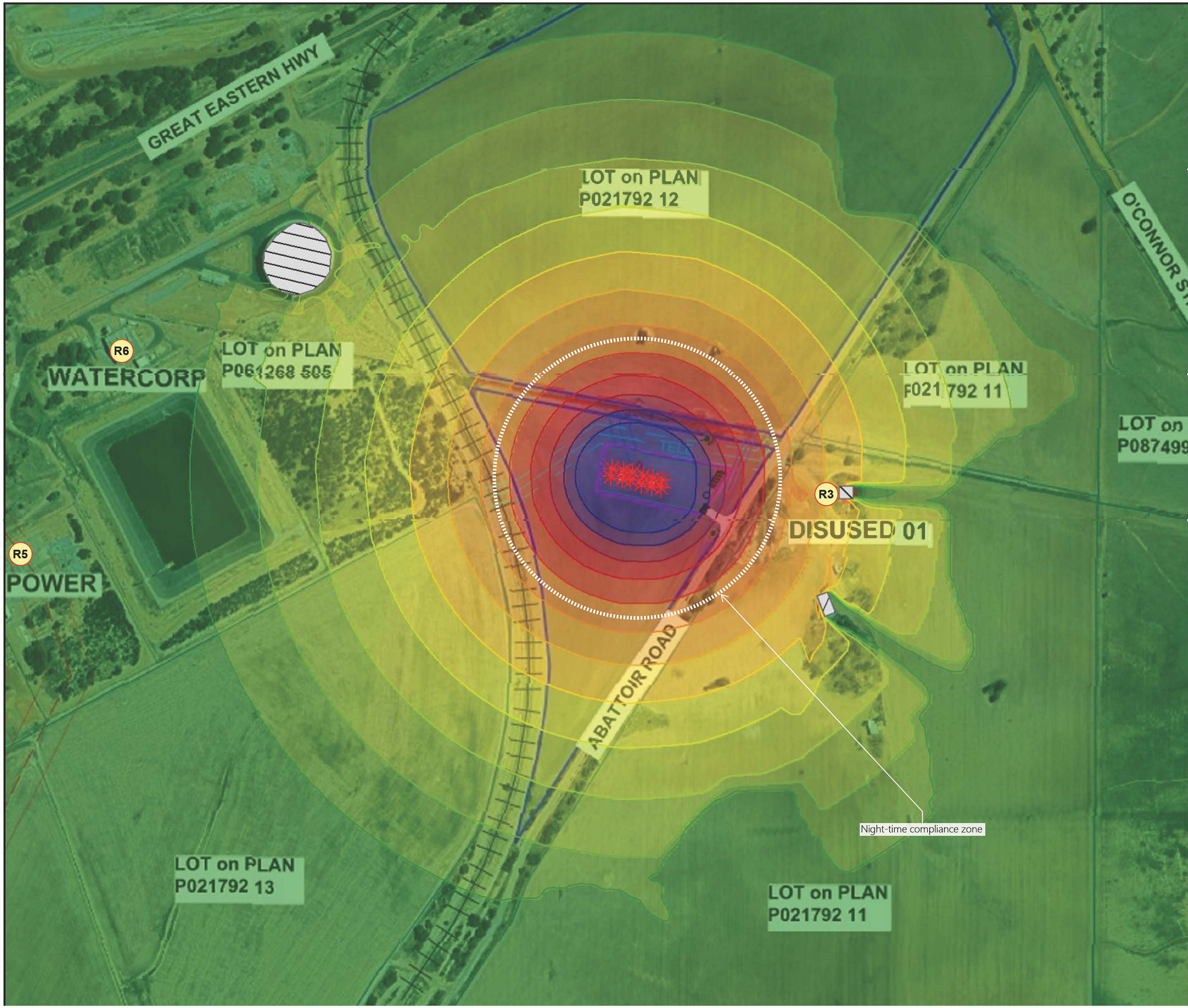
L_{A10} The noise level exceeded for 10% of the 15-minute interval. This is commonly referred to as the average maximum noise level.

L_{A90} The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

L_{Aeq} The A-weighted equivalent noise level (basically the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

When dealing with numerous days of statistical noise data, it is sometimes necessary to define the typical noise levels at a given monitoring location for a particular time of day. Standardised methods are available for determining these representative levels. Different jurisdictions would choose to define their own preferred Standard.

APPENDIX B: NOISE MODELLING CONTOURS



Proposed Distribution BESS
ACEnergy Pty Ltd
Abattoir Rd, Merredin

Predicted Environmental Noise Emissions

SCENARIO 1

J:\01 PER\02 MODELLING\JOBS SOUNDPLAN\10.00875 BESS Merredin\BESS Merredin ENA V1S1

Project No: 10.00875
Consultant: MdM
Date: 17/04/2025

SCENARIO 1: Night-time
-Active sound sources:
MVPS x 2 units (Configuration 1, running 50% fans)
BESS x 8 units (Running 40% with sound cover)
-Ground (alpha = 0.5)
-Metereological conditions:
T = 10deg / RH = 70%
Noise contours @ 1.5 above the ground

Signs and symbols

✳ Point source

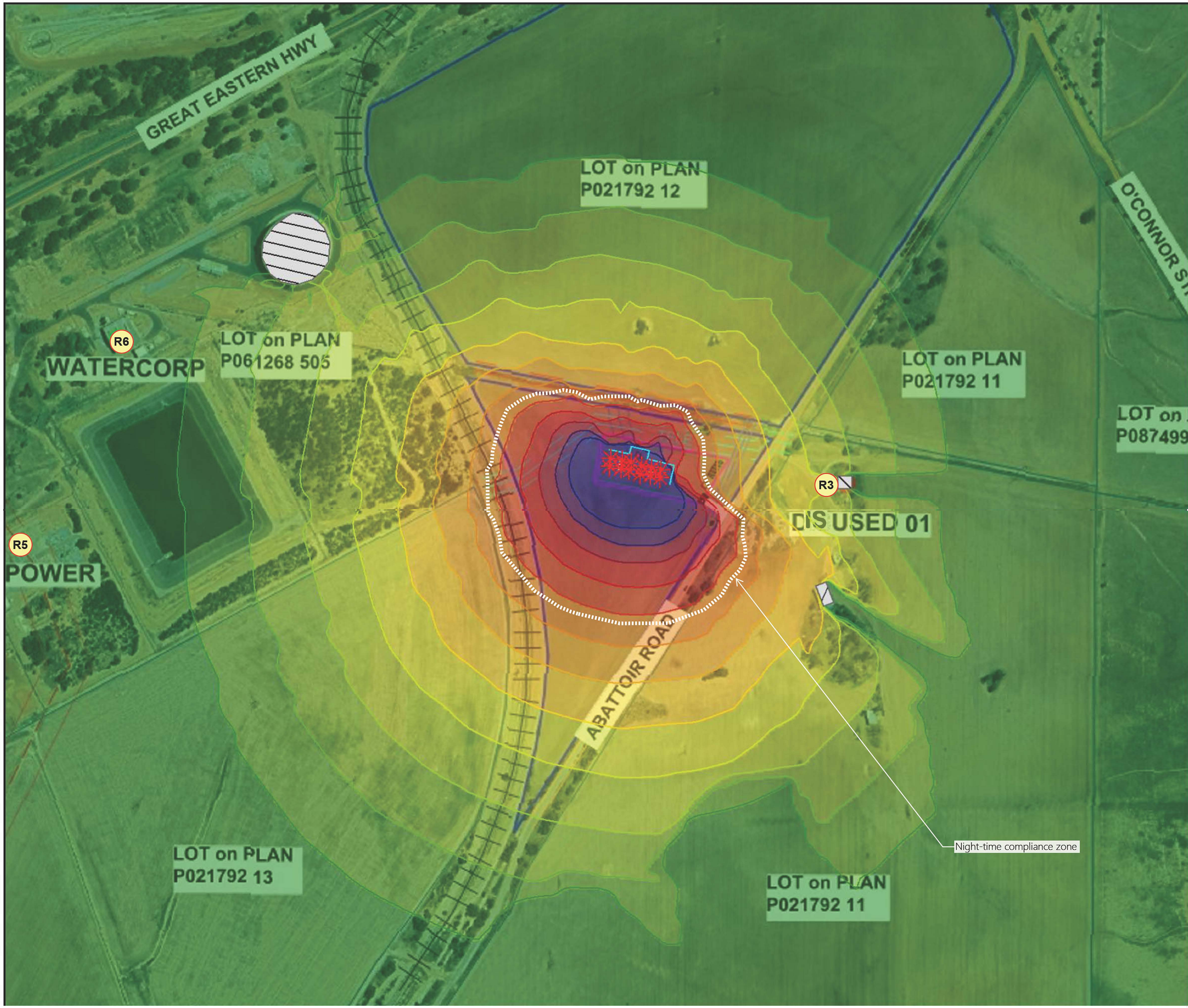
Levels in dB(A)

< 18
18 - 20
20 - 22
22 - 24
24 - 26
26 - 28
28 - 30
30 - 32
32 - 34
34 - 36
36 - 38
38 - 40
>= 40

1 : 4000

0 20 40 80 120 160 m

acoustics consultants AUSTRALIA



Proposed Distribution BESS
ACEnergy Pty Ltd
Abattoir Rd, Merredin

Predicted Environmental Noise Emissions

SCENARIO 1A

J:\01 PER\02 MODELLING\JOBS SOUNDPLAN\
10.00875 BESS Merredin\BESS Merredin ENA V1S1A

Project No: 10.00875
Consultant: MdM
Date: 17/04/2025

SCENARIO 1A: Night-time with 2.8m Noise Barriers
-Active sound sources:
MVPS x 2 units (Configuration 1, running 50% fans)
BESS x 8 units (Running 40% with sound cover)
-Ground (alpha = 0.5)
-Metereological conditions:
T = 10deg / RH = 70%
Noise contours @ 1.5 above the ground

Signs and symbols

Wall
Point source

Levels in dB(A)

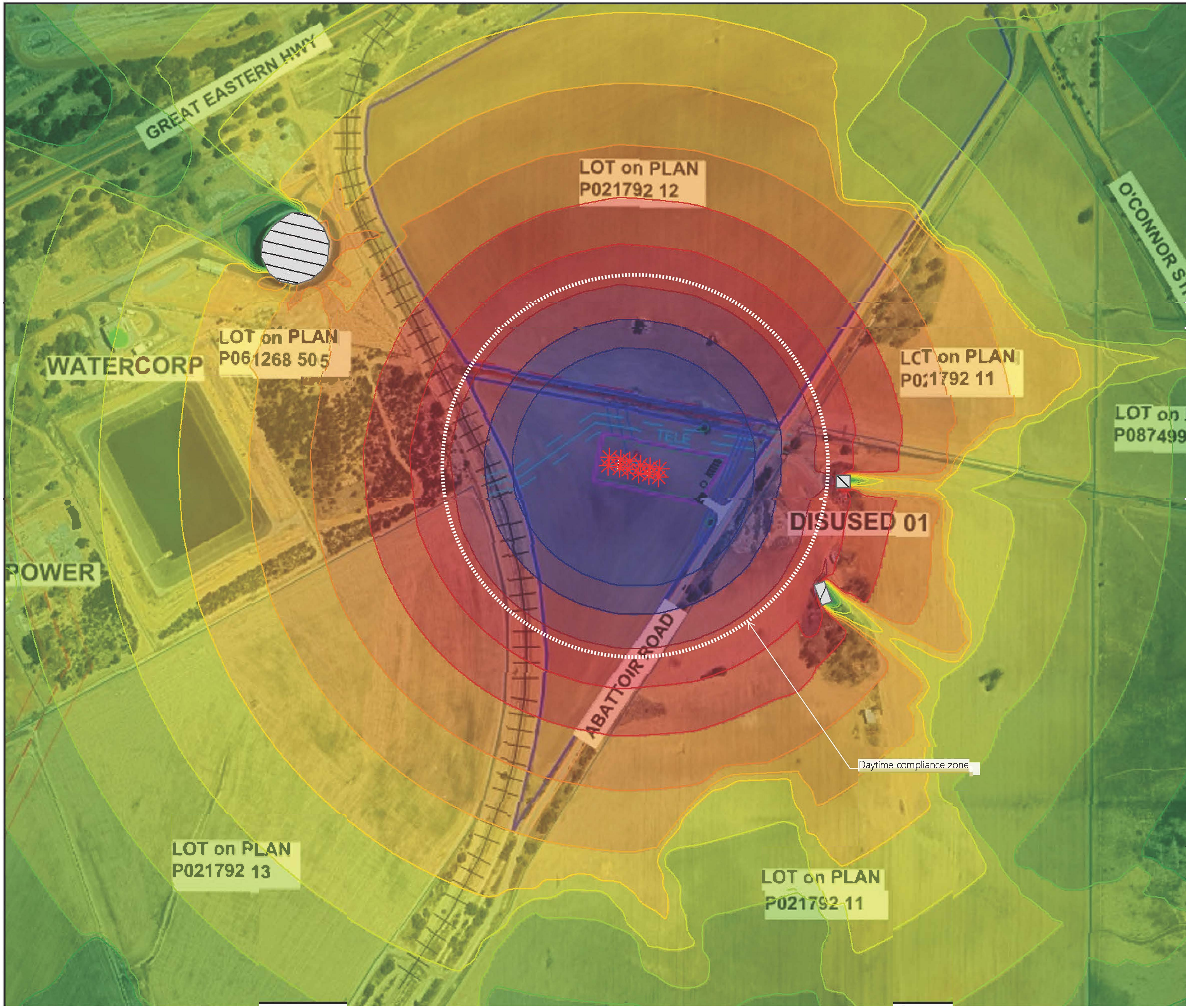
< 18
18 - 20
20 - 22
22 - 24
24 - 26
26 - 28
28 - 30
30 - 32
32 - 34
34 - 36
36 - 38
38 - 40
>= 40

1 : 4000

0 20 40 80 120 160 m

N

acoustics consultants AUSTRALIA



Proposed Distribution BESS
ACEnergy Pty Ltd
Abattoir Rd, Merredin

Predicted Environmental Noise Emissions

SCENARIO 2

J:\01 PER\02 MODELLING\JOBS SOUNDPLAN\10.00875 BESS Merredin\BESS Merredin ENA V1S2

Project No: 10.00875
Consultant: MdM
Date: 01/05/2025

SCENARIO 2: Daytime
-Active sound sources:
MVPS x 2 units (Configuration 3, running 100% fans)
BESS x 8 units (Running 80% with sound cover)
-Ground (alpha = 0.5)
-Metereological conditions:
T = 30deg / RH = 50%
Noise contours @ 1.5 above the ground

Signs and symbols

Point source

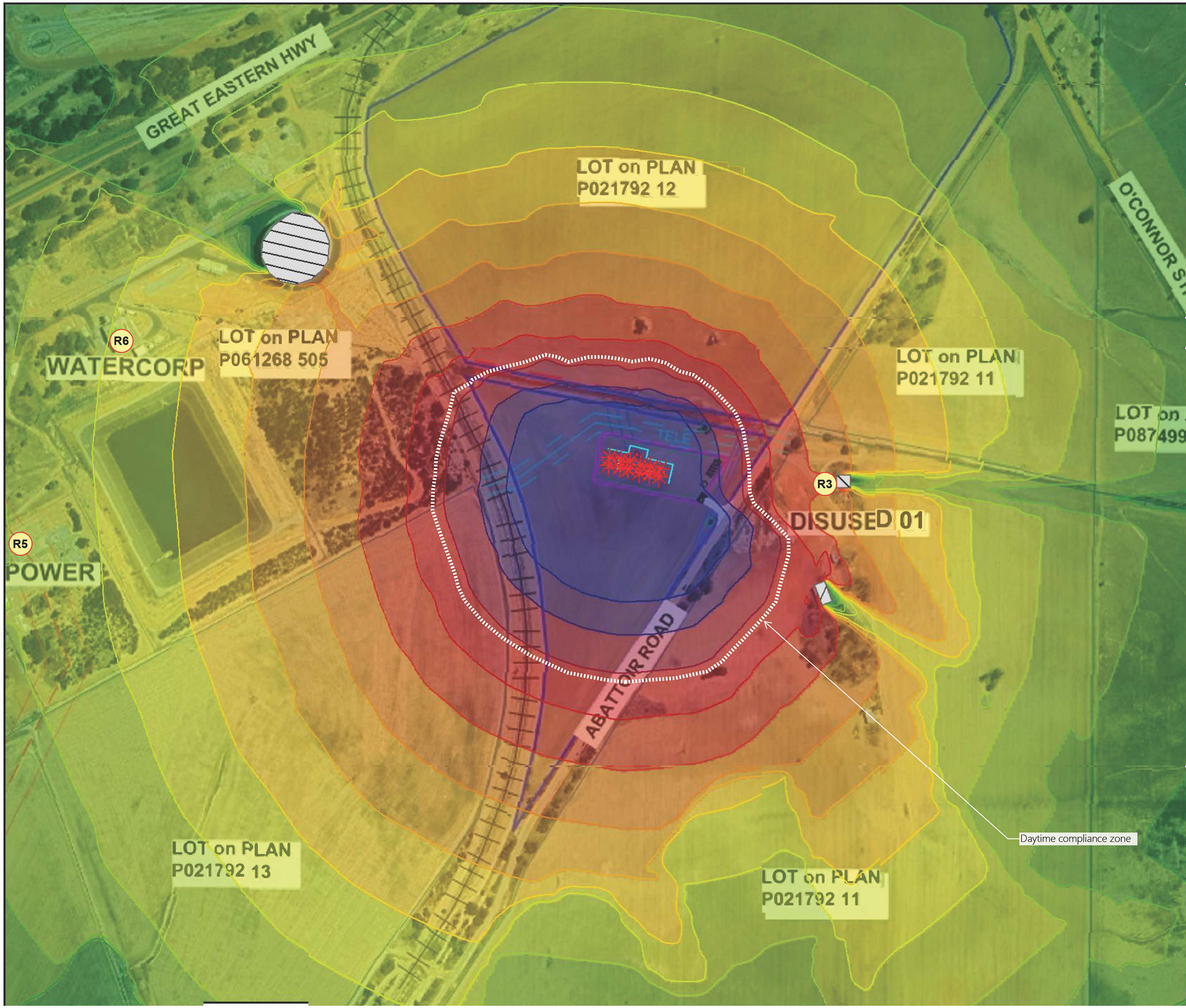
Levels in dB(A)

< 18
18 - 20
20 - 22
22 - 24
24 - 26
26 - 28
28 - 30
30 - 32
32 - 34
34 - 36
36 - 38
38 - 40
>= 40

1 : 4000

0 20 40 80 120 160

acoustics consultants AUSTRALIA



Proposed Distribution BESS
ACEnergy Pty Ltd
Abattoir Rd, Merredin

Predicted Environmental Noise Emissions

SCENARIO 2A

J:\01 PER\02 MODELLING\JOBS SOUNDPLAN\
10.00875 BESS Merredin\BESS Merredin ENA V1S2A

Project No: 10.00875
Consultant: MdM
Date: 17/04/2025

SCENARIO 2A: Daytime with 2.8m Noise Barriers
-Active sound sources:
MVPS x 2 units (Configuration 3, running 100% fans)
BESS x 8 units (Running 80% with sound cover)
-Ground (alpha = 0.5)
-Metereological conditions:
T = 30deg / RH = 50%
Noise contours @ 1.5 above the ground

Signs and symbols

Wall
Point source

Levels in dB(A)

< 18
18 - 20
20 - 22
22 - 24
24 - 26
26 - 28
28 - 30
30 - 32
32 - 34
34 - 36
36 - 38
38 - 40
>= 40

1 : 4000

0 20 40 80 120 160 m

acoustics consultants AUSTRALIA

APPENDIX E BUSHFIRE ATTACK LEVEL ASSESSMENT

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PO Box 437, Leederville, WA 6903
enquiries@westenv.com.au

Bushfire Attack Level (BAL) Assessment Report

Site details	
Address: Lot on P021792 12	
Suburb: Merredin	**State:** Western Australia
Local Government Area: Shire of Merredin	
Description of Building Works: Construction of a Battery Energy Storage System	

Report details			
Project number	**A25.098**	**Report version**	0
Report date		13/05/2025	
Author	Bridie Farrar Bushfire Consultant	**Review**	Daniel Panickar BPAD L3 37802 BPAD Bushfire Planning & Design Accredited Practitioner Level 3

Site Context

Acenergy Pty Ltd. are seeking to progress a Development Application (DA) to support the development of a Battery Energy Storage System (BESS) on a portion of Lot on P021792 12, which is being leased to Acenergy by the landholder (hereafter referred to as the subject site; Figure 1).

The subject site is not within a designated bushfire prone area on the *Western Australia Map of Bush Fire Prone Areas* (DFES, 2024); however, the Shire of Merredin (the Shire) have requested a bushfire risk assessment be undertaken to support the development. Given the short timeframe for preparation and lodgement of the DA, Western Environmental Approvals Pty Ltd (WEPL) have been engaged to undertake this assessment, with a focus on the appropriate siting of proposed assets. WEPL have prepared this Bushfire Attack Level (BAL) report as a preliminary bushfire assessment in lieu of a full Bushfire Management Plan (BMP). A BMP and assessment against the Country Fire Authority's (CFA) *Design Guidelines and Model Requirements for Renewable Energy Facilities Version 4* (the CFA Guidelines; 2023) will be prepared, if requested as a condition of development approval by the Shire.

Due to the short timeframe associated with DA lodgement, a preliminary desktop assessment of the BESS was undertaken for the purpose of determining the BAL in accordance with *Australian Standard AS 3959: 2018 Construction of Buildings in Bushfire Prone Areas* (AS 3959: 2018; SA, 2018) Simplified Procedure (Method 1). A detailed site assessment will be undertaken in the event that the Shire requests a BMP be prepared as a condition of development approval.

A Method 2 Bushfire Attack Level (BAL) calculation has also been undertaken in line with the methodology set out in AS 3959: 2018 (SA, 2018) to ensure that the proposed assets will be sited in areas where the radiant heat flux from a potential bushfire will not exceed 10 kW/m^2 (see Appendix A for calculations). Required separation distances between proposed assets and each Plot in this BAL assessment were calculated, with the resulting setback distances adopted as vegetation management areas required for the site. The Method 2 BAL calculations were undertaken solely to determine the setback required to achieve the required radiant heat flux.

The 10 kW/m^2 radiant heat flux threshold is widely adopted as being sufficient to significantly reduce the risk of radiant heat from the surrounding vegetation igniting the proposed assets within the site, in line with general guidance in the CFA Guidelines. Ultimately, this also implies that the resultant separation distances between the proposed BESS and classified vegetation will reduce the likelihood of bushfire ignition resulting from the functioning of the BESS. The separation distances prescribed around these assets is 22 m in width as a minimum, well exceeding the 10 m recommended by the Western Australian Planning Commission (WAPC) for Renewable Energy Facilities in Bushfire Prone Areas (*Position Statement: Renewable energy facilities; Department of Planning, Lands and Heritage; WAPC; 2020*).

Vegetation Classification

All vegetation within 100 m of the BESS was classified in accordance with Clause 2.2.3 of AS 3959: 2018 based on publicly available aerial imagery and Google Streetview imagery. Each distinguishable vegetation class with the potential to determine the BAL is identified in Table 1 and presented in Figure 2.

A portion of vegetation which directly abuts the subject site has been excluded as low-threat vegetation. This vegetation will be managed in perpetuity to ensure that the radiant heat flux exposure for the renewable energy assets does not exceed 10 kW/m^2 at a flame temperature of 1090 K. The landholder agreement confirming this arrangement is contained within Appendix B.

Table 1: Vegetation Classification

Plot	Vegetation classification	Effective slope
1	Class G Grassland	Downslope >0 to 5 degrees
2	Class G Grassland	All upslopes and flat land (0 degrees)
3	Excluded - clause 2.2.3.2 (e)	-
4	Excluded - clause 2.2.3.2 (f)	-

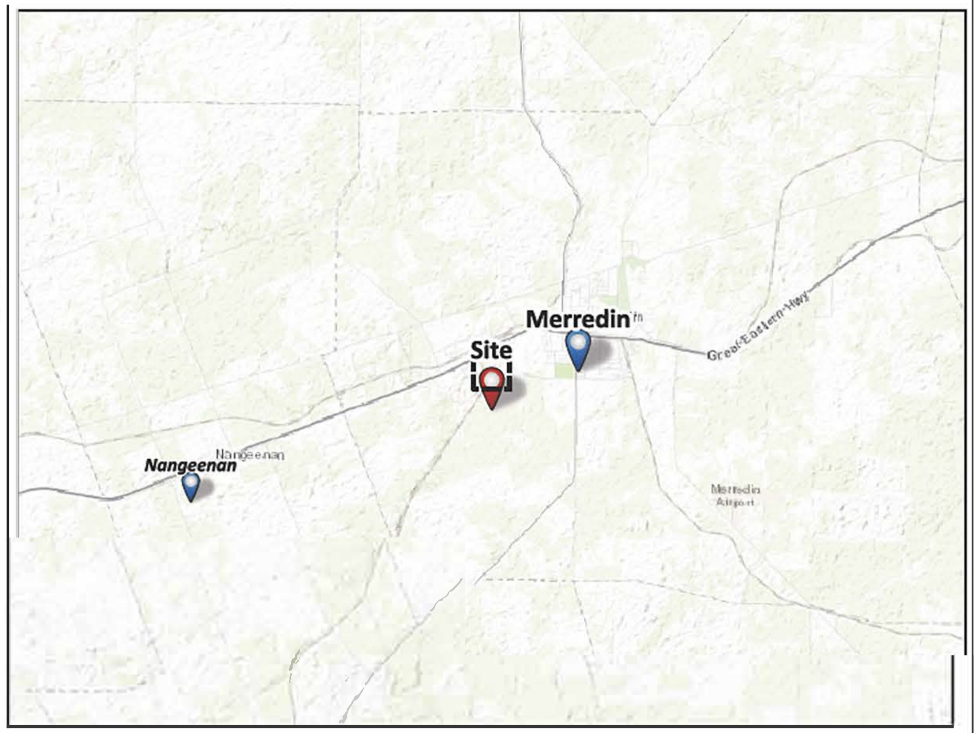

Figure 1: Site Overview

N

0 30 60 90 120 m

PROJECT/REPORT NAME	Bushfire Attack Level Report Merredin BESS
SCALE	1:2,000
SHEET SIZE	A3 COLOUR
CLIENT	Acenergy Pty Ltd
COORDINATE REFERENCE SYSTEM	GDA2020 / MGA zone 50
PROJECT NUMBER	A25.098
VERSION	0
DATA SOURCE	LANDGATE AERIAL IMAGERY
DRAWN BY / REVIEWED BY	SM/BF
DATE	6/5/2025

Legend

- Subject Site
- Buffer 100m
- Buffer 150m
- Battery
- Carpark Area
- Hardstand
- High Voltage Pole/Tower
- High Voltage Switchgear
- Medium Voltage Power Station
- New Access Track
- One Row Landscape
- Proposed Water Tank

No	Description	Drawn	Approved	Date
A	Original issue	SM	BF	6/5/2025

NOTES:

Cadastral boundary (LGATE-002). Base map ESRI Topo. Townsites (LGATE-248).

WESTERN ENVIRONMENTAL

Western Environmental Pty Ltd
08 6244 2310 | enquiries@westenv.com.au
Level 3/25 Prowse St, West Perth WA 6005
westenv.com.au

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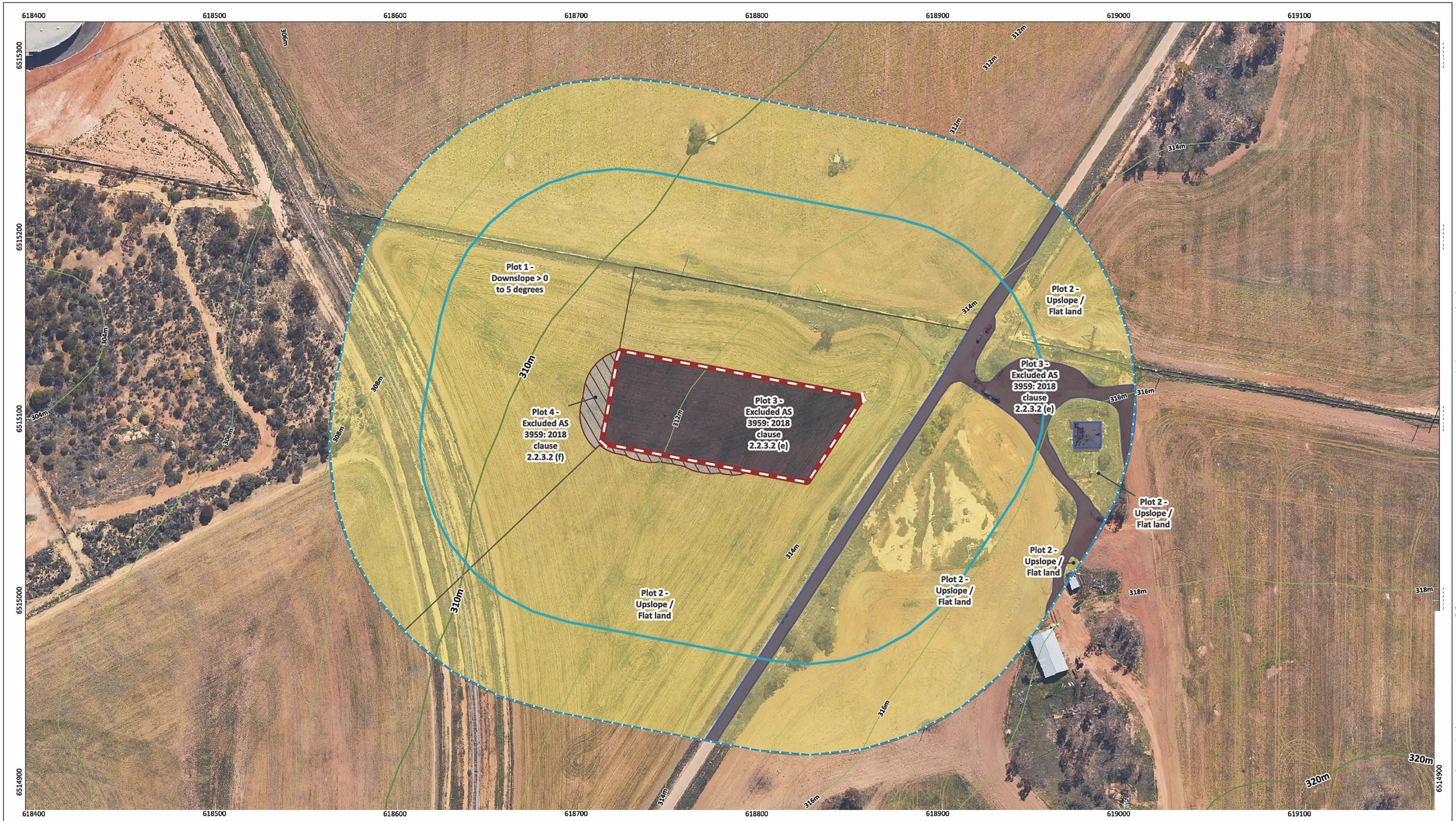

Figure 2: Vegetation Classification

N

0 30 60 90 120 m

SCALE	1:2,000
SHEET SIZE	A3 COLOUR
COORDINATE REFERENCE SYSTEM	GDA2020 / MGA zone 50
DATA SOURCE	LANDGATE AERIAL IMAGERY

PROJECT/REPORT NAME	Bushfire Attack Level Report Merredin BESS
CLIENT	Acenergy Pty Ltd
PROJECT NUMBER	A25.098
VERSION	0
DRAWN BY / REVIEWED BY	SM/BF
DATE	6/5/2025

Legend

- Subject Site
- Buffer 100m
- Buffer 150m
- 2m Contours (DPIRD-072)
  - 2m
  - 10m
- Vegetation to be maintained to a low-threat state
- Vegetation Classification
  - Class G - Grassland
  - Excluded AS 3959: 2018 2.2.3.2 (e)
  - Excluded AS 3959: 2018 2.2.3.2 (f)

No	Description	Drawn	Approved	Date
A	Original Issue	SM	BF	6/5/2025

NOTES:

Cadastral boundary from LANDGATE 2022. label corresponds to the vegetation association number.

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western.com.au

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Relevant Fire Danger Index

The Fire Danger Index for this site has been determined in accordance with Table 2.1 of AS 3959: 2018 and is presented in Table 2.

Table 2: Fire Danger Index (FDI)

Relevant Fire Danger Index			
FDI 40 ☐ *Table 2.4.5*	FDI 50 ☐ *Table 2.4.4*	FDI 80 ✓ *Table 2.4.3*	FDI 100 ☐ *Table 2.4.2*

Potential Bushfire Impacts

The potential bushfire impact to the site / proposed development from each of the identified vegetation plots are identified below in Table 3.

Appendix A contains the Method 2 BAL assessment calculations, using a flame temperature of 1090 K.

Table 3: Method 1 BAL Calculation (BAL Contours)

Plot	Vegetation classification	Effective slope	Separation distances required (m)					
			BAL-FZ	BAL-40	BAL-29	BAL-19	BAL-12.5	10 kW/m^2 @ 1090 K
1	Class G Grassland	Downslope >0 to 5 degrees	<7	7 - <9	9 - <14	14 - <20	20 - <50	25
2	Class G Grassland	All upslopes and flat land (0 degrees)	<6	6 - <8	8 - <12	12 - <17	17 - <50	22
3	Excluded - clause 2.2.3.2 (e)	-	No separation distances required - BAL-LOW					
4	Excluded - clause 2.2.3.2 (f)	-	No separation distances required - BAL-LOW					

Determined Bushfire Attack Level (BAL)

The determined Bushfire Attack Level (highest BAL) for the proposed works has been determined in accordance with Clause 2.2.6 of AS 3959: 2018 relevant data from the site assessment shown in Figure 3 and Table 4.

Following the clearing of the site and Vegetation Management Area for development, and maintenance of these areas as non-vegetated areas or low threat vegetation, all batteries and Medium Voltage Power Stations (MVPS) will be sited in areas with a radiant heat flux not exceeding 10 kW/m^2 as depicted in Figure 3.

Table 4: BAL Assessment Summary

Proposed Building/Asset	Plot Most Affecting BAL Rating	Separation Distance	BAL Rating
Battery 1	Plot 1	25 m	BAL-12.5
Battery 2	Plot 1	25 m	BAL-12.5
Battery 3	Plot 2	23 m	BAL-12.5
Battery 4	Plot 2	22 m	BAL-12.5
Battery 5	Plot 2	23 m	BAL-12.5
Battery 6	Plot 2	22 m	BAL-12.5
Battery 7	Plot 2	23 m	BAL-12.5
Battery 8	Plot 2	22 m	BAL-12.5
MVPS 1	Plot 2	22 m	BAL-12.5
MVPS 2	Plot 2	22 m	BAL-12.5

Note: This BAL rating is based on the information current at the date of this document and is valid for 12 months.

Figure 3: Bushfire Attack Level (BAL) contours

N

0 20 40 60 80 m

PROJECT/REPORT NAME	Bushfire Attack Level Report Merredin BESS
SCALE	1:1,400
SHEET SIZE	A3 COLOUR
CLIENT	Acenergy Pty Ltd
COORDINATE REFERENCE SYSTEM	GDA2020 / MGA zone 50
PROJECT NUMBER	A25.098
VERSION	0
DATA SOURCE	LANDGATE AERIAL IMAGERY
DRAWN BY / REVIEWED BY	SM/BF
DATE	6/5/2025

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Legend

- Subject Site
- Buffer 100m
- Bushfire Hazard Interface
- 10kW/m2 BAL contour
- Vegetation to be maintained to a low-threat state
- Battery
- Carpark Area
- Hardstand
- High Voltage Pole/Tower
- High Voltage Switchgear
- Medium Voltage Power Station
- New Access Track
- One Row Landscape
- Proposed Water Tank

Bushfire Attack Level (BAL)

- BAL-FZ
- BAL-40
- BAL-29
- BAL-19
- BAL-12.5
- BAL-LOW

No	Description	Drawn	Approved	Date
A	Original Issue	SM	BF	6/5/2025

NOTES:

Cadastral boundary from LANDGATE 2022. Label corresponds to the vegetation association number.

WESTERN ENVIRONMENTAL

Western Environmental Pty Ltd
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Level 3/25 Prowse St, West Perth WA 6005
westenv.com.au

Conclusion

The proposed BESS is sited appropriately to ensure that the radiant heat exposure of renewable energy assets during a bushfire is reduced so that it does not exceed 10 kW/m^2 at a flame temperature of 1090 K. This siting of renewable energy assets is also designed to reduce the potential for a fire originating from this infrastructure to spread to surrounding vegetation, igniting a bushfire. This method is considered best practice in Western Australia.

A full assessment of the BESS facility against the Guidelines and the CFA Guidelines will be undertaken if the Shire requests this as a condition of development approval. The facility has the ability to meet the requirements of each of these documents and is recommended for approval on the condition that a BMP is prepared which includes an assessment of the facility against the CFA Guidelines to ensure a design is created which reduces the risk to facility operators, responding firefighters and the surrounding community.

References

Country Fire Authority (CFA). (2023). *Design Guidelines and Model Requirements: Renewable Energy Facilities Version 4*. Government of Victoria.

Department of Fire and Emergency Services (DFES). (2024). *Map of Bush Fire Prone Areas*. Retrieved on 06/05/2025 from: http://www.dfes.wa.gov.au/regulationandcompliance/bushfireproneareas/Pages/default.aspx.

Standards Australia (SA). (2018). *Construction of buildings in bushfire-prone areas* (AS 3959: 2018).

Western Australian Planning Commission (WAPC). (2024a). *State Planning Policy 3.7 Bushfire*. Government of Western Australia.

Western Australian Planning Commission (WAPC). (2024b). *Planning for Bushfire Guidelines*. Government of Western Australia.

Appendix A
Method 2 BAL Calculations

NBC Bushfire Attack Assessment Report V4.1

AS3959 (2018) Appendix B - Detailed Method 2

Print Date: 6/05/2025 **Assessment Date:** 12/03/2025

Site Street Address: Merredin BESS,

Assessor: Daniel Panickar; Western Environmental

Local Government Area: WA **Alpine Area:** No

Equations Used

Transmissivity: Fuss and Hammins, 2002
Flame Length: RFS PBP, 2001/Vesta/Catchpole
Rate of Fire Spread: Noble et al., 1980
Radiant Heat: Drysdale, 1985; Sullivan et al., 2003; Tan et al., 2005
Peak Elevation of Receiver: Tan et al., 2005
Peak Flame Angle: Tan et al., 2005

Run Description: Grassland 5 degrees

Vegetation Information

Vegetation Type: Grassland

Vegetation Group: Grassland

Vegetation Slope: 5 Degrees **Vegetation Slope Type:** Downslope

Surface Fuel Load(t/ha): 4.5 **Overall Fuel Load(t/ha):** 4.5

Vegetation Height(m): 0 Only Applicable to Shrub/Scrub and Vesta

Site Information

Site Slope: 0 Degrees **Site Slope Type:** Downslope

Elevation of Receiver(m): 3 **APZ/Separation(m):** 25

Fire Inputs

Veg./Flame Width(m): 100 **Flame Temp(K):** 1090

Calculation Parameters

Flame Emissivity: 95 **Relative Humidity(%):** 25

Heat of Combustion(kJ/kg) 18600 **Ambient Temp(K):** 308

Moisture Factor: 5 **FDI:** 110

Program Outputs

Level of Construction: BAL 12.5 **Peak Elevation of Receiver(m):** 4.02

Radiant Heat(kW/m2): 9.76 **Flame Angle (degrees):** 79

Flame Length(m): 8.17 **Maximum View Factor:** 0.157

Rate Of Spread (km/h): 20.19 **Inner Protection Area(m):** 25

Transmissivity: 0.819 **Outer Protection Area(m):** 0

Fire Intensity(kW/m): 46945

BAL Thresholds

	BAL-40:	BAL-29:	BAL-19:	BAL-12.5:	10 kw/m2:	Elevation of Receiver:
Asset Protection Zone(m):	7	10	14	21	34	3

Run Description: Grassland Flat

Vegetation Information

Vegetation Type: Grassland

Vegetation Group: Grassland

Vegetation Slope: 0 Degrees | **Vegetation Slope Type:** Downslope

Surface Fuel Load(t/ha): 4.5 | **Overall Fuel Load(t/ha):** 4.5

Vegetation Height(m): 0 | Only Applicable to Shrub/Scrub and Vesta

Site Information

Site Slope: 0 Degrees | **Site Slope Type:** Downslope

Elevation of Receiver(m): 3 | **APZ/Separation(m):** 22

Fire Inputs

Veg./Flame Width(m): 100 | **Flame Temp(K):** 1090

Calculation Parameters

Flame Emissivity: 95 | **Relative Humidity(%):** 25

Heat of Combustion(kJ/kg) 18600 | **Ambient Temp(K):** 308

Moisture Factor: 5 | **FDI:** 110

Program Outputs

Level of Construction: BAL 12.5 | **Peak Elevation of Receiver(m):** 3.38

Radiant Heat(kW/m2): 9.55 | **Flame Angle (degrees):** 80

Flame Length(m): 6.87 | **Maximum View Factor:** 0.152

Rate Of Spread (km/h): 14.3 | **Inner Protection Area(m):** 22

Transmissivity: 0.827 | **Outer Protection Area(m):** 0

Fire Intensity(kW/m): 33248

BAL Thresholds

	BAL-40:	BAL-29:	BAL-19:	BAL-12.5:	10 kw/m2:	Elevation of Receiver:
Asset Protection Zone(m):	6	8	12	18	30	3

Appendix B:
Landholder Vegetation Management Agreement

Outlook

RE: Merredin Distribution BESS - Vegetation Management

From [redacted]
Date Tue 5/13/2025 11:34 AM
To Jane bai [redacted]
Cc Leo Purssell [redacted] Ron Ik <[redacted]

Hi Jane,

Thank you for your business cooperation.

We understand the request of Vegetation Management for the fire control. We shall let our farm leasee do it accordingly. If any cost is required, I shall let our farm lease contact you directly.

Would you have any queries on above please do not hesitate to contact me by E-mail [redacted] r on my mobile: [redacted] at your convenience.

Thank you and Best regards

Mike Lee (Shi Li)
Managing Director
Sunshine United Developments Pty Ltd
34 Lionel Street, Naval Base, WA 6165

From: Jane bai [redacted]
Sent: Tuesday, May 13, 2025 9:22 AM
To: Mike (Shi) Lee [redacted]
Subject: Fw: Merredin Distribution BESS - Vegetation Management

---

From: Jane bai
Sent: Tuesday, May 6, 2025 2:17 PM
To: Mike (Shi) Lee
Cc: Bai Xue; [redacted] Ron Ik; Leo Purssell
Subject: Merredin Distribution BESS - Vegetation Management

Hi Mike,

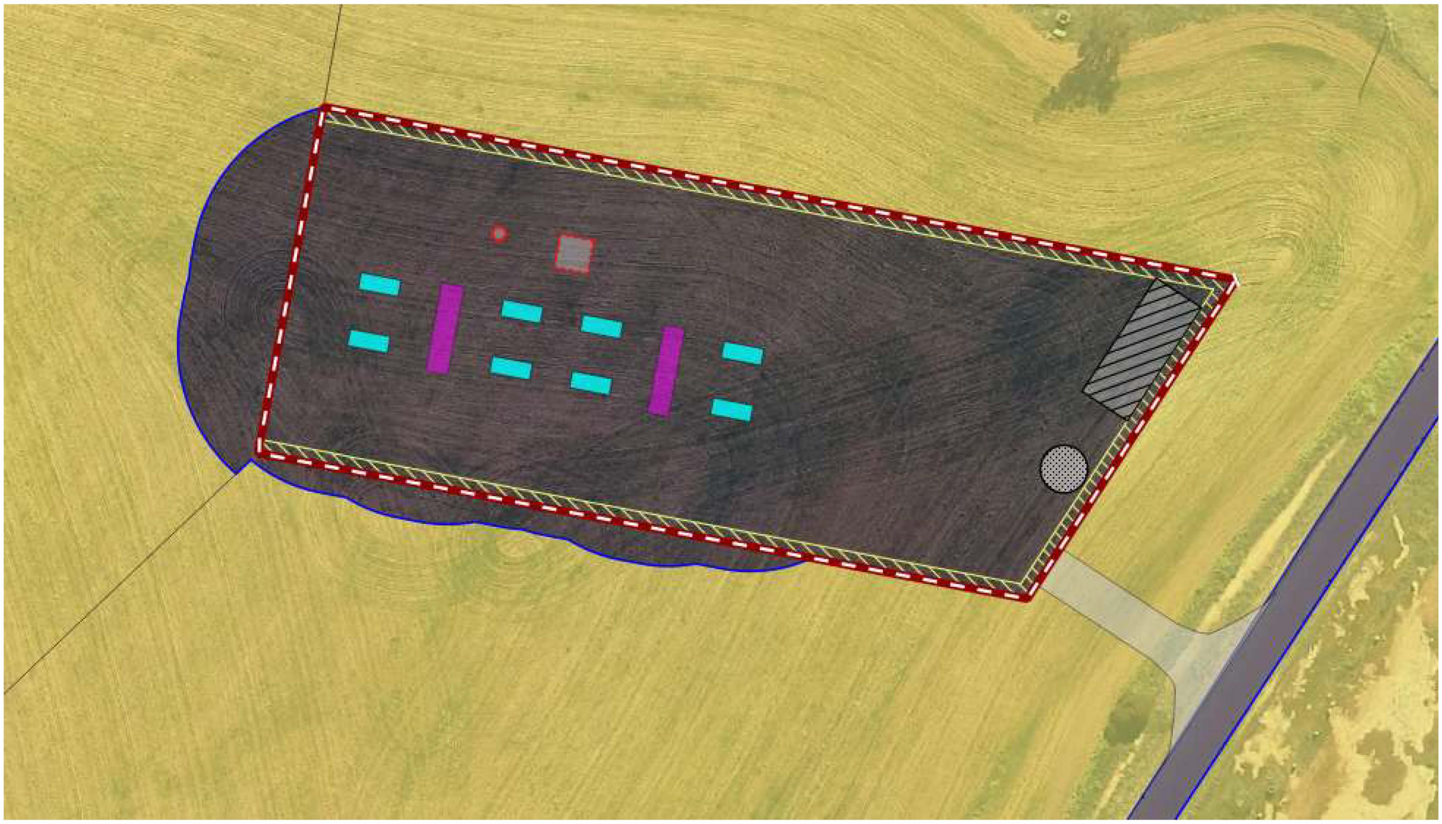
Hope you are doing well.

As part of the Merredin BESS project on **Lot 12 DP21792**, we are required to implement an **Asset Protection Zone (APZ)** for fire safety compliance. This includes maintaining specific vegetation conditions both **within and immediately outside** the project lease area (compound).

To meet these requirements, we kindly seek your approval for **ACEnergy** to carry out vegetation management during the operational stage **at our own cost** in the following areas outside the leased boundary:

- **Up to 15 metres west** of the project compound
- **Up to 6 metres south** of the project compound

Please refer to the area of vegetation management outside the leased boundary:



The main requirement is that **grass within these APZ areas must be maintained at a height of 100 mm or less at all times**, though other vegetation management conditions as set out in the attached guideline will also be followed.

We will source **local suppliers** to undertake this work, including **Mr. and Ms. Pursell**, if applicable and available.

We would be grateful for your written approval allowing ACEnergy to access and maintain these areas for the purpose of APZ compliance throughout the life of the project. Please don't hesitate to let us know if you would like to discuss this further or have any concerns.

Thank you.

Best Regards,

Jane Bai | Senior Project Development Engineer

ACENERGY Pty Ltd

Level 3, 689 Burke Road, Camberwell, 3124, VIC

O: +61 3 9813 2307

M: [redacted]
E:

W: https://www.acenergy.com.au/

**Important Note: The details of any projects being developed by ACEnergy are confidential. They must not be distributed to any third party without the written consent of ACEnergy.*

Appendix C
Additional Information / Advisory Notes

This assessment was undertaken as per AS 3959: 2018. It is important that the current version of AS 3959, is consulted for construction purposes.

This BAL rating is based on the information current at the date of this letter and is valid for 12 months from the date of this letter.

Bushfire Attack Level (BAL) as set out in the Australian Standard 3959 Construction of Buildings in Bushfire-Prone Areas (AS 3959), as referenced in the Building Code of Australia.

Bushfire Attack Level (BAL)	Classified vegetation within 100 m of the site and radiant heat flux exposure thresholds	Description of predicted bush fire attack and levels of exposure	Construction Section as per AS 3959
BAL-LOW		There is insufficient risk to warrant specific construction requirements.	4
BAL-12.5	≤12.5 kW/m^2	Ember attack	3 and 5
BAL-19	>12.5 kW/m^2 ≤19 kW/m^2	Increasing levels of ember attack and burning debris ignited by windborne embers together with increasing radiant heat flux.	3 and 6
BAL-29	>19 kW/m^2 ≤29 kW/m^2	Increasing levels of ember attack and burning debris ignited by windborne embers together with increasing radiant heat flux	3 and 7
BAL-40	>29 kW/m^2 ≤40 kW/m^2	Increasing levels of ember attack and burning debris ignited by windborne embers together with increasing radiant heat flux with the increased likelihood of exposure to flames.	3 and 8
BAL-FZ	>40 kW/m^2	Direct exposure to flames from fire front in addition to radiant heat flux and ember attack	3 and 9

Source: "*AS 3959: 2018 Construction of buildings in bushfire-prone areas*" published by Standards Australia, Sydney.

APPENDIX F LANDSCAPE CONCEPT PLAN

Aerial imagery © Nearmap

APPROVAL ISSUE - 30 April 2025

Notes

IMPORTANT NOTE RE CLARIFICATION:
Tenderers/Contractors are advised to contact this office to confirm/clarify any aspect of the works, incl. any details of the contract documents (incl. this plan) of which they are uncertain. No claim will be accepted on account of failure to do so. IF IN DOUBT ... ASK.

This plan shall be read in conjunction with the ACEnergy Pty Ltd MERREDIN D-BESS drawings.

Rev	Date	Revision Note	By

Issue	Date	Issue Note	By
1	30/4/2025	APPROVAL ISSUE	CW

Surveyors
—
Tel: eMail:

Structural Engineer:
—
Tel: eMail:

Consulting Engineer
—
Mob: eMail:

Project Managers
ACEnergy Pty Ltd
Mob: 0461 546 284 eMail: hk.sicad@acenergy.com.au

Other:
—
Mob: eMail:

Proprietor

ACENERGY

Project
MERREDIN D-BESS
Abattoir Road Merredin
Western Australia

Drawing
Overview/Context Plan

Sheet 1 of 4

Local Authority Shire of Merredin

0 100 200 300 m

Scale 1:4,000 @ A1; 1:8,000 @ A3

Drawn CW Date 22 Apr 2025

North

Project #	Drawing #	Rev
25728	01	

groundcontrol

Ground Control
Landscape Architecture Pty Ltd
ABN 53 776 078 327
PO Box 757 Mansfield Victoria Australia 3724
P 03 5779 1447 E gcla@groundcontrol.com.au

Aerial imagery © Nearmap

APPROVAL ISSUE - 30 April 2025

Notes

IMPORTANT NOTE RE CLARIFICATION:
Tenderers/Contractors are advised to contact this office to confirm/clarify any aspect of the works, incl. any details of the contract documents (incl. this plan) of which they are uncertain. No claim will be accepted on account of failure to do so. IF IN DOUBT ... ASK.

This plan shall be read in conjunction with the ACEnergy Pty Ltd MERREDIN D-BESS drawings.

Rev	Date	Revision Note	By

Issue	Date	Issue Note	By
1	30/4/2025	APPROVAL ISSUE	CW

Surveyors
—
Tel: eMail:

Structural Engineer:
—
Tel: eMail:

Consulting Engineer
—
Mob: eMail:

Project Managers
ACEnergy Pty Ltd
Mob: 0461 546 284 eMail: hk.sicad@acenergy.com.au

Other:
—
Mob: eMail:

Proprietor

Project
MERREDIN D-BESS
Abattoir Road Merredin
Western Australia

Drawing
Landscape Screening Plan

Sheet 2 of 4

Local Authority Shire of Merredin

0 10 20 30 40 m

Scale 1:500 @ A1; 1:1,000 @ A3

Drawn CW Date 22 Apr 2025

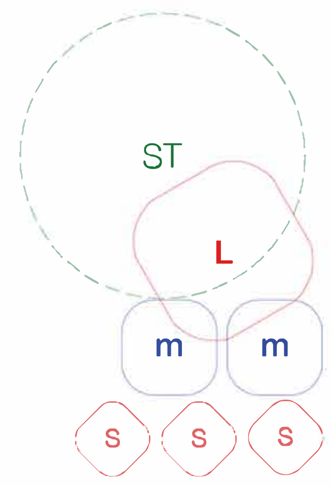
North

Project #	Drawing #	Rev
25728	02	

groundcontrol
Ground Control
Landscape Architecture Pty Ltd
ABN 53 776 078 327
PO Box 757 Mansfield Victoria Australia 3724
P 03 5779 1447 **E** gcla@groundcontrol.com.au

LIFE FORM	INDIGENOUS	SPECIES NAME	COMMON NAME	EST. MATURE HEIGHT	EST. MATURE SPREAD	POT SIZE	QUANTITY
		SMALL TREES					
ST	•	*Eucalyptus burracopensis*	Burracoppin Mallee	5.0	4.0	Hiko	10
ST	•	*Hakea francisiana*	Emu Tree	5.0	4.0	Hiko	8
ST	•	*Pittosporum phylliraeoides*	Weeping Pittosporum	5.0	4.0	Hiko	5
ST	•	*Santalum acuminatum*	Quandong	4.0	4.0	Hiko	5
		LARGE SHRUBS					
L	•	*Acacia acuminata*	Raspberry Jam Wattle	3.5	3.0	Hiko	20
L	•	*Callistemon phoenicius*	Lesser Bottlebrush	3.0	3.0	Hiko	20
L		*Hakea laurina*	Pincushion Hakea	3.0	3.0	Hiko	20
L	•	*Hakea multilineata*	Grass-leaf Hakea	3.5	3.0	Hiko	10
L	•	*Melaleuca macronychia subsp. macronychia*	Long-leaved Honey-myrtle	3.0	3.0	Hiko	16
		MEDIUM SHRUBS					
M	•	*Acacia leptopetala*	Wattle	2.0	3.0	Hiko	6
M	•	*Eremophila maculata*	Spotted Emu-bush	2.0	2.0	Hiko	15
M	•	*Grevillea hookeriana*	Red Toothbrushes	2.0	2.0	Hiko	15
M	•	*Leptospermum erubescens*	Roadside Teatree	2.0	2.0	Hiko	7
M	•	*Senna artemisioides*	Desert Cassia	2.5	3.0	Hiko	15
		SMALL SHRUBS					
S	•	*Acacia hemiteles*	Tan Wattle	1.5	2.0	Hiko	8
S	•	*Calothamnus quadrifidus*	One-sided Bottlebrush	1.5	2.0	Hiko	10
S	•	*Enchylaena tomentosa var. tomentosa*	Ruby Saltbush	1.5	2.0	Hiko	10
			TOTAL PLANTS QUANTITY				200

KEY TO PLANT LIFE FORMS



SMALL TREES

LARGE SHRUBS

MEDIUM SHRUBS

SMALL SHRUBS

Unless otherwise noted, all plants to be planted with Arborgreen 'Greenguard POP' or similar approved tree guards and biodegradable jute weed mats

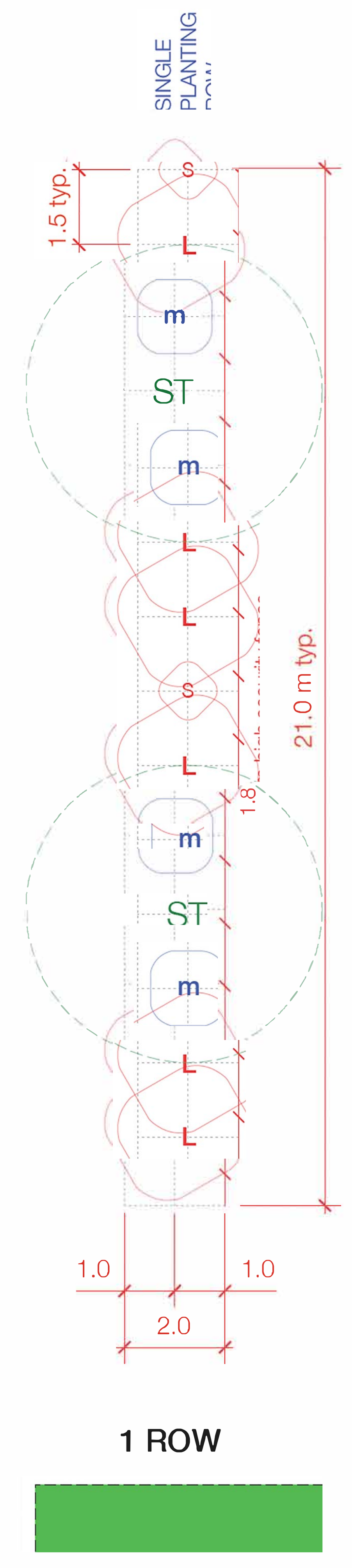
PLANT SET-OUT

Plant species shall be distributed in natural groupings to all planting areas, generally in accordance with plant life-form planting layouts as described in the Vegetation Buffer Detail Sheets as part of this drawing set.

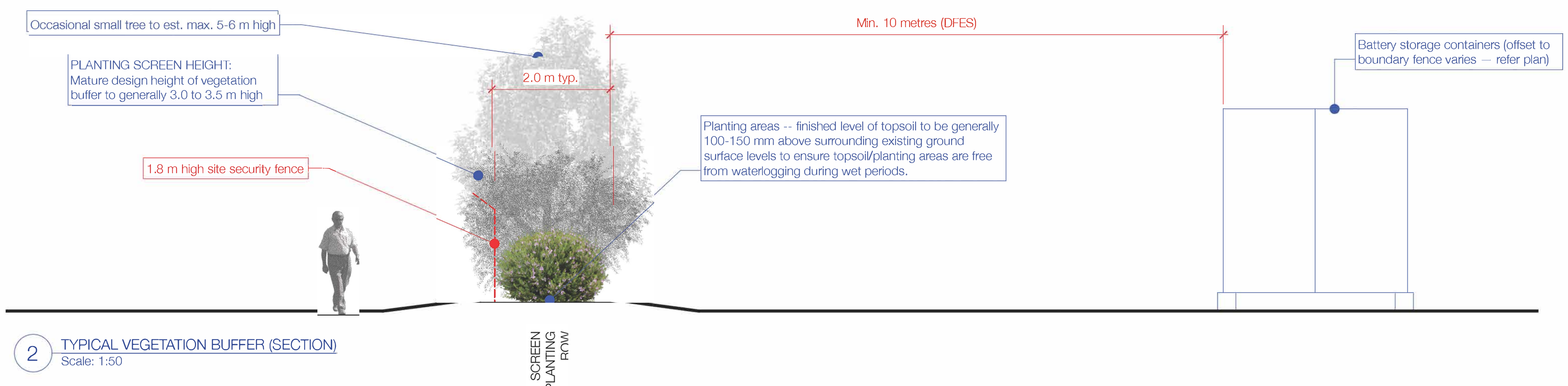
Avoid concentrations of one species in any one area.

Avoid planting more than 5 no. of the same species in any one 21 m long typical planting row.

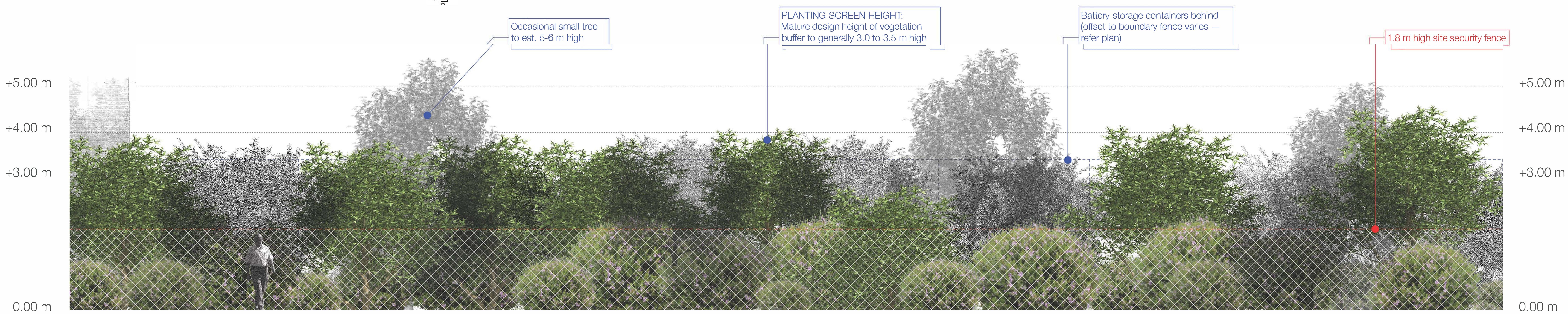
Maximise plant diversity at plant set-out.



1 TYP. VEGETATION BUFFER
Scale: 1:100



2 TYPICAL VEGETATION BUFFER (SECTION)
Scale: 1:50



3 TYPICAL VEGETATION BUFFER (EXTERNAL ELEVATION)
Scale: 1:50

APPROVAL ISSUE - 30 April 2025

Notes

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This plan shall be read in conjunction with the ACEnergy Pty Ltd MERREDIN D-BESS drawings.

Rev	Date	Revision Note	By

Issue	Date	Issue Note	By
1	30/4/2025	APPROVAL ISSUE	CW

Surveyors
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Consulting Engineer
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Mob: eMail:

Proprietor

Project
MERREDIN D-BESS
Abattoir Road Merredin
Western Australia

Drawing
Landscape Screening

Sheet 3 of 4

Local Authority Shire of Merredin

Scale As shown @ A1
Drawn CW Date 22 Apr 2025
Project # 25728 Drawing # 03 Rev

North

groundcontrol

Ground Control
Landscape Architecture Pty Ltd
ABN 53 776 078 327

PO Box 757 Mansfield Victoria Australia 3724
P 03 5779 1447 E gcla@groundcontrol.com.au

LANDSCAPE WORKS CONSTRUCTION NOTES:

1 WORKS BY CIVIL/OTHERS
All construction & civil works incl. demolition, building works, bulk earthworks, drainage infrastructure, road pavements, site electrical & battery facilities & associated infrastructure, fencing and other related works.

The civil contractor will ensure the following minimum depths of site topsoil are provided for the landscape works:

- Planting areas -- min. 150 mm depth site topsoil.
- Finished level of topsoil to be generally 100-150 mm above surrounding existing ground surface levels to ensure topsoil/planting areas are free from waterlogging during wet periods.

2 INSURANCES
Provide certificates of currency for Public Liability Insurance (min. $20M) and Workcover insurance (min. $20M) to the Superintendent prior to commencing works. Each certificate of currency shall note the Proprietor as an interested party.

3 ROAD OPENING PERMIT
Apply to the responsible authority for a road opening permit (if required), incl. the payment of all fees and charges re same. An approved copy of the approved road opening permit shall also be provided to the Superintendent prior to works commencing on site.

4 LANDSCAPE PRE-COMMENCEMENT MEETING
The Contractor shall Initiate, coordinate and attend a pre-commencement meeting with Council, Proprietor & Superintendent, incl. achieving compliance with all Council & specified requirements, checklists, insurances, approvals, etc.

5 TRAFFIC MANAGEMENT
If required, prepare and submit to the responsible authority a traffic management plan to their satisfaction, incl. the payment of all fees and charges re same. An approved copy of this plan shall also be provided to the Superintendent prior to works commencing on site. Implement approved traffic management plan during the duration of the Works on site.

6 LOCATE EXISTING SERVICES
Locate all existing services prior to commencing works, contacting Dial Before You Dig, the project civil engineers/contractor and/or the relevant authorities re same as required. Identify all overhead services prior to commencing works.

7 SET OUT THE WORKS
Accurately set the works out as per the documentation set.

8 SOIL TESTING & AMELIORATION
Undertake soil sampling & testing from an approved ag. soil testing laboratory, incl. seeking recommendations for fertilising & ameliorating planting zone to improve soil pH, NPK balance, trace elements, etc., including the addition of organic matter to improve structure and/or water-holding capacity. Any recommended adjustments must be made to improve the soil conditions for native tree & shrub planting.

9 PLANTING AREAS PREPARATION -- INITIAL
These works to be done ideally in LATE FEBRUARY/MARCH of the planting year:

- Eradicate broadleaf, woody and noxious weeds from all planting areas using selective, non-residual herbicides. Manual removal of larger woody weeds may be required -- inspect site to confirm extent.
- Rip along planting line to 2.0 m wide to min. 300 mm depth with a Yeomans/Keyline plough with tynes at max. 750 mm centres to break up/aerate natural subgrade and to relieve compaction, grade & level.
- Apply fertilisers and additives at rates recommended by soil test results.
- Cultivate planting lines to break up soil clods and provide an appropriate planting medium.
- DO NOT WORK WET SOIL. Remove any deleterious material brought to the surface, consolidate soil and grade soil surface to even grades, free of any depressions or undulations.
- Apply Amgrow Wettasoil Professional Granular or similar approved soil wetting agent (applied at manufacturer's recommended rates) to any soils showing evidence of non-wetting.

10 PLANTING AREAS PREPARATION -- SECONDARY
These works to be done ideally in APRIL/MAY of the planting year:

- Eradicate broadleaf, woody and noxious weeds from all planting areas using selective, non-residual herbicides. Manual removal of larger woody weeds may be required.
- Re-cultivate planting lines to break up soil clods and provide an appropriate planting medium.
- DO NOT WORK WET SOIL. Remove any deleterious material brought to the surface, consolidate soil and grade soil surface to even grades, free of any depressions or undulations.
- Apply Amgrow Wettasoil Professional Granular or similar approved soil wetting agent (applied at manufacturer's recommended rates) to any soils showing evidence of non-wetting.

11 PLANT SUPPLY
All plants shall be healthy, free from any pests or diseases, be attractive, well grown and well formed plant specimens and shall have a healthy, well formed root system commensurate in size with the foliage mass (root systems must not be pot bound). Plant container sizes shall be as listed in the detail planting schedule, but shall be min. hiko, ViroTube or 50 mm round/square pot size.

The planting contractor shall inspect all plants on delivery to site and shall certify in writing to the Superintendent that all plants supplied are as described above and are accepted by the planting contractor for planting in this project.

12 PLANTING
Set out plants as documented. Individual holes are to be dug (tree planter, mini-auger, etc.) in the prepared planting areas of sufficient size to easily accommodate the plant's root system and relieve any polishing. Create broad, shallow watering bowl to ALL plants to facilitate effective watering (min. 5 litre capacity). All plants shall be watered-in immediately after planting and at such times during the Contract period as is required to maintain growth free of water stress. Planting medium must be moist - do not plant into dry soil. Handle and plant all plants at all times in accordance with best horticultural practice.

13 FERTILISING
Refer maintenance section.

14 WEED MATS/MULCHING
Supply & install to each plant a 600 x 600 mm TreeMax or similar approved jute weed mat. Installation strictly to manufacturer's recommendations. Supply & spread min. 75 mm depth x min. 600 mmØ approved organic mulch to each plant.

15 TREE/PLANT GUARDS
Supply & install to each plant Arborgreen 'Greenguard POP' 450 x 200 mm (sides): Code: 'GRGRDPOP-TRI' or similar approved 100% biodegradable tree guard, incl. 1 no. x 25 x 25 x 750 mm HWD stake per guard to all plants. Ensure stake extends min. 300 mm into ground. Installation strictly to manufacturer's recommendations.

16 GRASSING (IF REQUIRED)
Some areas of grass seeding may be required and will be directed and quantified by the Superintendent.

Do not sow seed in periods of extreme heat, cold or wet, or where wind velocities are excessive unless otherwise approved. Seed mix shall be as follows:

- TURF-TYPE REGENERATING PERENNIAL RYEGRASS 95% by count
- TURF-TYPE TALL FESCUE 3% by count
- SUB CLOVER 1% by count
- WHITE CLOVER 1% by count

Seeding rate shall be min. 30 gms per m2. Apply seed evenly – seed application shall be via direct drilling or by other approved methods. Seeding shall be programmed when there is a period of anticipated weather conditions (i.e. rain) that will provide the best chance for germination of grass seed. Any areas affected by heavy rain, wind removing seed or other cause shall be re-seeded as specified to achieve an even cover of grass.

Slash grass when growth height has reached 100 mm or otherwise as directed by Superintendent. Should all the areas not require cutting at one time, complete all further cuts as necessary until 100% of the area has achieved successful coverage and all areas have received at least first cut.

17 PRACTICAL COMPLETION COORDINATION
The Contractor shall Initiate, coordinate and attend a Practical Completion meeting with Council, Proprietor & Superintendent, incl. achieving compliance with all Council & specified requirements, checklists, insurances, approvals, etc.
NOTE: Min. 3 no. working days notice is required for a Practical Completion meeting.

18 LANDSCAPE ESTABLISHMENT MAINTENANCE PERIOD
Maintain the contract works from the Date of Practical Completion to the Date of Final Completion/hand-over.

Maintenance shall include care of the contract area by accepted horticultural practices, and rectification of any defects that become apparent during this period. Maintenance tasks to be carried out during the maintenance period shall include, but shall not be limited to, slashing, watering as required, weed control, pest & disease control & management, tree/plant guard adjustment/replacement as required, rubbish removal.

WEED CONTROL – PLANTED AREAS:
In planted areas, poison all broadleaf, noxious & woody weeds as they appear. Slashable grasses are to be retained generally between planting rows. Selective herbicides shall be nominated by the Contractor and approved by the Superintendent prior to use. Non-selective herbicide shall be Monsanto 'Roundup BIACTIVE' glyphosate-based herbicide -- standard 'Roundup' is NOT to be used. NO OTHER HERBICIDE SHALL BE USED WITHOUT PRIOR APPROVAL. All herbicide applications shall use NuFarm 'Spraymate or similar approved marker dye admixture and shall be handled and applied strictly according to manufacturer's recommendations, recommended rates and directions.

GRASS MANAGEMENT – PLANTED AREAS:
Slash all areas between plants in rows and min. 1.5 m along all outside edges of all planting zones on a regular basis to maintain grass height to max. 100 mm. Slashing shall comply with all local Council and DFES guidelines re grass heights.

JUTE MAT, MULCH & TREE/PLANT GUARDS:
Maintain jute mat, mulch and tree/plant tree guards for first two summers minimum, repair and replace as required during this period.

PLANT REPLACEMENT:
Replace any failing, failed or dead plants during the maintenance period. The Superintendent and the Contractor will inspect the full planting areas at the end of each summer and will identify the number and species of plants that are failing, have failed/died. The Contractor shall replace all such plants identified.

WATERING:
The Contractor shall ensure all plants planted/maintained under this contract receive adequate (but not excessive) watering to maintain optimum growth and health. Watering shall be localised to each plant, not broad spraying across the entire planting area, to limit weed/grass growth between planting rows.

Watering shall be either manually via watercart/hose as required OR via a drip irrigation system, using Netafim 'UniRAM AS' inline dripline @ 1.6 LPH with emitter spacing of 400 mm -- one surface dripline per planting row. Drip irrigation system to be designed by an accredited irrigation designer and connect to an available clean water source, incl. filtration at source.

All plants shall be watered as required for at least the FIRST TWO SUMMERS to aid in establishment of healthy root systems and foliage growth, with further waterings if required during late spring and/or early autumn or at any other time of the year based on prevailing climatic conditions. Further waterings may be needed beyond this minimum establishment watering should prevailing climatic conditions deteriorate with potential to lead to deterioration of plant growth, health or plant deaths (e.g. severe drought, El Niño conditions, etc.).

WETTING AGENT:
Apply Amgrow Wettasoil Professional Granular or similar approved soil wetting agent (applied at manufacturer's recommended rates) to any soils showing evidence of non-wetting.

FERTILISING:
All plants (excluding Proteacea family) shall be fertilised with Scotts 'Osmocote® Plus Trace Elements: Native Gardens' (NPK 21.8 : 0.7 : 7.2) or similar approved at the manufacturer's recommended rates. Fertiliser shall be locally spread on soil surface around plants during planting operations. If unsure which plants are in the Proteacea family – ASK.

Allow for one fertiliser application in Year 1 and second application in Year 2.

PESTS & DISEASES:
Regularly monitor all plants grasses planted/maintained under this contract for evidence of pest and/or disease attack -- identify and treat any/all problems arising.

RABBITS, HARES, KANGAROOS, ETC.:
Identify any predation by rabbits, hares and other pests with potential to damage or destroy the landscape works under this contract. Take all necessary steps, within local authority regulations and/or guidelines, to limit or eradicate predation. Maintain all tree guards in good condition to limit rabbit/hare/kangaroo/other damage to plants with installed guards.

APPROVAL ISSUE - 30 April 2025

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1	30/4/2025	APPROVAL ISSUE	CW

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Other:
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Mob: eMail:

Proprietor

ACENERGY

Project
MERREDIN D-BESS
Abattoir Road Merredin
Western Australia

Drawing
Landscape Specification Notes

Sheet 4 of 4

Local Authority Shire of Merredin

Scale N.T.S.
Drawn CW Date 22 Apr 2025
Project # 25728 Drawing # 04 Rev
North

groundcontrol

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APPENDIX G STORMWATER DRAINAGE STRATEGY

DOCUMENT AUTHORISATION					
Revision	**Revision Date**	**Proposal Details**			
A	28/03/25	Issued for Initial Client Review			
B	06/05/25	Updated for Revised Client Layout			
C	14/05/25	Amended to Suit Client Comments			
Prepared By		**Reviewed By**		**Authorised By**	
G. Kleyweg	GK	C. Kleyweg	CK	C. Kleyweg	CK

CONTENTS

TABLES

FIGURES

1. PREMISE STORMWATER DRAINAGE STRATEGY

Note: This document is copyright to Premise. The information provided in this stormwater drainage strategy report has been developed by Premise over several years and has been presented in accordance with the requirements of several of our clients. The information in this report is therefore intended to be commercial in confidence and is not to be shared with external parties at any time, unless a Director of Premise provides written authorisation that the document may be shared at a specific time to a specific party, or parties. The terms and conditions associated with the receipt of this material is that it is not shared or distributed without our express, and written consent.

If you have received this information in error, Premise must be notified immediately. We request the immediate destruction of all formats of this document, inclusive of paper and electronic copies should you have received this document in error.

1.1 Location

Table 1 – Location Information – Lot 12 Abattoir Rd, Merredin

Lot Number	Area	Road Name	Suburb	Locality (Shire, City, etc.)
12	32.33ha*	Abattoir Road	Merredin	Shire of Merredin

*Note: 32.33ha is the whole area of Lot 12 Abattoir Road. However, the catchment areas being modelled do not include the entirety of the lot due to drainage only needing to be provided for the Distributed Battery Energy Storage System (D-BESS) as shown in the report and drainage calculations.

Figure 1 – Proposed Development Area Lot 12 Abattoir Road, Merredin

The subject site is surrounded by farmland and existing rural development.

The north-east corner of the land is proposed to be developed to operate a Distributed Battery Energy Storage System (D-BESS). The rest of the land does not currently have plans for development.

The following points are pertinent to the development of the subject landholdings: -

- The land is presently zoned as Farmland
- There are no nominated wetlands on the subject landholdings. There is an existing swale along the northern boundary of the subject site draining to the west. This swale acts to protect the site from large volumes of overland flow from upstream catchments.
- The area is considered "flood-prone" in the 1% ARI event due to being within 300m of the 1 in 100 AEP Floodplain Development Control Area. This is shown in the figure below and will be further explained in the following section 1.2 Stormwater Drainage Strategy.

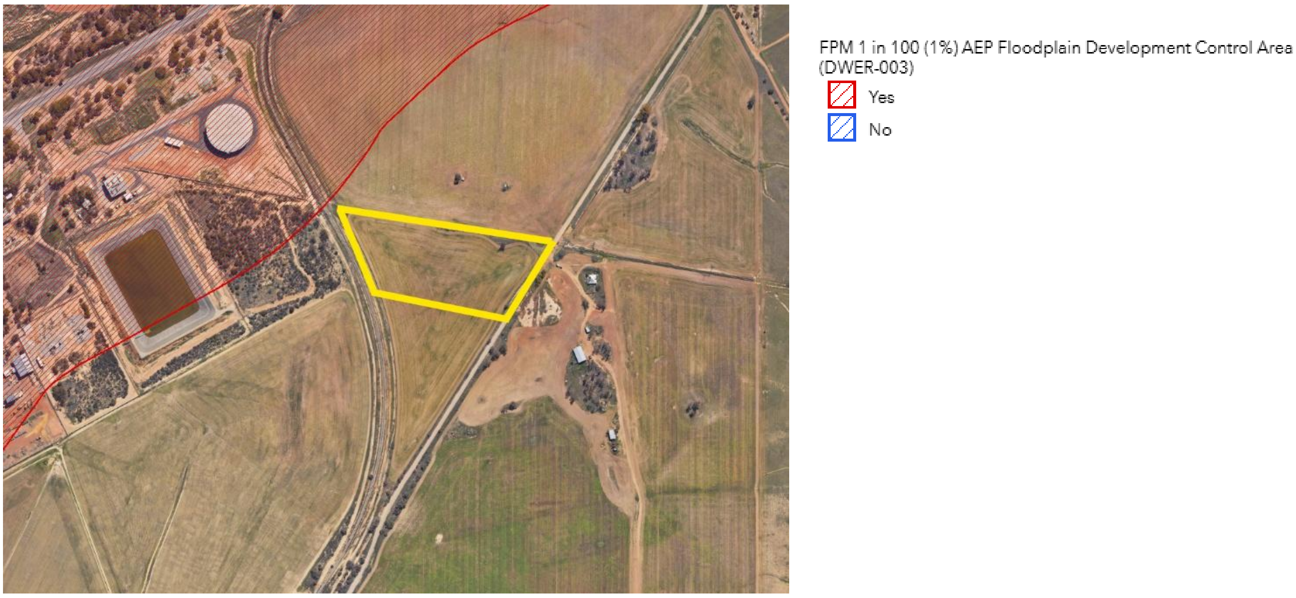


Figure 2 – 1 in 100 AEP Floodplain Development Control Area – Lot 12 Abattoir Road, Merredin

In this Stormwater Drainage Strategy, we have nominated overland flow control measures to protect the proposed development area, and we have set levels for critical infrastructure to ensure an appropriate 0.15m clearance to 1% AEP flood levels as they traverse the site. Swale storage is calculated in accordance with the commentary in the following sections.

1.2 Stormwater Drainage Strategy

The Stormwater Drainage Strategy for the Study Area is for the natural overland flow paths to flow into a strategically placed catch drain which will lead to a swale that has been designed to accommodate the difference between the pre- and post-development 1 in 100-year flows. This difference in pre- and post-development flows is effectively the proposed flexible pavement layers over the 6,500m^2 pad area for the proposed installation of critical infrastructure for the BESS project.

While developing, it is crucial to not impact any pre-development flows. This drainage strategy has been designed with this in mind, and the proposed drainage will flow in the direction of existing flow patterns.

A portion of the lot to the east of the Study Area naturally flows toward the site. This has been shown on our Major Catchment Plan drawing which accompanies this report. This catchment will therefore sheet flow towards the subject site and across Abattoir Road. This area is shown in cyan blue below which would impact the proposed works area.

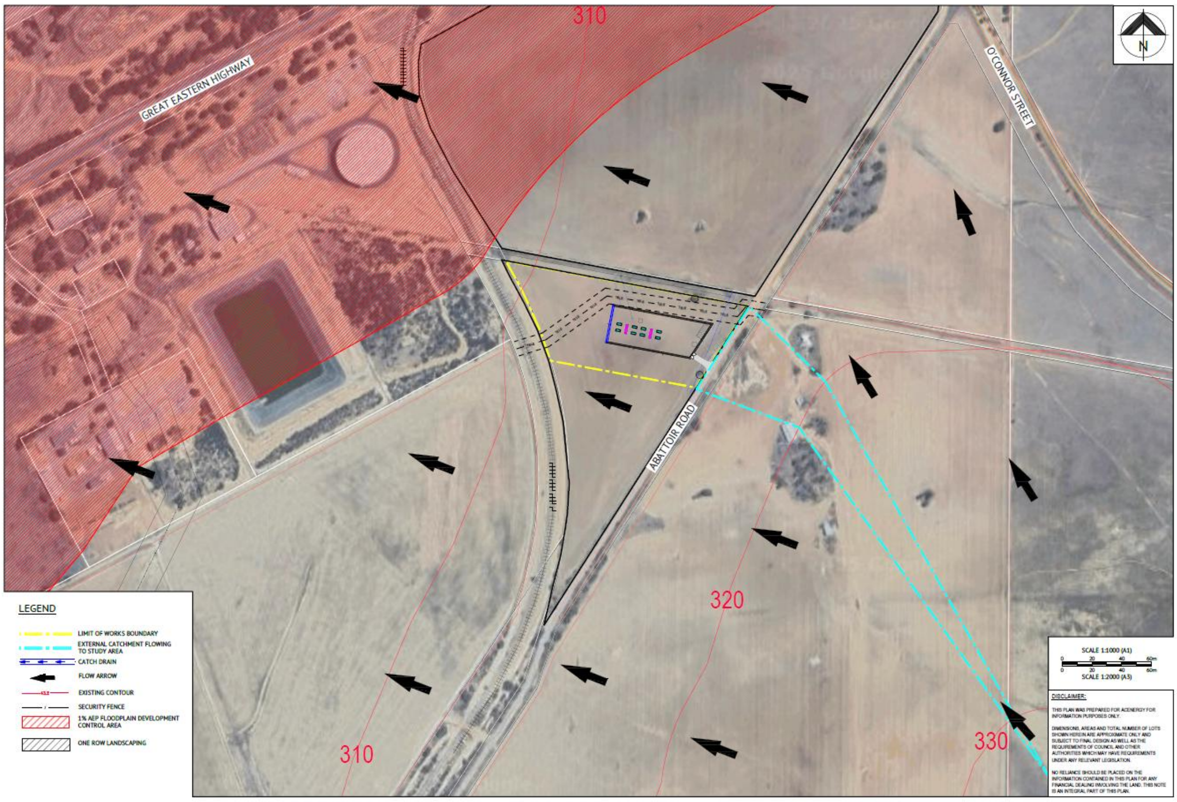


Figure 3 - Major Catchment Plan

As explained in Section 1.1 Location and in the above Major Catchment Plan, the Study Area is adjacent to a 'flood-prone' area due to being within 300m of the 1 in 100 AEPI Floodplain Development Control Area. This Floodplain Development Control Area is shown hatched in red. The subject site offers strong continual slopes from regional highpoints around RL 332 to the southeast. These gradients lessen further to the west of the site as evidenced by the red shaded area which has the higher likelihood of inundation in major storm events. Therefore, a simple strategy of diverting the upstream catchment around the proposed BESS hardstand and infrastructure, and the provision of a suitably sized catch basin at the western, or downstream end of the BESS hardstand is suitable.

The image below shows the general overland flow across the site, and the proposed drainage strategy to be implemented within the proposed pad for the BESS infrastructure. 135mm depth swales are to be located within the landscape buffers. This low flow swale should be located centrally within the landscape buffers with vegetation planted off centre to allow the swale to function for the critical storm events.

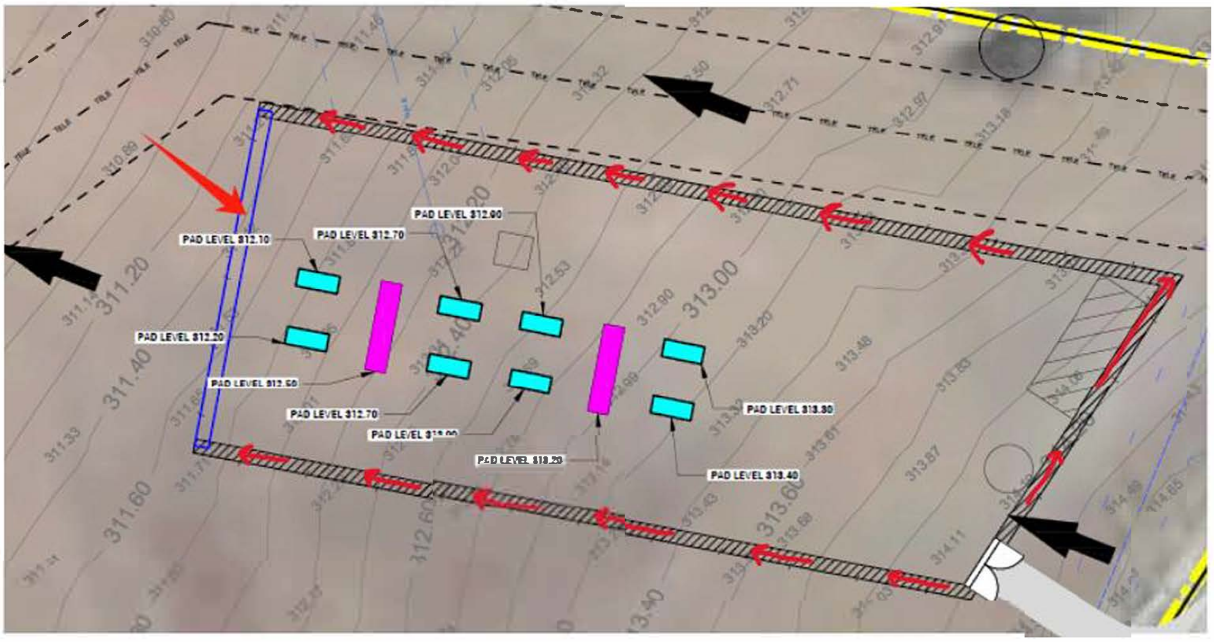


Figure 4 – Drainage Strategy – Lot 12 Abattoir Road, Merredin

As nominated earlier, we believe the pad level should be elevated a minimum of 150mm above the existing levels of the site. This would enable a simple overland flow of pre-development flows to continue around the proposed hardstand and infrastructure.

Does the location have suitable flow-paths for existing overland flow?	**YES.** The subject site is grading toward the west and north-west, away from the proposed hardstand and infrastructure that is to be developed.
Can infiltration drainage techniques be used?	**NO.** Desktop reviews and site photos received from the client have been used to determine the infiltration of the Study Area. A value of 0.5m/day has been utilised which is conservatively low, however the presence of gravel / gravelly clays on the site leads us to believe that the soil isn't suitable for infiltration techniques and therefore a low permeability should be used in our calculations.
Do existing stormwater drainage systems exist in site vicinity?	**YES.**

[redacted]	There is an existing 0.6H x 1.85W drain to the west of the Study Area as well as an existing swale that runs along the north of the Study Area. This existing swale helps protect the site from larger upstream catchment flows, hence the external catchment shown in our Major Catchment Plan is isolated and thin. The majority of the upstream catchment through the subject landholding does not impact the proposed 6,500m² building pad.

1.2.1 DEFINE INFORMATION REQUIREMENTS

The following information has been sourced as part of this study, and utilised in determining the Desktop Stormwater Drainage Study: -

- **Aerial Imagery** – Reviewed from Google Maps
- **Existing Rainfall Data for Merredin** – The Bureau of Meteorology keeps detailed information for a range of centres in Australia.

The following table is taken from the Bureau of Meteorology and shows detailed rainfall statistics for the nearest major station at Merredin, with statistics collated since 1903.

Table 2 – Average Monthly Rainfall Statistics

Month	*Mean Monthly Rainfall (mm)
January	14.5
February	15.7
March	21.4
April	22.8
May	40.0
June	48.5
July	50.0
August	39.4
September	25.3
October	18.5
November	15.2
December	13.7
Annual	**325.0**

Ref: Monthly Rainfall - 010092 - Bureau of Meteorology

The IFD chart below is taken from the Bureau of Meteorology for Merredin (Ref: Rainfall IFD Data System: Water Information: Bureau of Meteorology

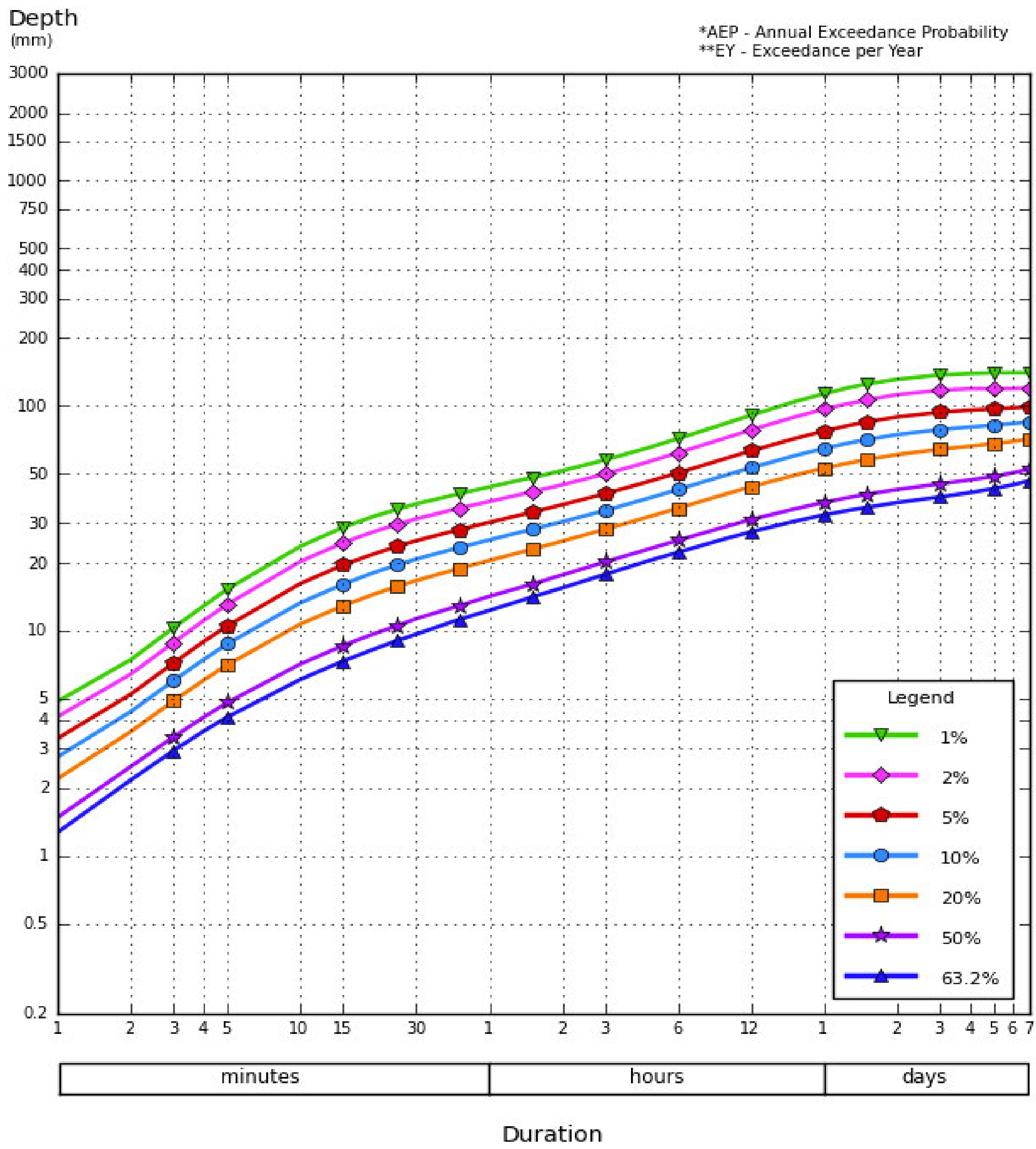


Figure 5 – Bureau of Meteorology IFD Chart – Merredin

1.2.2 POST DEVELOPMENT COEFFICIENTS OF RUNOFF

The following table provides the detail of runoff coefficients used in the stormwater drainage modelling for this Desktop Stormwater Review: -

Table 3 – Proposed Post-Development Runoff Coefficients

63.2% AEP	18.1% AEP	1% AEP
0.50*	0.50*	0.60*

*NOTE: These coefficients have been used for the area that is proposed to be developed (within the security fence). The rest of the Study Area has been kept at the pre-development coefficient of 0.2 for all calculations.

1.2.3 DETAILED HYDROLOGICAL ANALYSIS – POST DEVELOPMENT

Premise have run a series of design checks to satisfy the Shire of Merredin's requirements that the differences between the pre- and post-development storm events are managed for storm events falling on the proposed BESS infrastructure pad. Our first analysis is to use a synthetic hydrograph to determine appropriate basin storage on the western edge of the proposed BESS infrastructure pad. The critical design elements are: -

Table 4 - Critical Design Elements for the Proposed 1% AEP Storage

Item	Notes
Basin Measurements	50m x 2m
Side Slopes	1 in 3
Basin I.L.	311.0m AHD
Coefficient of Runoff	0.5 (clay / gravelly clay / gravels)
Mannings Coefficient of Runoff (n)	Grass = 0.03 Compacted limestone / road base = 0.025

On the following pages are tables showing the synthetic hydrograph outputs for the 1% AEP.

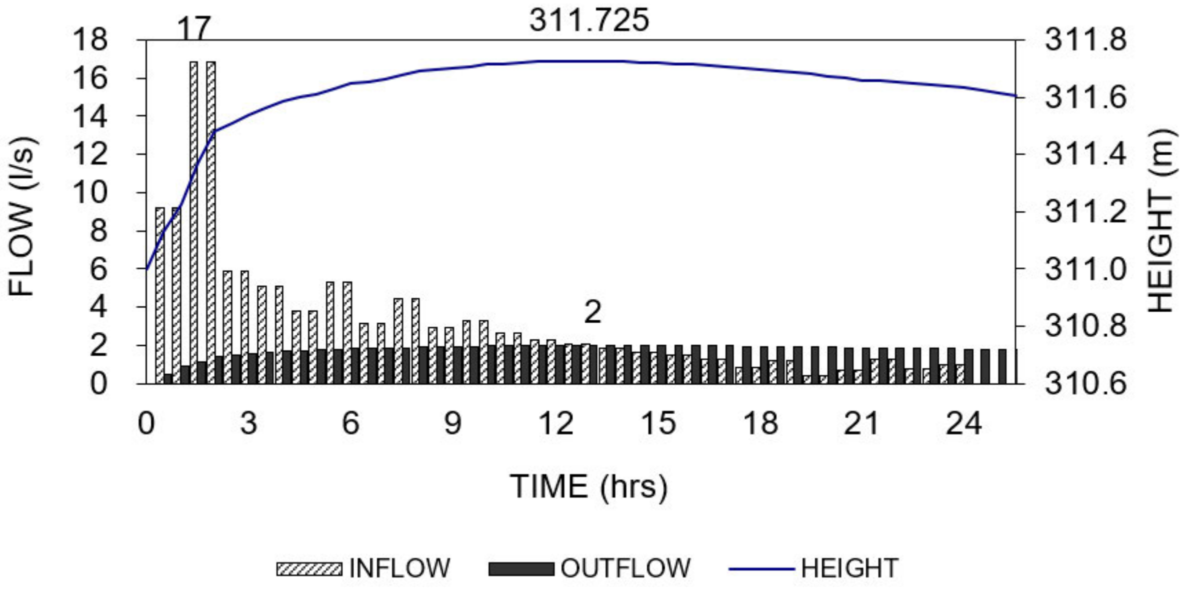


Figure 6 – Inflow-Outflow 100Yr 24Hr Event

The following graph shows the relationship between outflow, storage and height. The outflow in this example is infiltration into the soil. The model is conservative in that it doesn't allow for evaporation from wind or solar energy.

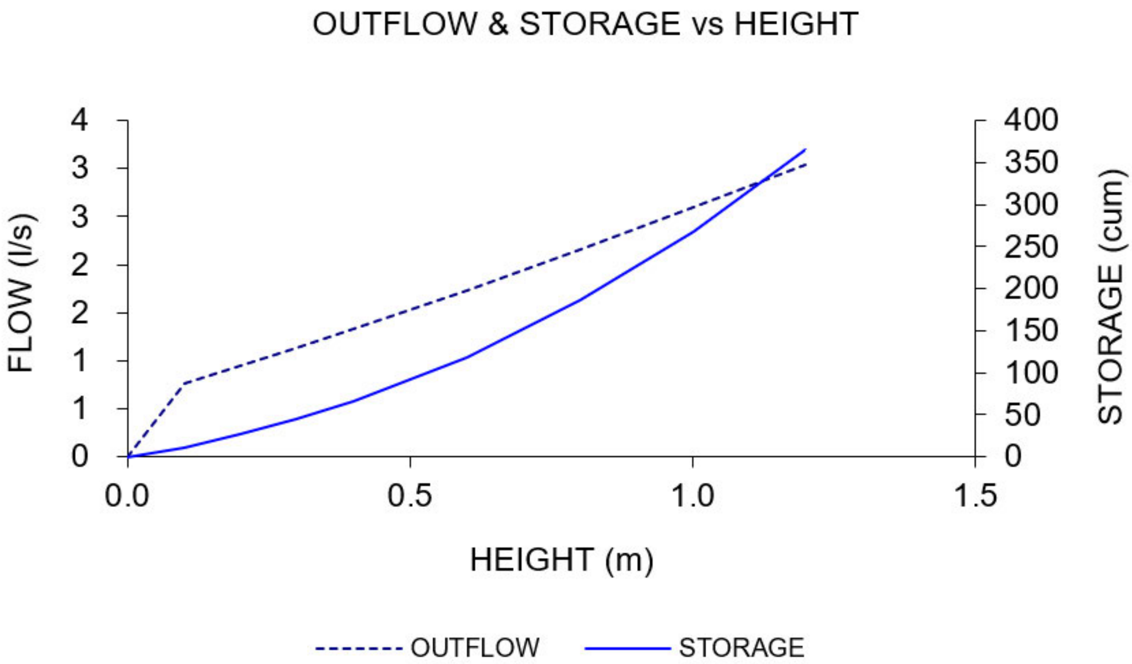


Figure 7 – Outflow and Storage vs Height (100Yr 24Hr)

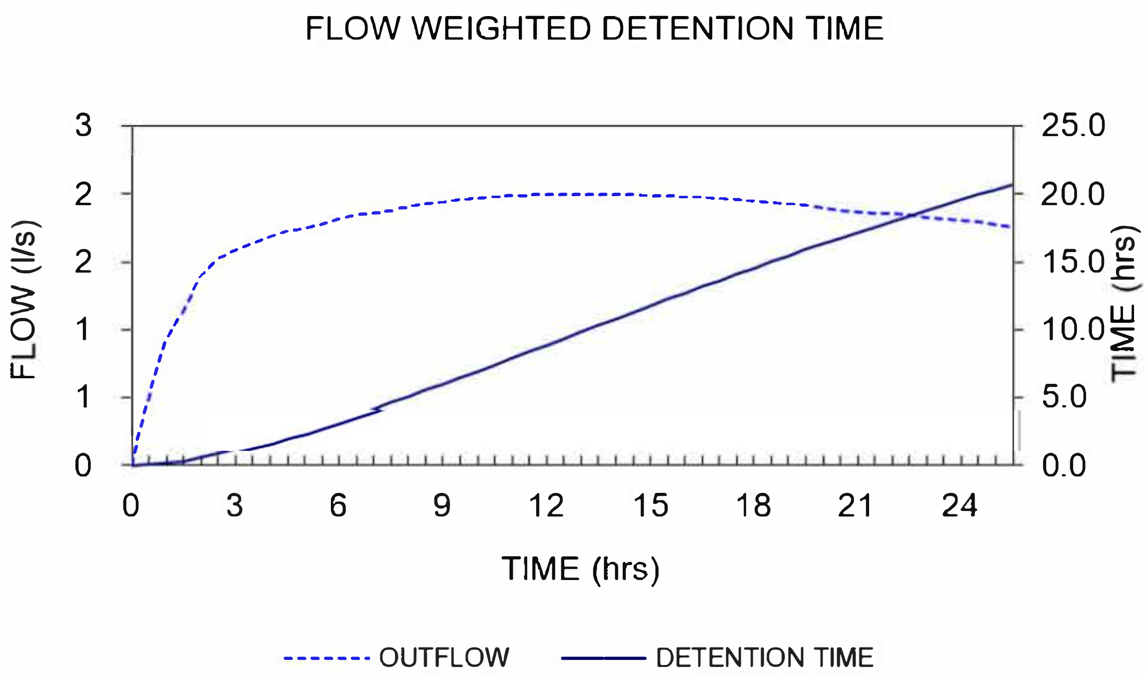


Figure 8 – 1% AEP Hydrograph (24 Hr)

The basin has been designed to accommodate the 1% AEP event shown in the graphs above. This means the design is robust for all storm events, and the catch drain system will protect the proposed BESS infrastructure pad from all external catchments.

The total area of the site is 32.33ha, however the contributing catchment at 26,567m² and 6500m² denoted as the proposed BESS Infrastructure Pad area. The remainder of the site will be left undeveloped and is therefore outside of the calculations presented in this report.

Premise have run a series of design checks utilising a set of drainage spreadsheets. The table below is based on: -

- Soil infiltration rate of 0.5m/day.
- Design Retention Volume = 164m3 for the 1% AEP.
- The proposed swale will have a depth of 0.725m for the 1% AEP and will then allow over-topping to maintain pre-development flows.

Table 5 – 1%, 18.1% and 63.2% AEP Drainage Calculations

Catchment Calculation	Equivalent Area (ha)	Time (hrs)	Catch Swale IL	Depth (m)	Storage Volume Required (m³	T.W.L
Lot 12 Abattoir Road, Merredin						
1% AEP	0.260	24	311.00	0.725	161	311.725m
18.1% AEP	0.195	12	311.00	0.313	47	311.313m
63.2% AEP	0.195	6	311.00	0.179	23	311.179m

1.2.4 MANAGEMENT OF OVERLAND FLOWS AND FLOW DEPTH CALCULATIONS

The second phase of the drainage design is to review the likely depth of flows across the proposed BESS Infrastructure Pad to ensure critical infrastructure is stored above the likely sheet flows for each storm. Premise personnel have developed drainage calculations utilising the rational method and 2016 IFD charts and rainfall data from the Bureau of Meteorology for Merredin. To determine catchment depth of flow characteristics over a total catchment, we have broken the catchment into nodes in accordance with standard drainage design principles. The nodes in the drainage catchment are shown in the Major Catchment Diagram below: -

At each of the nodes, we have determined the following: -

- The terrain slope
- The Mannings n coefficient
- Total length of catchment
- Total area of the catchment
- Time of concentration
- Rainfall intensity for the appropriate storm duration

The outputs we then measure at each point in the catchment are the depth of flow and the velocity of that flow. These outputs allow us to set the critical infrastructure 150mm above the 1% AEP sheet flow.

Table 6 - Sheet Flow and Depth of Flow Calculations (1% AEP)

Catchment Node	Depth of Flow (mm)	Side Slopes	Flow Width (m)	Mannings 'n'	Slope (%)	Time of Concentration (min)	Flow Velocity (l/sec)
Ch 0.0	n.a.	3%	n.a.	0.025	n.a.	0	n.a.
Ch 710	13	3%	20.0	0.025	2.4	39.42	68.9
Ch 740	100	1 in 3	1.1	0.025	2.43	40.22	71.8
Ch 870	135	1 in 3	1.31	0.03	2.38	44.62	127.3
Sheet Flow	12	1%	50	0.025	1.97	13.96	128.9

The calculations from Ch 0.0 to CH 870 above enable Premise to confirm diversion swales can form part of the landscaping along the edges of the BESS Infrastructure Pad. The depth of flow in these swales is insignificant at a maximum of 135mm.

The sheet flow calculation in dark red in the last row of Table 6 above is a calculation showing the depth of sheet flow in the 1% AEP across the BESS Infrastructure Pad. This calculated depth at 12mm confirms the 150mm minimum clearance above proposed pad levels is sufficient to protect infrastructure.

1.2.5 SUMMARY

The drainage calculations above and attached in the appendices show that the drainage system is robust. Therefore, Premise believe that this drainage strategy will adequately manage flood risk while keeping pre-development flows to their natural flow paths.

As mentioned earlier in this report, we believe it is prudent that upon topsoil stripping, the Contractor provides a finished surface level for the BESS Infrastructure Pad that is 150mm above the existing surface level.

Premise

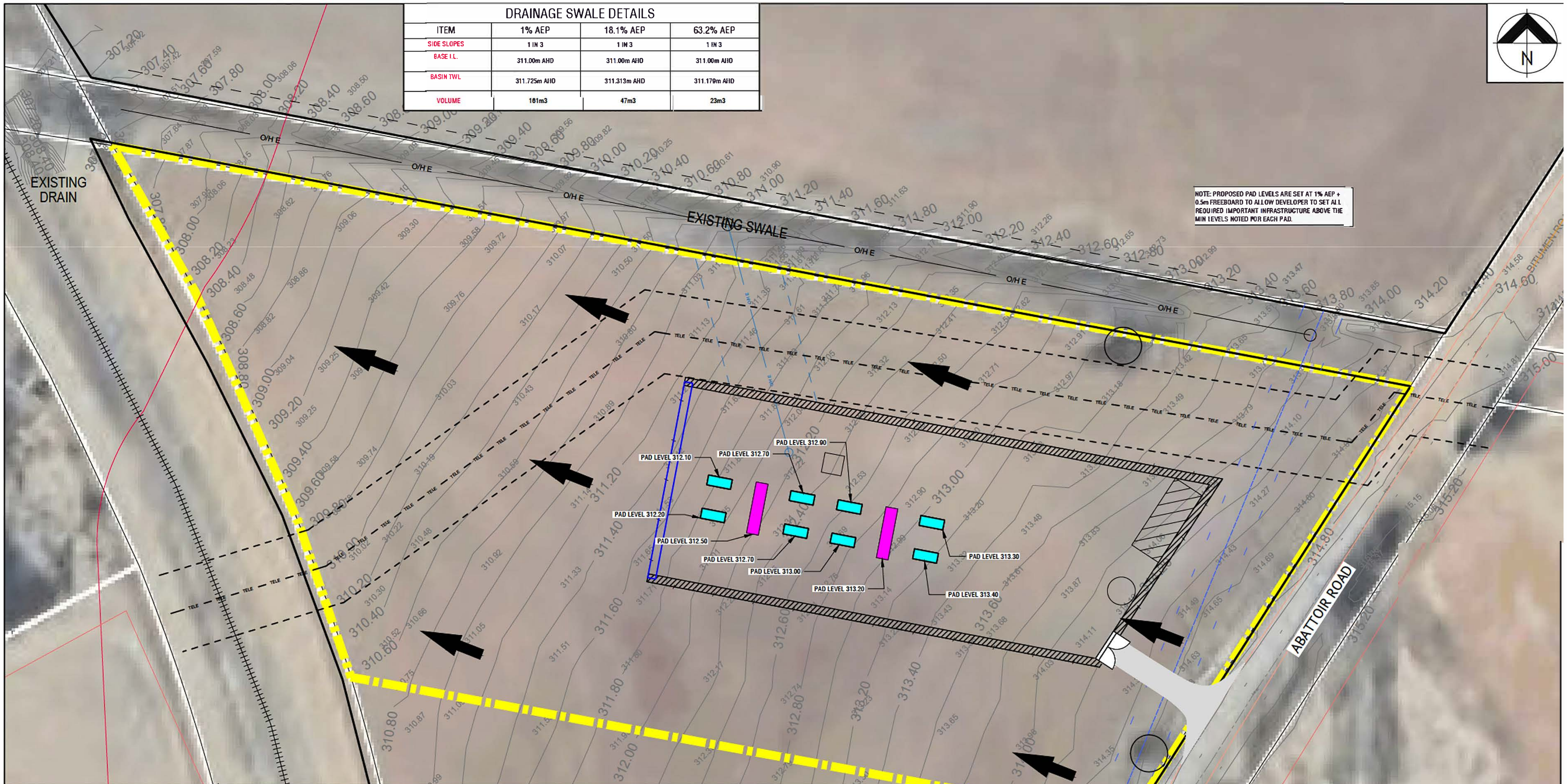
Appendix A

ENGINEERING DRAWINGS


310
GREAT EASTERN HIGHWAY
O'CONNOR STREET
N
ABATTOIR ROAD
320
310
330
LEGEND
LIMIT OF WORKS BOUNDARY
EXTERNAL CATCHMENT FLOWING TO STUDY AREA
CATCH DRAIN
FLOW ARROW
EXISTING CONTOUR
SECURITY FENCE
1% AEP FLOODPLAIN DEVELOPMENT CONTROL AREA
ONE ROW LANDSCAPING
SCALE 1:1000 (A1)
0 20 40 60m
SCALE 1:2000 (A3)
DISCLAIMER:
THIS PLAN WAS PREPARED FOR ACENERGY FOR INFORMATION PURPOSES ONLY.
DIMENSIONS, AREAS AND TOTAL NUMBER OF LOTS SHOWN HEREIN ARE APPROXIMATE ONLY AND SUBJECT TO FINAL DESIGN AS WELL AS THE REQUIREMENTS OF COUNCIL AND OTHER AUTHORITIES WHICH MAY HAVE REQUIREMENTS UNDER ANY RELEVANT LEGISLATION.
NO RELIANCE SHOULD BE PLACED ON THE INFORMATION CONTAINED IN THIS PLAN FOR ANY FINANCIAL DEALING INVOLVING THE LAND. THIS NOTE IS AN INTEGRAL PART OF THIS PLAN.

DRAINAGE SWALE DETAILS

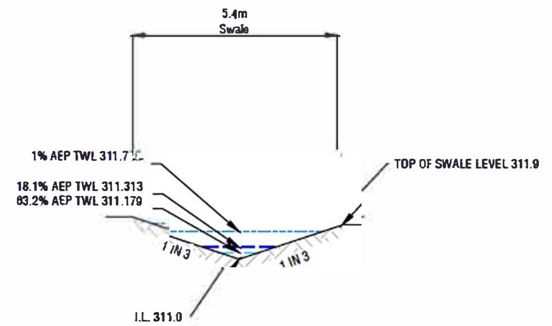
ITEM	1% AEP	18.1% AEP	63.2% AEP
SIDE SLOPES	1 IN 3	1 IN 3	1 IN 3
BASE I.L.	311.00m AHD	311.00m AHD	311.00m AHD
BASIN TWL	311.725m AHD	311.313m AHD	311.179m AHD
VOLUME	161m3	47m3	23m3



NOTE: PROPOSED PAD LEVELS ARE SET AT 1% AEP + 0.5m FREEBOARD TO ALLOW DEVELOPER TO SET ALL REQUIRED IMPORTANT INFRASTRUCTURE ABOVE THE MIN LEVELS NOTED FOR EACH PAD.

LEGEND

- LIMIT OF WORKS BOUNDARY
- CATCH DRAIN
- FLOW ARROW
- EXISTING CONTOUR
- SECURITY FENCE
- ONE ROW LANDSCAPING



SWALE CROSS SECTION
SCALE 1:100

LANDSCAPED SWALE CROSS SECTION
SCALE 1:100

SCALE 1:250 (A1)
SCALE 1:500 (A3)

DISCLAIMER:

THIS PLAN WAS PREPARED FOR ACENERGY FOR INFORMATION PURPOSES ONLY.

DIMENSIONS, AREAS AND TOTAL NUMBER OF LOTS SHOWN HEREIN ARE APPROXIMATE ONLY AND SUBJECT TO FINAL DESIGN AS WELL AS THE REQUIREMENTS OF COUNCIL AND OTHER AUTHORITIES WHICH MAY HAVE REQUIREMENTS UNDER ANY RELEVANT LEGISLATION.

NO RELIANCE SHOULD BE PLACED ON THE INFORMATION CONTAINED IN THIS PLAN FOR ANY FINANCIAL DEALING INVOLVING THE LAND. THIS NOTE IS AN INTEGRAL PART OF THIS PLAN.

Appendix B

DRAINAGE CALCULATIONS

Premise

PRE AND POST-DEVELOPMENT OVERLAND FLOW CHARACTERISTICS 1:1 year ARI

PROJECT: P003016 Merredin BESS Stormwater

DATE: 5/05/2025

Start CH0.00 - Merredin BESS Top of Catchment

Rational Method	PRE DEV	POST DEV	
Catchment area overland - m^2	0	0	
Runoff Coefficient - %	20	20	
Catchment area Lots - m^2	0	0	
Runoff Coefficient - %	20	20	
Catchment area Verge - m^2	0	0	
Runoff Coefficient - %	20	20	
Impervious area - m^2	0	0	
Length of overland flow - m	710	710	
Catchment top RL	332.0	332.0	
Catchment Base RL	315.00	315.00	
Ground slope to culvert S	0.024	0.024	
Overland Flow Time - min	35.34	35.34	
Time Upstream - min	0.00	0.00	
Total Overland Flow Time - min	35.34	35.34	
Intensity - mm/hr	19.0	19.0	Refer IFD Table
Flow - litres/sec	0.0	0.0	
Flow - m^3/s	0.00	0.00	

Notes: 3.6438
Total Merredin Catchment = 2.0507 ha
Runoff Coefficient for Grass = 0.03

Kinematic Wave Eqn (Manning's n) - grass 0.025

FLOWRATE WITHIN EXISTING OPEN CHANNEL DRAIN - MANNING FORMULA (CH0.00)

Depth of flow mm	LH bank slope %	RH bank slope %	Base width m	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Channel Slope S %	Channel Flow Q m^3/sec	Flow Velocity m/sec
0	16.67	16.67	0.50	0.500	0.025	0.00	0.50	0.00	0.7	0.00	#DIV/0!
										0.00	

n for excavated earth drains with short grass, few weeds

CH 710.0m - Open Drain

Rational Method	PRE DEV	POST DEV	
Catchment area overland - m^2	20000	20000	
Runoff Coefficient - %	20	20	
Catchment area Lots - m^2	0	0	
Runoff Coefficient - %	20	20	
Catchment area Main Drain - m^2	0	0	
Runoff Coefficient - %	20	20	
Impervious area - m^2	4000	4000	
Length of overland flow - m	710	710	
Catchment top RL	332.0	332.0	
Catchment Base RL	315.00	315.00	
Ground slope to culvert S	0.024	0.024	
Overland Flow Time - min	39.42	39.42	
Time Upstream - min	0.00	0.00	
Total Overland Flow Time - min	39.42	39.42	
Intensity - mm/hr	17.0	17.0	Refer IFD Table
Flow - litres/sec	18.9	18.9	
Flow - m^3/s	0.02	0.02	

Calculated Average Runoff Coefficient

Kinematic Wave Eqn (Manning's n) 0.03

FLOWRATE ACROSS EXISTING LAND - 20m WIDE SHEET FLOW CALCULATION

Depth of flow mm	LH bank slope %	RH bank slope %	Base width m	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Channel Slope S %	Channel Flow Q m^3/sec	Flow Velocity m/sec
6	3.00	3.00	20.00	20.400	0.030	0.12	20.40	0.01	2.3944	0.02	0.2
										0.02	

n for excavated earth drains with short grass, few weeds

CH 740.0m - Open Drain, Channel Away from Development Area (Western Side of Abattoir Road)

Rational Method	PRE DEV	POST DEV	
Catchment area overland - m^2	20500	20500	
Runoff Coefficient - %	20	20	
Catchment area Lots - m^2	0	0	
Runoff Coefficient - %	20	20	
Catchment area Main Drain - m^2	0	0	
Runoff Coefficient - %	20	20	
Impervious area - m^2	4100	4100	
Length of overland flow - m	740	740	
Catchment top RL	332.0	332.0	
Catchment Base RL	314.00	314.00	
Ground slope to culvert S	0.024	0.024	
Overland Flow Time - min	40.22	40.22	
Time Upstream - min	0.00	0.00	
Total Overland Flow Time - min	40.22	40.22	
Intensity - mm/hr	17.0	17.0	Refer IFD Table
Flow - litres/sec	19.4	19.4	
Flow - m^3/s	[illegible]	0.02	

Calculated Average Runoff Coefficient

Kinematic Wave Eqn (Manning's n) 0.03

FLOWRATE WITHIN THE EXISTING OPEN CHANNEL DRAIN - MANNING FORMULA

Depth of flow mm	LH bank slope %	RH bank slope %	Base width m	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Channel Slope S %	Channel Flow Q m^3/sec	Flow Velocity m/sec
55	33.33	33.33	0.50	0.830	0.030	0.04	0.85	0.04	2.4324	0.02	0.6
										0.0	

n for excavated earth drains with short grass, few weeds

CH 870.0m - Western end of BESS

Rational Method	PRE DEV	POST DEV	
Catchment area overland - m^2	28500	20000	
Runoff Coefficient - %	20	20	
Catchment area Lots - m^2	0	6500	
Runoff Coefficient - %	20	60	
Catchment area Main Drain - m^2	0	0	
Runoff Coefficient - %	20	20	
Impervious area - m^2	5800	7900	
Length of overland flow - m	870	870	
Catchment top RL	332.0	332.0	
Catchment Base RL	311.30	311.30	
Ground slope to culvert S	0.024	0.024	
Overland Flow Time - min	44.62	44.62	
Time Upstream - min	0.00	0.00	
Total Overland Flow Time - min	44.62	44.62	
Intensity - mm/hr	16.0	16.0	Refer IFD Table

Calculated Average Runoff Coefficient

Kinematic Wave Eqn (Manning's n) 0.03

Flow - litres/sec	23.6	35.1
Flow - m^3/s	0.02	0.04

FLOWRATE WITHIN THE EXISTING OPEN CHANNEL DRAIN - MANNING FORMULA

Depth of flow mm	LH bank slope %	RH bank slope %	Base width m	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Channel Slope S %	Channel Flow Q m^3/sec	Flow Velocity m/sec
75	33.33	33.33	0.50	0.950	0.030	0.05	0.97	0.06	2.3793	0.04	0.8
				n for excavated earth drains with short grass, few weeds						0.04	

Box Culvert Sizing Check - Analysis for Comparative Purposes Only

HGL Calculations

BOX CULVERT FLOW ANALYSIS - MANNING FORMULA

Culvert size Width mm	Culvert size Depth mm	Number of Culverts	HGL slope %	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Culvert Flow Q m^3/s	Culvert Flow Q litres/sec	Flow Velocity m/sec	Entry head loss m	Bend Loss m
300	300	1	2.38	0.012	0.090	1.2	0.0750	0.21	206	2.286	0.266	0.107
				n for concrete pipe				0.035	35.11			

Circular Pipe Check Sizing Check

ROUND CULVERT FLOW ANALYSIS - MANNING FORMULA

Culvert size Depth mm	Number of Culverts	HGL slope %	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Culvert Flow Q m^3/s	Culvert Flow Q litres/sec	Flow Velocity m/sec	Entry head loss m
375	1	2.379	0.012	0.110	1.2	0.0938	0.29	293	2.65	0.359
Head Loss Calculations							0.035111111			

hl = k (Vo2/2g)

Vo - outlet pipe velocity

2g = 2 x 9.81m/sec2

Loss (m) = k (V12 - V22)/2g

V DRAIN FLOW ANALYSIS - MANNING FORMULA

Depth of flow mm	Left side %	Right side %	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	V drain S %	V drain Q m^3/s	V drain Q litres/sec	V drain Velocity m/sec
160	33.33	33.33	0.960	0.03	0.0768	1.0120	0.0759	2.379	0.07	71	0.92

Premise

PRE AND POST-DEVELOPMENT OVERLAND FLOW CHARACTERISTICS 1:5 year ARI

PROJECT: P003016 Merredin BESS Stormwater

DATE: 5/06/2025

Start CH0.00 - Merredin BESS Top of Catchment

Rational Method	PRE DEV	POST DEV	
Catchment area overland - m²	0	0	
Runoff Coefficient - %	20	20	
Catchment area Lots - m²	0	0	
Runoff Coefficient - %	20	20	
Catchment area Verge - m²	0	0	
Runoff Coefficient - %	20	20	
Impervious area - m²	0	0	
Length of overland flow - m	710	710	
Catchment top RL	332.0	332.0	
Catchment Base RL	315.00	315.00	
Ground slope to culvert S	0.024	0.024	
Overland Flow Time - min	35.34	35.34	
Time Upstream - min	0.00	0.00	
Total Overland Flow Time - min	35.34	35.34	
Intensity - mm/hr	32.0	32.0	Refer IFD Table
Flow - litres/sec	0.0	0.0	
Flow - m³/s	0.00	0.00	

Notes:
Total Merredin Catchment = 2.6567 ha
Runoff Coefficient for Grass = 0.03

Kinematic Wave Eqn (Manning's n) - grass 0.025

FLOWRATE WITHIN EXISTING OPEN CHANNEL DRAIN - MANNING FORMULA (CH0.00)

Depth of flow mm	LH bank slope %	RH bank slope %	Base width m	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Channel Slope S %	Channel Flow Q m³/sec	Flow Velocity m/sec
0	16.67	16.67	0.50	0.500	0.025	0.00	0.50	0.00	0.7	0.00	#DIV/0!
										0.00	

n for excavated earth drains with short grass, few weeds

CH 710.0m - Open Drain

Rational Method	PRE DEV	POST DEV	
Catchment area overland - m²	20000	20000	
Runoff Coefficient - %	20	20	
Catchment area Lots - m²	0	0	
Runoff Coefficient - %	20	20	
Catchment area Main Drain - m²	0	0	
Runoff Coefficient - %	20	20	
Impervious area - m²	4000	4000	
Length of overland flow - m	710	710	
Catchment top RL	332.0	332.0	
Catchment Base RL	315.00	315.00	
Ground slope to culvert S	0.024	0.024	
Overland Flow Time - min	39.42	39.42	
Time Upstream - min	0.00	0.00	
Total Overland Flow Time - min	39.42	39.42	
Intensity - mm/hr	29.0	29.0	Refer IFD Table
Flow - litres/sec	32.2	32.2	
Flow - m³/s	[illegible]	[illegible]	

Calculated Average Runoff Coefficient

Kinematic Wave Eqn (Manning's n) 0.03

FLOWRATE ACROSS EXISTING LAND - 20m WIDE SHEET FLOW CALCULATION

Depth of flow mm	LH bank slope %	RH bank slope %	Base width m	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Channel Slope S %	Channel Flow Q m³/sec	Flow Velocity m/sec
8	3.00	3.00	20.00	20.533	0.030	0.16	20.53	0.01	2.3944	0.03	0.2
										0.03	

n for excavated earth drains with short grass, few weeds

CH 740.0m - Open Drain, Channel Away from Development Area (Western Side of Abattoir Road)

Rational Method	PRE DEV	POST DEV	
Catchment area overland - m²	20000	20000	
Runoff Coefficient - %	20	20	
Catchment area Lots - m²	0	0	
Runoff Coefficient - %	20	20	
Catchment area Main Drain - m²	0	0	
Runoff Coefficient - %	20	20	
Impervious area - m²	4100	4100	
Length of overland flow - m	740	740	
Catchment top RL	332.0	332.0	
Catchment Base RL	314.00	314.00	
Ground slope to culvert S	0.024	0.024	
Overland Flow Time - min	40.22	40.22	
Time Upstream - min	0.00	0.00	
Total Overland Flow Time - min	40.22	40.22	
Intensity - mm/hr	29.0	29.0	Refer IFD Table
Flow - litres/sec	33.0	33.0	
Flow - m³/s	0.03	0.03	

Calculated Average Runoff Coefficient

Kinematic Wave Eqn (Manning's n) 0.03

FLOWRATE WITHIN THE EXISTING OPEN CHANNEL DRAIN - MANNING FORMULA

Depth of flow mm	LH bank slope %	RH bank slope %	Base width m	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Channel Slope S %	Channel Flow Q m³/sec	Flow Velocity m/sec
65	33.33	33.33	0.50	0.890	0.030	0.05	0.91	0.05	2.4320	0.03	0.7
										0.03	

n for excavated earth drains with short grass, few weeds

CH 870.0m - Western end of BESS

Rational Method	PRE DEV	POST DEV	
Catchment area overland - m²	25500	20000	
Runoff Coefficient - %	20	20	
Catchment area Lots - m²	0	6500	
Runoff Coefficient - %	20	60	
Catchment area Main Drain - m²	0	0	
Runoff Coefficient - %	20	20	
Impervious area - m²	5300	7900	
Length of overland flow - m	870	870	
Catchment top RL	332.0	332.0	
Catchment Base RL	311.30	311.30	
Ground slope to culvert S	[illegible]	[illegible]	
Overland Flow Time - min	44.62	44.62	
Time Upstream - min	0.00	0.00	
Total Overland Flow Time - min	44.62	44.62	
Intensity - mm/hr	27.4	27.4	Refer IFD Table
Flow - litres/sec	39.8	59.3	
Flow - m³/s	0.04	0.06	

Calculated Average Runoff Coefficient

Kinematic Wave Eqn (Manning's n) 0.03

FLOWRATE WITHIN THE EXISTING OPEN CHANNEL DRAIN - MANNING FORMULA

Depth of flow mm	LH bank slope %	RH bank slope %	Base width m	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Channel Slope S %	Channel Flow Q m³/sec	Flow Velocity m/sec
95	33.33	33.33	0.50	1.070	0.030	0.07	1.10	0.07	2.3793	0.06	0.9
										0.06	

n for excavated earth drains with short grass, few weeds

Box Culvert Sizing Check - Analysis for Comparative Purposes Only

Outlet Velocity = 2

HGL Calculations

BOX CULVERT FLOW ANALYSIS - MANNING FORMULA

Culvert size	Number of	HGL slope	Manning's	Flow section area	Wetted perimeter	Hydraulic radius	Culvert Flow Q	Culvert Flow Q	Flow Velocity	Entry head loss	Bend Loss	Pit Head Loss	Exit head loss

Width mm	Depth mm	Culverts	%	n	a	p	a/p = r	m³/s	litres/sec	m/sec	m	m	m	m
300	300	1	2.38	0.012	0.090	1.2	0.0750	0.21	206	2.286	0.266	0.107	0.186	#REF!
				n for concrete pipe				0.059	59.25					

Circular Pipe Check Sizing Check

ROUND CULVERT FLOW ANALYSIS - MANNING FORMULA

Culvert size Depth mm	Number of Culverts	HGL slope %	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Culvert Flow Q m³/s	Culvert Flow Q litres/sec	Flow Velocity m/sec	Entry head loss m
375	1	2.379	0.012	0.110	1.2	0.0938	0.29	293	2.65	0.359
							0.05925			

Head Loss Calculations
hl = k (Vo2/2g)
Vo - outlet pipe velocity
2g = 2 x 9.81m/sec2
Loss (m) = k (V12 - V22)/2g

V DRAIN FLOW ANALYSIS - MANNING FORMULA

Depth of flow mm	Left side %	Right side %	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	V drain S %	V drain Q m³/s	V drain Q litres/sec	V drain Velocity m/sec
160	33.33	33.33	0.960	0.03	0.0768	1.0120	0.0759	2.379	0.07	71	0.92

Premise

PRE AND POST-DEVELOPMENT OVERLAND FLOW CHARACTERISTICS 1:10 year ARI

PROJECT: P003016 Merredin BESS Stormwater

DATE: 5/06/2025

Start CH0.00 - Merredin BESS Top of Catchment

Rational Method	PRE DEV	POST DEV	
Catchment area overland - m²	0	0	
Runoff Coefficient - %	20	20	
Catchment area Lots - m²	0	0	
Runoff Coefficient - %	20	20	
Catchment area Verge - m²	0	0	
Runoff Coefficient - %	20	20	
Impervious area - m²	0	0	
Length of overland flow - m	710	710	
Catchment top RL	332.0	332.0	
Catchment Base RL	315.00	315.00	
Ground slope to culvert S	0.024	0.024	
Overland Flow Time - min	35.34	35.34	
Time Upstream - min	0.00	0.00	
Total Overland Flow Time - min	35.34	35.34	
Intensity - mm/hr	39.0	39.0	Refer IFD Table
Flow - litres/sec	0.0	0.0	
Flow - m³/s	0.00	0.00	

Notes:
Total Merredin Catchment = 2.6567 ha
Runoff Coefficient for Grass = 0.03

Kinematic Wave Eqn (Manning's n) - grass 0.025

FLOWRATE WITHIN EXISTING OPEN CHANNEL DRAIN - MANNING FORMULA (CH0.00)

Depth of flow mm	LH bank slope %	RH bank slope %	Base width m	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Channel Slope S %	Channel Flow Q m³/sec	Flow Velocity m/sec
0	16.67	16.67	0.50	0.500	0.025	0.00	0.50	0.00	0.7	0.00	#DIV/0!
										0.00	

n for excavated earth drains with short grass, few weeds

CH 710.0m - Open Drain

Rational Method	PRE DEV	POST DEV	
Catchment area overland - m²	20000	20000	
Runoff Coefficient - %	20	20	
Catchment area Lots - m²	0	0	
Runoff Coefficient - %	20	20	
Catchment area Main Drain - m²	0	0	
Runoff Coefficient - %	20	20	
Impervious area - m²	4000	4000	
Length of overland flow - m	710	710	
Catchment top RL	332.0	332.0	
Catchment Base RL	315.00	315.00	
Ground slope to culvert S	0.024	0.024	
Overland Flow Time - min	39.42	39.42	
Time Upstream - min	0.00	0.00	
Total Overland Flow Time - min	39.42	39.42	
Intensity - mm/hr	36.5	36.5	Refer IFD Table
Flow - litres/sec	40.6	40.6	
Flow - m³/s	[illegible]	[illegible]	

Calculated Average Runoff Coefficient

Kinematic Wave Eqn (Manning's n) 0.03

FLOWRATE ACROSS EXISTING LAND - 20m WIDE SHEET FLOW CALCULATION

Depth of flow mm	LH bank slope %	RH bank slope %	Base width m	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Channel Slope S %	Channel Flow Q m³/sec	Flow Velocity m/sec
9	3.00	3.00	20.00	20.600	0.030	0.18	20.60	0.01	2.394	0.04	0.2
										0.04	

n for excavated earth drains with short grass, few weeds

CH 740.0m - Open Drain, Channel Away from Development Area (Western Side of Abattoir Road)

Rational Method	PRE DEV	POST DEV	
Catchment area overland - m²	20000	20000	
Runoff Coefficient - %	20	20	
Catchment area Lots - m²	0	0	
Runoff Coefficient - %	20	20	
Catchment area Main Drain - m²	0	0	
Runoff Coefficient - %	20	20	
Impervious area - m²	4100	4100	
Length of overland flow - m	740	740	
Catchment top RL	332.0	332.0	
Catchment Base RL	314.00	314.00	
Ground slope to culvert S	0.024	0.024	
Overland Flow Time - min	40.22	40.22	
Time Upstream - min	0.00	0.00	
Total Overland Flow Time - min	40.22	40.22	
Intensity - mm/hr	36.0	36.0	Refer IFD Table
Flow - litres/sec	41.0	41.0	
Flow - m³/s	[illegible]	[illegible]	

Calculated Average Runoff Coefficient

Kinematic Wave Eqn (Manning's n) 0.03

FLOWRATE WITHIN THE EXISTING OPEN CHANNEL DRAIN - MANNING FORMULA

Depth of flow mm	LH bank slope %	RH bank slope %	Base width m	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Channel Slope S %	Channel Flow Q m³/sec	Flow Velocity m/sec
75	33.33	33.33	0.50	0.950	0.030	0.05	0.97	0.06	2.4326	0.04	0.8
										0.04	

n for excavated earth drains with short grass, few weeds

CH 870.0m - Western end of BESS

Rational Method	PRE DEV	POST DEV	
Catchment area overland - m²	25500	20000	
Runoff Coefficient - %	20	20	
Catchment area Lots - m²	0	6500	
Runoff Coefficient - %	20	60	
Catchment area Main Drain - m²	0	0	
Runoff Coefficient - %	20	20	
Impervious area - m²	5300	7900	
Length of overland flow - m	870	870	
Catchment top RL	332.0	332.0	
Catchment Base RL	311.30	311.30	
Ground slope to culvert S	[illegible]	[illegible]	
Overland Flow Time - min	44.62	44.62	
Time Upstream - min	0.00	0.00	
Total Overland Flow Time - min	44.62	44.62	
Intensity - mm/hr	33.0	33.0	Refer IFD Table
Flow - litres/sec	48.6	72.4	
Flow - m³/s	0.05	0.07	

Calculated Average Runoff Coefficient

Kinematic Wave Eqn (Manning's n) 0.03

FLOWRATE WITHIN THE EXISTING OPEN CHANNEL DRAIN - MANNING FORMULA

Depth of flow mm	LH bank slope %	RH bank slope %	Base width m	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Channel Slope S %	Channel Flow Q m³/sec	Flow Velocity m/sec
100	33.33	33.33	0.50	1.100	0.030	0.08	1.13	0.07	2.3793	0.07	0.9
										0.07	

n for excavated earth drains with short grass, few weeds

Box Culvert Sizing Check - Analysis for Comparative Purposes Only

Outlet Velocity = 2

HGL Calculations

BOX CULVERT FLOW ANALYSIS - MANNING FORMULA

Culvert size	Number of	HGL slope	Manning's	Flow section area	Wetted perimeter	Hydraulic radius	Culvert Flow Q	Culvert Flow Q	Flow Velocity	Entry head loss	Bend Loss	Pit Head Loss	Exit head loss

Width mm	Depth mm	Culverts	%	n	a	p	a/p = r	m³/s	litres/sec	m/sec	m	m	m	m
300	300	1	2.38	0.012	0.090	1.2	0.0750	0.21	206	2.286	0.266	0.107	0.186	#REF!
				n for concrete pipe				0.072	72.42					

Circular Pipe Check Sizing Check

ROUND CULVERT FLOW ANALYSIS - MANNING FORMULA

Culvert size Depth mm	Number of Culverts	HGL slope %	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Culvert Flow Q m³/s	Culvert Flow Q litres/sec	Flow Velocity m/sec	Entry head loss m
375	1	2.379	0.012	0.110	1.2	0.0938	0.29	293	2.65	0.359
Head Loss Calculations							0.072416667			

hl = k (Vo2/2g)
Vo - outlet pipe velocity
2g = 2 x 9.81m/sec2
Loss (m) = k (V12 - V22)/2g

V DRAIN FLOW ANALYSIS - MANNING FORMULA

Depth of flow mm	Left side %	Right side %	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	V drain S %	V drain Q m³/s	V drain Q litres/sec	V drain Velocity m/sec
160	33.33	33.33	0.960	0.03	0.0768	1.0120	0.0759	2.379	0.07	71	0.92

Premise

PRE AND POST-DEVELOPMENT OVERLAND FLOW CHARACTERISTICS 1:20 year ARI

PROJECT: P003016 Merredin BESS Stormwater
DATE: 5/06/2025

Start CH0.00 - Merredin BESS Top of Catchment

Rational Method	PRE DEV	POST DEV	
Catchment area overland - m²	0	0	
Runoff Coefficient - %	20	20	
Catchment area Lots - m²	0	0	
Runoff Coefficient - %	20	20	
Catchment area Verge - m²	0	0	
Runoff Coefficient - %	20	20	
Impervious area - m²	0	0	
Length of overland flow - m	710	710	
Catchment top RL	332.0	332.0	
Catchment Base RL	315.00	315.00	
Ground slope to culvert S	0.024	0.024	
Overland Flow Time - min	35.34	35.34	
Time Upstream - min	0.00	0.00	
Total Overland Flow Time - min	35.34	35.34	
Intensity - mm/hr	48.0	48.0	Refer IFD Table
Flow - litres/sec	0.0	0.0	
Flow - m³/s	0.00	0.00	

Notes
Total Merredin Catchment = 2.6567 ha
Runoff Coefficient for Grass = 0.03

Kinematic Wave Eqn (Manning's n) - grass 0.025

FLOWRATE WITHIN EXISTING OPEN CHANNEL DRAIN - MANNING FORMULA (CH0.00)

Depth of flow mm	LH bank slope %	RH bank slope %	Base width m	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Channel Slope S %	Channel Flow Q m³/sec	Flow Velocity m/sec
0	16.67	16.67	0.50	0.500	0.025	0.00	0.50	0.00	0.7	0.00	#DIV/0!
										0.00	

n for excavated earth drains with short grass, few weeds

CH 710.0m - Open Drain

Rational Method	PRE DEV	POST DEV	
Catchment area overland - m²	20000	20000	
Runoff Coefficient - %	20	20	
Catchment area Lots - m²	0	0	
Runoff Coefficient - %	20	20	
Catchment area Main Drain - m²	0	0	
Runoff Coefficient - %	20	20	
Impervious area - m²	4000	4000	
Length of overland flow - m	710	710	
Catchment top RL	332.0	332.0	
Catchment Base RL	315.00	315.00	
Ground slope to culvert S	0.024	0.024	
Overland Flow Time - min	39.42	39.42	
Time Upstream - min	0.00	0.00	
Total Overland Flow Time - min	39.42	39.42	
Intensity - mm/hr	43.0	43.0	Refer IFD Table
Flow - litres/sec	47.8	47.8	
Flow - m³/s	[illegible]	[illegible]	

Calculated Average Runoff Coefficient

Kinematic Wave Eqn (Manning's n) 0.03

FLOWRATE ACROSS EXISTING LAND - 20m WIDE SHEET FLOW CALCULATION

Depth of flow mm	LH bank slope %	RH bank slope %	Base width m	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Channel Slope S %	Channel Flow Q m³/sec	Flow Velocity m/sec
10	3.00	3.00	20.00	20.667	0.030	0.20	20.67	0.01	2.3944	0.05	0.2
										0.05	

n for excavated earth drains with short grass, few weeds

CH 740.0m - Open Drain, Channel Away from Development Area (Western Side of Abattoir Road)

Rational Method	PRE DEV	POST DEV	
Catchment area overland - m²	20000	20000	
Runoff Coefficient - %	20	20	
Catchment area Lots - m²	0	0	
Runoff Coefficient - %	20	20	
Catchment area Main Drain - m²	0	0	
Runoff Coefficient - %	20	20	
Impervious area - m²	4100	4100	
Length of overland flow - m	740	740	
Catchment top RL	332.0	332.0	
Catchment Base RL	314.00	314.00	
Ground slope to culvert S	0.024	0.024	
Overland Flow Time - min	40.22	40.22	
Time Upstream - min	0.00	0.00	
Total Overland Flow Time - min	40.22	40.22	
Intensity - mm/hr	43.0	43.0	Refer IFD Table
Flow - litres/sec	49.0	49.0	
Flow - m³/s	0.05	0.05	

Calculated Average Runoff Coefficient

Kinematic Wave Eqn (Manning's n) 0.03

FLOWRATE WITHIN THE EXISTING OPEN CHANNEL DRAIN - MANNING FORMULA

Depth of flow mm	LH bank slope %	RH bank slope %	Base width m	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Channel Slope S %	Channel Flow Q m³/sec	Flow Velocity m/sec
85	33.33	33.33	0.50	1.010	0.030	0.06	1.04	0.06	2.4326	0.05	0.8
										0.05	

n for excavated earth drains with short grass, few weeds

CH 870.0m - Western end of BESS

Rational Method	PRE DEV	POST DEV	
Catchment area overland - m²	25500	20000	
Runoff Coefficient - %	20	20	
Catchment area Lots - m²	0	6500	
Runoff Coefficient - %	20	60	
Catchment area Main Drain - m²	0	0	
Runoff Coefficient - %	20	20	
Impervious area - m²	5300	7900	
Length of overland flow - m	870	870	
Catchment top RL	332.0	332.0	
Catchment Base RL	311.30	311.30	
Ground slope to culvert S	[illegible]	[illegible]	
Overland Flow Time - min	44.62	44.62	
Time Upstream - min	0.00	0.00	
Total Overland Flow Time - min	44.62	44.62	
Intensity - mm/hr	40.0	40.0	Refer IFD Table
Flow - litres/sec	58.9	87.8	
Flow - m³/s	0.06	0.09	

Calculated Average Runoff Coefficient

Kinematic Wave Eqn (Manning's n) 0.03

FLOWRATE WITHIN THE EXISTING OPEN CHANNEL DRAIN - MANNING FORMULA

Depth of flow mm	LH bank slope %	RH bank slope %	Base width m	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Channel Slope S %	Channel Flow Q m³/sec	Flow Velocity m/sec
115	33.33	33.33	0.50	1.190	0.030	0.10	1.23	0.08	2.3793	0.09	0.9
										0.09	

n for excavated earth drains with short grass, few weeds

Box Culvert Sizing Check - Analysis for Comparative Purposes Only

Outlet Velocity = 2

HGL Calculations

BOX CULVERT FLOW ANALYSIS - MANNING FORMULA

Culvert size	Number of	HGL slope	Manning's	Flow section area	Wetted perimeter	Hydraulic radius	Culvert Flow Q	Culvert Flow Q	Flow Velocity	Entry head loss	Bend Loss	Pit Head Loss	Exit head loss

Width mm	Depth mm	Culverts	%	n	a	p	a/p = r	m^3/s	litres/sec	m/sec	m	m	m	m
300	300	1	2.38	0.012	0.090	1.2	0.0750	0.21	206	2.286	0.266	0.107	0.186	#REF!
				n for concrete pipe				0.088	87.78					

Circular Pipe Check Sizing Check

ROUND CULVERT FLOW ANALYSIS - MANNING FORMULA

Culvert size Depth mm	Number of Culverts	HGL slope %	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Culvert Flow Q m^3/s	Culvert Flow Q litres/sec	Flow Velocity m/sec	Entry head loss m
375	1	2.379	0.012	0.110	1.2	0.0938	0.29	293	2.65	0.359
Head Loss Calculations							0.087777778			

hl = k (Vo2/2g)
Vo - outlet pipe velocity
2g = 2 x 9.81m/sec2
Loss (m) = k (V12 - V22)/2g

V DRAIN FLOW ANALYSIS - MANNING FORMULA

Depth of flow mm	Left side %	Right side %	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	V drain S %	V drain Q m^3/s	V drain Q litres/sec	V drain Velocity m/sec
160	33.33	33.33	0.960	0.03	0.0768	1.0120	0.0759	2.379	0.07	71	0.92

Premise

PRE AND POST-DEVELOPMENT OVERLAND FLOW CHARACTERISTICS 1:50 year ARI

PROJECT: P003016 Merredin BESS Stormwater

DATE: 5/06/2025

Start CH0.00 - Merredin BESS Top of Catchment

Rational Method	PRE DEV	POST DEV	
Catchment area overland - m²	0	0	
Runoff Coefficient - %	20	20	
Catchment area Lots - m²	0	0	
Runoff Coefficient - %	20	20	
Catchment area Verge - m²	0	0	
Runoff Coefficient - %	20	20	
Impervious area - m²	0	0	
Length of overland flow - m	710	710	
Catchment top RL	332.0	332.0	
Catchment Base RL	315.00	315.00	
Ground slope to culvert S	0.024	0.024	
Overland Flow Time - min	35.34	35.34	
Time Upstream - min	0.00	0.00	
Total Overland Flow Time - min	35.34	35.34	
Intensity - mm/hr	58.0	58.0	Refer IFD Table
Flow - litres/sec	0.0	0.0	
Flow - m³/s	0.00	0.00	

Notes
Total Merredin Catchment = 2.6567 ha
Runoff Coefficient for Grass = 0.03

Kinematic Wave Eqn (Manning's n) - grass 0.025

FLOWRATE WITHIN EXISTING OPEN CHANNEL DRAIN - MANNING FORMULA (CH0.00)

Depth of flow mm	LH bank slope %	RH bank slope %	Base width m	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Channel Slope S %	Channel Flow Q m³/sec	Flow Velocity m/sec
0	16.67	16.67	0.50	0.500	0.025	0.00	0.50	0.00	0.7	0.00	#DIV/0!
										0.00	

n for excavated earth drains with short grass, few weeds

CH 710.0m - Open Drain

Rational Method	PRE DEV	POST DEV	
Catchment area overland - m²	20000	20000	
Runoff Coefficient - %	20	20	
Catchment area Lots - m²	0	0	
Runoff Coefficient - %	20	20	
Catchment area Main Drain - m²	0	0	
Runoff Coefficient - %	20	20	
Impervious area - m²	4000	6000	
Length of overland flow - m	710	710	
Catchment top RL	332.0	332.0	
Catchment Base RL	315.00	315.00	
Ground slope to culvert S	0.024	0.024	
Overland Flow Time - min	39.42	39.42	
Time Upstream - min	0.00	0.00	
Total Overland Flow Time - min	39.42	39.42	
Intensity - mm/hr	54.0	54.0	Refer IFD Table
Flow - litres/sec	60.0	90.0	
Flow - m³/s	[illegible]	[illegible]	

Calculated Average Runoff Coefficient

Kinematic Wave Eqn (Manning's n) 0.03

FLOWRATE ACROSS EXISTING LAND - 20m WIDE SHEET FLOW CALCULATION

Depth of flow mm	LH bank slope %	RH bank slope %	Base width m	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Channel Slope S %	Channel Flow Q m³/sec	Flow Velocity m/sec
15	3.00	3.00	20.00	21.000	0.030	0.31	21.00	0.01	2.3944	0.09	0.3
										0.09	

n for excavated earth drains with short grass, few weeds

CH 740.0m - Open Drain, Channel Away from Development Area (Western Side of Abattoir Road)

Rational Method	PRE DEV	POST DEV	
Catchment area overland - m²	20000	20000	
Runoff Coefficient - %	20	20	
Catchment area Lots - m²	0	0	
Runoff Coefficient - %	20	20	
Catchment area Main Drain - m²	0	0	
Runoff Coefficient - %	20	20	
Impervious area - m²	4100	4100	
Length of overland flow - m	740	740	
Catchment top RL	332.0	332.0	
Catchment Base RL	314.00	314.00	
Ground slope to culvert S	0.024	0.024	
Overland Flow Time - min	40.22	40.22	
Time Upstream - min	0.00	0.00	
Total Overland Flow Time - min	40.22	40.22	
Intensity - mm/hr	54.0	54.0	Refer IFD Table
Flow - litres/sec	61.5	61.5	
Flow - m³/s	0.06	0.06	

Calculated Average Runoff Coefficient

Kinematic Wave Eqn (Manning's n) 0.03

FLOWRATE WITHIN THE EXISTING OPEN CHANNEL DRAIN - MANNING FORMULA

Depth of flow mm	LH bank slope %	RH bank slope %	Base width m	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Channel Slope S %	Channel Flow Q m³/sec	Flow Velocity m/sec
95	33.33	33.33	0.50	1.070	0.030	0.07	1.10	0.07	2.4326	0.06	0.9
										0.06	

n for excavated earth drains with short grass, few weeds

CH 870.0m - Western end of BESS

Rational Method	PRE DEV	POST DEV	
Catchment area overland - m²	25500	20000	
Runoff Coefficient - %	20	20	
Catchment area Lots - m²	0	6500	
Runoff Coefficient - %	20	60	
Catchment area Main Drain - m²	0	0	
Runoff Coefficient - %	20	20	
Impervious area - m²	5300	7900	
Length of overland flow - m	870	870	
Catchment top RL	332.0	332.0	
Catchment Base RL	311.30	311.30	
Ground slope to culvert S	[illegible]	[illegible]	
Overland Flow Time - min	44.62	44.62	
Time Upstream - min	0.00	0.00	
Total Overland Flow Time - min	44.62	44.62	
Intensity - mm/hr	50.0	50.0	Refer IFD Table
Flow - litres/sec	73.6	109.7	
Flow - m³/s	0.07	0.11	

Calculated Average Runoff Coefficient

Kinematic Wave Eqn (Manning's n) 0.03

FLOWRATE WITHIN THE EXISTING OPEN CHANNEL DRAIN - MANNING FORMULA

Depth of flow mm	LH bank slope %	RH bank slope %	Base width m	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Channel Slope S %	Channel Flow Q m³/sec	Flow Velocity m/sec
125	33.33	33.33	0.50	1.250	0.030	0.11	1.29	0.08	2.3793	0.11	1.0
										0.11	

n for excavated earth drains with short grass, few weeds

Box Culvert Sizing Check - Analysis for Comparative Purposes Only

Outlet Velocity = 2

HGL Calculations

BOX CULVERT FLOW ANALYSIS - MANNING FORMULA

Culvert size Width mm	 Depth mm	Number of Culverts	HGL slope %	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Culvert Flow Q m³/s	Culvert Flow Q litres/sec	Flow Velocity m/sec	Entry head loss m	Bend Loss m	Pit Head Loss m	Exit head loss m
300	300	1	2.38	0.012	0.090	1.2	0.0750	0.21	206	2.286	0.266	0.107	0.186	#REF!
				n for concrete pipe				0.110	109.72					

Circular Pipe Check Sizing Check

ROUND CULVERT FLOW ANALYSIS - MANNING FORMULA

Culvert size Depth mm	Number of Culverts	HGL slope %	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Culvert Flow Q m³/s	Culvert Flow Q litres/sec	Flow Velocity m/sec	Entry head loss m
375	1	2.379	0.012	0.110	1.2	0.0938	0.29	293	2.65	0.359
Head Loss Calculations							0.109722222			

hl = k (Vo2/2g)
Vo - outlet pipe velocity
2g = 2 x 9.81m/sec2
Loss (m) = k (V12 - V22)/2g

V DRAIN FLOW ANALYSIS - MANNING FORMULA

Depth of flow mm	Left side %	Right side %	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	V drain S %	V drain Q m³/s	V drain Q litres/sec	V drain Velocity m/sec
160	33.33	33.33	0.960	0.03	0.0768	1.0120	0.0759	2.379	0.07	71	0.92

Premise

PRE AND POST-DEVELOPMENT OVERLAND FLOW CHARACTERISTICS 1:100 year ARI

PROJECT: P003016 Merredin BESS Stormwater

DATE: 5/05/2025

Start CH0.00 - Merredin BESS Top of Catchment

Rational Method	PRE DEV	POST DEV	Notes		
Catchment area overland - m²	0	0	Total Merredin Catchment = 2.6567 ha		
Runoff Coefficient - %	20	20	Runoff Coefficient for Grass = 0.03		
Catchment area Lots - m²	0	0			
Runoff Coefficient - %	20	20			
Catchment area Verge - m²	0	0			
Runoff Coefficient - %	20	20			
Impervious area - m²	0	0			
Length of overland flow - m	710	710			
Catchment top RL	332.0	332.0			
Catchment Base RL	315.00	315.00			
Ground slope to culvert S	0.024	0.024			
Overland Flow Time - min	35.34	35.34		Kinematic Wave Eqn (Manning's n) - grass	0.025
Time Upstream - min	0.00	0.00			
Total Overland Flow Time - min	35.34	35.34			
Intensity - mm/hr	72.9	72.9	Refer IFD Table		
Flow - litres/sec	0.0	0.0			
Flow - m³/s	0.00	0.00			

FLOWRATE WITHIN EXISTING OPEN CHANNEL DRAIN - MANNING FORMULA (CH0.00)

Depth of flow mm	LH bank slope %	RH bank slope %	Base width m	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Channel Slope S %	Channel Flow Q m³/sec	Flow Velocity m/sec
0	16.67	16.67	0.50	0.500	0.025	0.00	0.50	0.00	0.7	0.00	#DIV/0!
				n for excavated earth drains with short grass, few weeds						0.00	

CH 710.0m - Open Drain

Rational Method	PRE DEV	POST DEV	Notes		
Catchment area overland - m²	20000	20000			
Runoff Coefficient - %	20	20	Calculated Average Runoff Coefficient		
Catchment area Lots - m²	0	0			
Runoff Coefficient - %	20	20			
Catchment area Main Drain - m²	0	0			
Runoff Coefficient - %	20	20			
Impervious area - m²	4000	4000			
Length of overland flow - m	710	710			
Catchment top RL	332.0	332.0			
Catchment Base RL	315.00	315.00			
Ground slope to culvert S	0.024	0.024			
Overland Flow Time - min	39.42	39.42		Kinematic Wave Eqn (Manning's n)	0.03
Time Upstream - min	0.00	0.00			
Total Overland Flow Time - min	39.42	39.42			
Intensity - mm/hr	62.0	62.0	Refer IFD Table		
Flow - litres/sec	68.9	68.9			
Flow - m³/s	0.07	0.07			

FLOWRATE ACROSS EXISTING LAND - 20m WIDE SHEET FLOW CALCULATION

Depth of flow mm	LH bank slope %	RH bank slope %	Base width m	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Channel Slope S %	Channel Flow Q m³/sec	Flow Velocity m/sec
13	3.00	3.00	20.00	20.867	0.030	0.27	20.87	0.01	2.3944	0.07	0.3
				n for excavated earth drains with short grass, few weeds						0.07	

CH 740.0m - Open Drain, Channel Away from Development Area (Western Side of Abattoir Road)

Rational Method	PRE DEV	POST DEV	Notes		
Catchment area overland - m²	20500	20500			
Runoff Coefficient - %	20	20	Calculated Average Runoff Coefficient		
Catchment area Lots - m²	0	0			
Runoff Coefficient - %	20	20			
Catchment area Main Drain - m²	0	0			
Runoff Coefficient - %	20	20			
Impervious area - m²	4100	4100			
Length of overland flow - m	740	740			
Catchment top RL	332.0	332.0			
Catchment Base RL	314.00	314.00			
Ground slope to culvert S	0.024	0.024			
Overland Flow Time - min	40.22	40.22		Kinematic Wave Eqn (Manning's n)	0.03
Time Upstream - min	0.00	0.00			
Total Overland Flow Time - min	40.22	40.22			
Intensity - mm/hr	63.0	63.0	Refer IFD Table		
Flow - litres/sec	71.8	71.8			
Flow - m³/s	0.07	0.07			

FLOWRATE WITHIN THE EXISTING OPEN CHANNEL DRAIN - MANNING FORMULA

Depth of flow mm	LH bank slope %	RH bank slope %	Base width m	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Channel Slope S %	Channel Flow Q m³/sec	Flow Velocity m/sec
100	33.33	33.33	0.50	1.100	0.030	0.08	1.13	0.07	2.4324	0.07	0.9
				n for excavated earth drains with short grass, few weeds						0.07	

CH 870.0m - Western end of BESS

Rational Method	PRE DEV	POST DEV	Notes		
Catchment area overland - m²	26000	20000			
Runoff Coefficient - %	20	20	Calculated Average Runoff Coefficient		
Catchment area Lots - m²	0	6500			
Runoff Coefficient - %	20	60			
Catchment area Main Drain - m²	0	0			
Runoff Coefficient - %	20	20			
Impervious area - m²	5200	7900			
Length of overland flow - m	870	870			
Catchment top RL	332.0	332.0			
Catchment Base RL	311.30	311.30			
Ground slope to culvert S	0.024	0.024			
Overland Flow Time - min	44.62	44.62		Kinematic Wave Eqn (Manning's n)	0.03
Time Upstream - min	0.00	0.00			
Total Overland Flow Time - min	44.62	44.62			
Intensity - mm/hr	58.0	58.0	Refer IFD Table		
Flow - litres/sec	83.8	127.3			
Flow - m³/s	0.08	0.13			

FLOWRATE WITHIN THE EXISTING OPEN CHANNEL DRAIN - MANNING FORMULA

Depth of flow mm	LH bank slope %	RH bank slope %	Base width m	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Channel Slope S %	Channel Flow Q m³/sec	Flow Velocity m/sec
135	33.33	33.33	0.50	1.310	0.030	0.12	1.35	0.09	2.3793	0.13	1.0
				n for excavated earth drains with short grass, few weeds						0.13	

Box Culvert Sizing Check - Analysis for Comparative Purposes Only

Outlet Velocity = 2

HGL Calculations

BOX CULVERT FLOW ANALYSIS - MANNING FORMULA

Culvert size Width mm	Culvert size Depth mm	Number of Culverts	HGL slope %	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Culvert Flow Q m³/s	Culvert Flow Q litres/sec	Flow Velocity m/sec	Entry head loss m	Bend Loss m	Pit Head Loss m	Exit head loss m
300	300	1	2.38	0.012	0.090	1.2	0.0750	0.21	206	2.286	0.266	0.107	0.186	#REF!
				n for concrete pipe				0.127	127.28					

Circular Pipe Check Sizing Check

ROUND CULVERT FLOW ANALYSIS - MANNING FORMULA

Culvert size Depth mm	Number of Culverts	HGL slope %	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Culvert Flow Q m³/s	Culvert Flow Q litres/sec	Flow Velocity m/sec	Entry head loss m
375	1	2.379	0.012	0.110	1.2	0.0938	0.29	293	2.65	0.359
Head Loss Calculations							0.127277778			

hl = k (Vo2/2g)

Vo - outlet pipe velocity

2g = 2 x 9.81m/sec2

Loss (m) = k (V12 - V22)/2g

V DRAIN FLOW ANALYSIS - MANNING FORMULA

Depth of flow mm	Left side %	Right side %	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	V drain S %	V drain Q m³/s	V drain Q litres/sec	V drain Velocity m/sec
160	33.33	33.33	0.960	0.03	0.0768	1.0120	0.0759	2.379	0.07	71	0.92

CH 870.0m - Depth of Flow Calculation (55m Wide BESS Footprint)

Rational Method	PRE DEV	POST DEV	
Catchment area overland - m²	26500	0	
Runoff Coefficient - %	20	20	Calculated Average Runoff Coefficient
Catchment area Lots - m²	0	6500	
Runoff Coefficient - %	20	60	
Catchment area Main Drain - m²	0	0	
Runoff Coefficient - %	20	20	
Impervious area - m²	5300	3900	
Length of overland flow - m	870	137	
Catchment top RL	332.0	314.0	
Catchment Base RL	311.30	311.30	
Ground slope to culvert S	0.024	0.020	
Overland Flow Time - min	40.00	13.96	Kinematic Wave Eqn (Manning's n) 0.025
Time Upstream - min	0.00	0.00	
Total Overland Flow Time - min	40.00	13.96	
Intensity - mm/hr	63.0	119.0	Refer IFD Table
Flow - litres/sec	92.8	128.9	
Flow - m³/s	0.09	0.13	

FLOWRATE ACROSS EXISTING LAND - 50m WIDE SHEET FLOW CALCULATION

Depth of flow mm	LH bank slope %	RH bank slope %	Base width m	Flow width m	Manning's n	Flow section area a	Wetted perimeter p	Hydraulic radius a/p = r	Channel Slope S %	Channel Flow Q m³/sec	Flow Velocity m/sec
10	3.00	3.00	50.00	50.667	0.025	0.50	50.67	0.01	1.9708	0.13	0.3
			n for excavated crushed limestone pad							0.13	

COMPENSATION BASIN CALCULATOR

Project: Lot 12 Abattoir Road, Merredin **Job No.** P003016

Client: ACENERGY **Date:** 28/03/2025

COMPENSATING BASIN DISCHARGE - Section 7.5.7 AR&R 1987

LOCATION	KELLERBERRIN					
EQUIV AREA (ha)	0.260					
ARI	100					
DURATION (hrs)	24					
RAINFALL (mm/hr)	4.59	---------------	------- PEAK --------------		---------------	
INFLOW VOL (cum)	286	INFLOW	OUTFLOW	VOLUME	LEVEL	
HYET PERIOD (hrs)	1.00	17	2	161	311.725	
CALC PERIOD (hrs)	0.50	---------------	--------------	--------------	--------------	

DURATN	INFLOW	OUTFLOW	VOLUME	LEVEL	RAINFALL	WORST CASE
1	78	2	103	311.541	41.3	
2	58	2	122	311.608	25.3	
3	40	2	133	311.641	19.1	
6	26	2	151	311.696	11.8	
12	28	2	158	311.717	7.4	
24	17	2	161	311.725	4.6	<=
48	11	2	140	311.664	2.8	
72	7	2	130	311.634	2.0	

PERIOD	HRS	HYETO GRAPH (%)	INFLOW (l/s)	OUTFLOW (l/s)	VOLUME (cum)	LEVEL (m)
			0	0	0	311.000
0	0.00	0.00	9	1	16	311.128
1	0.50	5.80	9	1	31	311.224
2	1.00	5.80	17	1	59	311.368
3	1.50	10.60	17	1	87	311.479
4	2.00	10.60	6	2	95	311.509
5	2.50	3.70	6	2	102	311.538
6	3.00	3.70	5	2	109	311.562
7	3.50	3.20	5	2	115	311.585
8	4.00	3.20	4	2	118	311.599
9	4.50	2.40	4	2	122	311.610
10	5.00	2.40	5	2	129	311.629
11	5.50	3.35	5	2	135	311.648
12	6.00	3.35	3	2	137	311.655
13	6.50	2.00	3	2	140	311.662
14	7.00	2.00	4	2	144	311.676
15	7.50	2.80	4	2	149	311.690
16	8.00	2.80	3	2	151	311.695
17	8.50	1.85	3	2	153	311.700
18	9.00	1.85	3	2	155	311.707
19	9.50	2.05	3	2	157	311.714
20	10.00	2.05	3	2	158	311.718
21	10.50	1.65	3	2	159	311.721
22	11.00	1.65	2	2	160	311.723
23	11.50	1.45	2	2	161	311.725
24	12.00	1.45	2	2	161	311.725
25	12.50	1.30	2	2	161	311.725
26	13.00	1.30	2	2	161	311.724
27	13.50	1.15	2	2	160	311.723
28	14.00	1.15	2	2	160	311.722
29	14.50	1.05	2	2	159	311.720
30	15.00	1.05	2	2	158	311.717
31	15.50	0.95	2	2	157	311.715
32	16.00	0.95	1	2	156	311.711
33	16.50	0.80	1	2	155	311.707
34	17.00	0.80	1	2	153	311.702
35	17.50	0.55	1	2	151	311.696
36	18.00	0.55	1	2	150	311.692
37	18.50	0.75	1	2	148	311.688
38	19.00	0.75	0	2	146	311.680
39	19.50	0.25	0	2	143	311.672
40	20.00	0.25	1	2	141	311.666
41	20.50	0.45	1	2	139	311.659
42	21.00	0.45	1	2	138	311.656
43	21.50	0.80	1	2	137	311.653
44	22.00	0.80	1	2	135	311.648
45	22.50	0.50	1	2	133	311.642
46	23.00	0.50	1	2	131	311.637
47	23.50	0.60	1	2	130	311.633
48	24.00	0.60	0	2	127	311.623
49	24.50	0.00	0	2	123	311.614
50	25.00	0.00	0	2	120	311.604
TOTAL Q		100	159	92		
TOTAL V			286	166	286	

STORAGE & DISCHARGE RELATIONSHIPS

DEPTH (m)	Vs (cu m)	Qo (l/s)	WATER LEVEL (m)	LAKE VOLUME (cu m)	TWL AREA (sq m)	CULVERT FLOW (l/s)	ORIFICE FLOW (l/s)	INFILT'N Qo (l/s)	CLOGGED Qo (l/s)
0.000	0	0	311.00	0	100	0	0	0.6	0.6
0.100	12	1	311.10	12	132	0	0	0.8	0.9
0.200	26	1	311.20	26	164	0	0	0.9	1.3
0.300	44	1	311.30	44	197	0	0	1.1	1.8
0.400	66	1	311.40	66	231	0	0	1.3	2.4
0.600	119	2	311.60	119	300	0	0	1.7	3.8
0.800	186	2	311.80	186	373	0	0	2.2	5.6
1.000	268	3	312.00	268	448	0	0	2.6	7.8
1.200	365	3	312.20	365	526	0	0	3.0	10.4

BASIN GEOMETRY

V = A*h + B*h^2 + C*h^3

Length (m)	50	100	**Coefficient A**	100
Width (m)	2		**Coefficient B**	156
Side Slope (1 in)	3		**Coefficient C**	12

OUTLET CULVERT PARAMETERS

Diameter (m)	0.300
Culvert Fall (m)	0.080
Culvert Length (m)	4.0
Tailwater Depth (m)	0.300
No of Culverts	1
Entrance Type (1-3)	1
Inlet Loss Coeff	4.00
Manning's n	0.011

SOIL PERMEABILITY PARAMETERS

Permeability Kt (m/d)	0.5
Clogged Kc (m/d)	0.5
Clogged Layer Thickness t (m)	0.5

ORIFICE PLATE PARAMETERS

Orifice Dia (m)	0.010
Orifice Coeff	1.00
Orifice CL depth (m	1.000

COMPENSATION BASIN CALCULATOR

Project: Lot 12 Abattoir Road, Merredin | **Job No.** P003016

Client: ACENERGY | **Date:** 28/03/2025

COMPENSATING BASIN DISCHARGE - Section 7.5.7 AR&R 1987

LOCATION	KELLERBERRIN				
EQUIV AREA (ha)	0.195				
ARI	5				
DURATION (hrs)	12				
RAINFALL (mm/hr)	3.43	---------------	------- PEAK --------------		---------------
INFLOW VOL (cum)	80	INFLOW	OUTFLOW	VOLUME	LEVEL
HYET PERIOD (hrs)	0.50	12	1	47	311.313
CALC PERIOD (hrs)	0.25	---------------	--------------	--------------	---------------

DURATN	INFLOW	OUTFLOW	VOLUME	LEVEL	RAINFALL	WORST CASE
1	29	1	34	311.245	19.1	
2	26	1	40	311.274	11.8	
3	17	1	42	311.290	8.9	
6	11	1	46	311.309	5.5	
12	12	1	47	311.313	3.4	<=
24	7	1	47	311.311	2.1	
48	5	1	41	311.284	1.2	
72	3	1	37	311.260	0.9	

PERIOD	HRS	HYETO GRAPH (%)	INFLOW (l/s)	OUTFLOW (l/s)	VOLUME (cum)	LEVEL (m)
			0	0	0	311.000
0	0.00	0.00	6	0	5	311.047
1	0.25	6.90	6	1	10	311.090
2	0.50	6.90	12	1	21	311.161
3	0.75	13.50	12	1	31	311.224
4	1.00	13.50	4	1	33	311.237
5	1.25	4.25	4	1	36	311.251
6	1.50	4.25	2	1	36	311.256
7	1.75	2.15	2	1	37	311.260
8	2.00	2.15	3	1	39	311.269
9	2.25	3.35	3	1	41	311.279
10	2.50	3.35	2	1	42	311.286
11	2.75	2.75	2	1	43	311.292
12	3.00	2.75	2	1	44	311.296
13	3.25	2.10	2	1	44	311.300
14	3.50	2.10	2	1	45	311.304
15	3.75	2.45	2	1	46	311.309
16	4.00	2.45	2	1	47	311.311
17	4.25	1.85	2	1	47	311.313
18	4.50	1.85	1	1	47	311.311
19	4.75	0.80	1	1	46	311.309
20	5.00	0.80	1	1	46	311.307
21	5.25	0.90	1	1	46	311.306
22	5.50	0.90	1	1	45	311.304
23	5.75	0.70	1	1	45	311.302
24	6.00	0.70	1	1	45	311.303
25	6.25	1.55	1	1	45	311.304
26	6.50	1.55	1	1	45	311.304
27	6.75	1.35	1	1	45	311.304
28	7.00	1.35	1	1	45	311.304
29	7.25	1.15	1	1	45	311.303
30	7.50	1.15	1	1	45	311.302
31	7.75	1.00	1	1	45	311.301
32	8.00	1.00	1	1	44	311.298
33	8.25	0.60	1	1	44	311.295
34	8.50	0.60	0	1	43	311.292
35	8.75	0.45	0	1	42	311.288
36	9.00	0.45	0	1	41	311.283
37	9.25	0.20	0	1	41	311.279
38	9.50	0.20	0	1	40	311.276
39	9.75	0.55	0	1	39	311.273
40	10.00	0.55	0	1	39	311.270
41	10.25	0.50	0	1	38	311.266
42	10.50	0.50	0	1	38	311.263
43	10.75	0.35	0	1	37	311.259
44	11.00	0.35	0	1	36	311.255
45	11.25	0.35	0	1	36	311.251
46	11.50	0.35	0	1	35	311.247
47	11.75	0.25	0	1	34	311.243
48	12.00	0.25	0	1	33	311.238
49	12.25	0.00	0	1	32	311.233
50	12.50	0.00	0	1	31	311.228
TOTAL Q		100	89	54		
TOTAL V			80	49	80	

STORAGE & DISCHARGE RELATIONSHIPS

DEPTH (m)	Vs (cu m)	Qo (l/s)	WATER LEVEL (m)	LAKE VOLUME (cu m)	TWL AREA (sq m)	CULVERT FLOW (l/s)	ORIFICE FLOW (l/s)	INFILT'N Qo (l/s)	CLOGGED Qo (l/s)
0.000	0	0	311.00	0	100	0	0	0.6	0.6
0.100	12	1	311.10	12	132	0	0	0.8	0.9
0.200	26	1	311.20	26	164	0	0	0.9	1.3
0.300	44	1	311.30	44	197	0	0	1.1	1.8
0.400	66	1	311.40	66	231	0	0	1.3	2.4
0.600	119	2	311.60	119	300	0	0	1.7	3.8
0.800	186	2	311.80	186	373	0	0	2.2	5.6
1.000	268	3	312.00	268	448	0	0	2.6	7.8
1.200	365	3	312.20	365	526	0	0	3.0	10.4

BASIN GEOMETRY

Length (m)	50
Width (m)	2
Side Slope (1 in)	3

V = A*h + B*h^2 + C*h^3

Coefficient A	100
Coefficient B	156
Coefficient C	12

OUTLET CULVERT PARAMETERS

Diameter (m)	0.300
Culvert Fall (m)	0.080
Culvert Length (m)	4.0
Tailwater Depth (m)	0.300
No of Culverts	1
Entrance Type (1-3)	1
Inlet Loss Coeff	4.00
Manning's n	0.011

SOIL PERMEABILITY PARAMETERS

Permeability Kt (m/d)	0.5
Clogged Kc (m/d)	0.5
Clogged Layer Thickness t (m)	0.5

ORIFICE PLATE PARAMETERS

Orifice Dia (m)	0.010
Orifice Coeff	1.00
Orifice CL depth (m)	1.000

COMPENSATION BASIN CALCULATOR

Project:	Lot 12 Abattoir Road, Merredin	**Job No.**	P003016
Client:	ACENERGY	**Date:**	28/03/2025

COMPENSATING BASIN DISCHARGE - Section 7.5.7 AR&R 1987

LOCATION	KELLERBERRIN				
EQUIV AREA (ha)	0.195				
ARI	1				
DURATION (hrs)	6				
RAINFALL (mm/hr)	3.11	----------------	------- PEAK	--------------	--------------
INFLOW VOL (cum)	36	INFLOW	OUTFLOW	VOLUME	LEVEL
HYET PERIOD (hrs)	0.50	6	1	23	311.179
CALC PERIOD (hrs)	0.25	----------------	--------------	--------------	--------------

DURATN	INFLOW	OUTFLOW	VOLUME	LEVEL	RAINFALL	WORST CASE
1	16	1	18	311.147	10.6	
2	15	1	21	311.163	6.6	
3	10	1	22	311.170	5.0	
6	6	1	23	311.179	3.1	<=
12	7	1	23	311.175	1.9	
24	4	1	21	311.163	1.2	
48	3	1	20	311.156	0.7	
72	2	1	15	311.122	0.5	

PERIOD	HRS	HYETO GRAPH (%)	INFLOW (l/s)	OUTFLOW (l/s)	VOLUME (cum)	LEVEL (m)
			0	0	0	311.000
0	0.00	0.00	2	0	2	311.014
1	0.25	4.55	2	0	3	311.027
2	0.50	4.55	4	0	6	311.053
3	0.75	9.15	4	1	9	311.078
4	1.00	9.15	1	1	9	311.080
5	1.25	2.10	1	1	9	311.082
6	1.50	2.10	6	1	14	311.119
7	1.75	15.30	6	1	19	311.152
8	2.00	15.30	3	1	21	311.162
9	2.25	6.45	3	1	22	311.173
10	2.50	6.45	1	1	23	311.175
11	2.75	3.20	1	1	23	311.177
12	3.00	3.20	1	1	23	311.177
13	3.25	2.15	1	1	23	311.177
14	3.50	2.15	1	1	23	311.178
15	3.75	2.65	1	1	23	311.179
16	4.00	2.65	1	1	23	311.178
17	4.25	1.65	1	1	23	311.176
18	4.50	1.65	0	1	22	311.173
19	4.75	1.15	0	1	22	311.171
20	5.00	1.15	0	1	22	311.168
21	5.25	0.95	0	1	21	311.165
22	5.50	0.95	0	1	21	311.161
23	5.75	0.70	0	1	20	311.157
24	6.00	0.70	0	1	19	311.152
25	6.25	0.00	0	1	19	311.147
26	6.50	0.00	0	1	18	311.142
27	6.75	0.00	0	1	17	311.137
28	7.00	0.00	0	1	16	311.132
29	7.25	0.00	0	1	16	311.127
30	7.50	0.00	0	1	15	311.122
31	7.75	0.00	0	1	14	311.117
32	8.00	0.00	0	1	13	311.112
33	8.25	0.00	0	1	13	311.107
34	8.50	0.00	0	1	12	311.103
35	8.75	0.00	0	1	11	311.098
36	9.00	0.00	0	1	11	311.092
37	9.25	0.00	0	1	10	311.087
38	9.50	0.00	0	1	9	311.082
39	9.75	0.00	0	1	9	311.077
40	10.00	0.00	0	1	8	311.073
41	10.25	0.00	0	1	8	311.068
42	10.50	0.00	0	1	7	311.064
43	10.75	0.00	0	0	7	311.061
44	11.00	0.00	0	0	7	311.057
45	11.25	0.00	0	0	6	311.054
46	11.50	0.00	0	0	6	311.051
47	11.75	0.00	0	0	6	311.048
48	12.00	0.00	0	0	5	311.045
49	12.25	0.00	0	0	5	311.043
50	12.50	0.00	0	0	5	311.040
TOTAL Q		100	40	35		
TOTAL V			36	32	36	

STORAGE & DISCHARGE RELATIONSHIPS

DEPTH (m)	Vs (cu m)	Qo (l/s)	WATER LEVEL (m)	LAKE VOLUME (cu m)	TWL AREA (sq m)	CULVERT FLOW (l/s)	ORIFICE FLOW (l/s)	INFILT'N Qo (l/s)	CLOGGED Qo (l/s)
0.000	0	0	311.00	0	100	0	0	0.6	0.6
0.100	12	1	311.10	12	132	0	0	0.8	0.9
0.200	26	1	311.20	26	164	0	0	0.9	1.3
0.300	44	1	311.30	44	197	0	0	1.1	1.8
0.400	66	1	311.40	66	231	0	0	1.3	2.4
0.600	119	2	311.60	119	300	0	0	1.7	3.8
0.800	186	2	311.80	186	373	0	0	2.2	5.6
1.000	268	3	312.00	268	448	0	0	2.6	7.8
1.200	365	3	312.20	365	526	0	0	3.0	10.4

BASIN GEOMETRY

Length (m)	50
Width (m)	2
Side Slope (1 in)	3

V = A*h + B*h^2 + C*h^3

Coefficient A	100
Coefficient B	156
Coefficient C	12

OUTLET CULVERT PARAMETERS

Diameter (m)	0.300
Culvert Fall (m)	0.080
Culvert Length (m)	4.0
Tailwater Depth (m)	0.300
No of Culverts	1
Entrance Type (1-3)	1
Inlet Loss Coeff	4.00
Manning's n	0.011

SOIL PERMEABILITY PARAMETERS

Permeability Kt (m/d)	0.5
Clogged Kc (m/d)	0.5
Clogged Layer Thickness t (m)	0.5

ORIFICE PLATE PARAMETERS

Orifice Dia (m)	0.010
Orifice Coeff	1.00
Orifice CL depth (m)	1.000

APPENDIX H BESS FIRE SAFETY FAQ

BESS Fire Safety FAQ

Merredin D-BESS

Rev.0

1. **How does the proposed battery system mitigate fire risks?**

The battery system proposed by ACEnergy uses lithium-iron phosphate (LFP) chemistry, which is one of the safest lithium-ion battery types available. Unlike other battery chemistries, LFP batteries have a significantly lower risk of overheating and fire. This is because they are highly stable and do not easily enter thermal runaway—a rapid overheating reaction that can lead to fire or explosion.

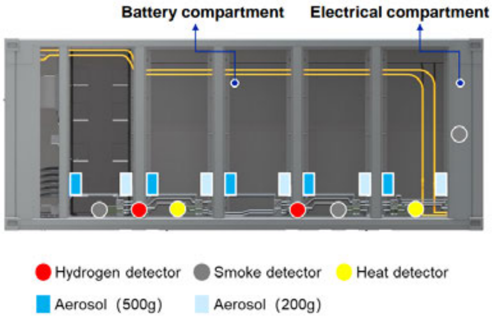
The safety of the battery system has been tested under extreme conditions using the UL 9540A test, a recognised fire safety assessment for battery energy storage systems. The results confirm that the battery does not produce external flames, does not overheat nearby units, and does not pose an explosion risk. The containerised design and in-built fire suppression system further reduce fire risks by containing and extinguishing any potential fire within the unit.

Each battery container is equipped with smoke detectors, gas sensors, and temperature monitors to provide early warning of any issues. Please refer to the figure below as an example. If an abnormal condition is detected, the automatic fire suppression system activates to quickly contain and extinguish the fire within the container. This prevents the fire from spreading to other battery units or the surrounding area.

Ener C+ Product Overview - Fire Suppression System

➢ Detection system

- Equipped with different types of detectors, such as smoke detector, heat detector and gas detector
- All detection signals are received and processed by the fire control panel, and the hydrogen (H_2) detector can be linked with the explosion-proof fan system.



No	Type	Quantity	Configuration	Remarks
1	Heat detector	2	**Optional**	Detection of temperature, in the battery compartment
2	Smoke detector	2+1	Standard	Detection of smoke particles, two in the battery compartment, and one in the electrical compartment
3	Hydrogen detector	2	Standard	Detection of hydrogen, in the battery compartment
4	Fire control panel	1	Standard	Receive detector signals and control fire extinguishing system and explosion-proof system, in the electrical compartment
5	Aerosol	12	Optional	In the battery compartment

The Battery Management System (BMS) continuously monitors the temperature, voltage, and overall condition of each battery. This real-time monitoring allows for early detection of potential issues so that preventative action can be taken before a problem escalates. The system also includes an explosion-proof panel that safely disperses gases before they reach hazardous levels.

Testing has also shown that even if an LFP battery is physically damaged, such as by being punctured, it does not ignite. In rare cases where an LFP battery does catch fire, it primarily produces carbon dioxide, which helps slow combustion. These safety measures ensure that the battery system is designed to prevent, detect, and contain fire risks effectively.

2. **How does the project mitigate risks of fire ignited from within a BESS container?**

ACEnergy has adopted a comprehensive, multi-layered approach to reduce fire risks, including the unlikely event of a fire originating within a BESS container. Key design and planning measures include:

- Adequate separation distances: All battery containers and Medium Voltage Power Stations (MVPS) will be installed with sufficient spacing between units to minimise the risk of fire spreading between components.
- Asset Protection Zone (APZ): A managed APZ of up to 25 metres will be maintained around the BESS and MVPS equipment. This reduces the

likelihood of vegetation contributing to fire spread and supports safe fire response operations.

- Dedicated water supply: A water tank sized in accordance with the Department of Fire and Emergency Services (DFES WA) bushfire protection guidelines will be installed to support firefighting efforts should an incident occur.
- Emergency access: The project will establish a suitable access point from Abattoir Road, designed to allow safe and efficient entry and exit for emergency service vehicles.
- Fire management planning: ACEnergy is committed to preparing and submitting a Bushfire and Fire Management Plan prior to construction. This plan will address both bushfire threats and on-site fire response procedures in line with current regulatory requirements and DFES expectations.

These measures are designed to support prevention, containment, and safe response to any internal fire event, ensuring the protection of people, property, and the surrounding environment.

3. **Has the BESS product undergone fire testing, and what standards does it meet?**

Yes, the batteries have undergone extensive fire safety testing and meets stringent international safety standards to ensure protection against fire and thermal events. It is certified to IEC 62619 (battery safety), UL 9540A (thermal runaway fire testing), UL 9540 (BESS safety certification), and UL 1973 (battery performance and safety).

A large-scale burn test conducted by DNV, an internationally recognised testing body, confirmed that the selected BESS product can effectively contain fire within a single unit, preventing spread to adjacent units. Even when placed at the minimum allowable separation distance, neighbouring units remained below critical thermal runaway thresholds, demonstrating strong fire containment and safety measures.

These tests confirm that the BESS meets industry best practices for fire safety and reliability, ensuring compliance with both international and Australian regulatory requirements.

4. **Do LFP batteries release toxic gases if they catch fire?**

According to a full breakdown of the gases released in the UL9540A testing of the proposed battery system, and a declaration from the manufacturer CATL, the proposed battery products do not contain toxic and harmful substances prohibited by the EU, as defined under the EU Battery Regulation: (EU) 2023/1542.

With respect to the potential for long-term air quality impacts, the publicly available Report of Technical Findings Victorian Big Battery (VBB) Fire serves as a reference. Note that the VBB project employs Nickel Manganese Cobalt (NMC) lithium-ion batteries which share very similar off-gas components with the LFP lithium-ion batteries proposed in the Merredin D-BESS project, except for the release of oxygen. This document details the air monitoring performed by the Environment Protection Authority Victoria (EPA) by deploying two mobile air quality monitors within 2 km of the VBB site. Locations were chosen where there was potential to impact the local community. The data demonstrates that two hours after the fire event, the air quality in the surrounding area was “good” and no long-lasting air quality concerns arose from the fire event. Note that NMC lithium-ion batteries are generally considered more prone to thermal runaway effect than the LFP lithium-ion batteries, due to a lower thermal threshold and the release of oxygen that fuels combustion and accelerates thermal runaway during incidents of overcharging, overheating, or physical damage. In the worst-case scenario event, performed under UL 9540A module level fire testing, the products of combustion of a Megapack battery module (from the NMC lithium-ion batteries used in the VBB) can include flammable and non-flammable gases. Based on those regulatory tests, the flammable gases were found to be below their Lower Flammable Limit (LFL) and would not pose a deflagration or explosion risk to first responders or the general public. The non-flammable gases were found to be comparable to the smoke encountered in a typical Class A structure fire and do not contain any unique or atypical gases beyond what is found in the combustion of modern combustible materials.