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LAND CAPABILITY ASSESSMENT FOR ON-SITE WASTEWATER MANAGEMENT

438 LOBBS ROAD, GLENBRAE, VIC



**PREPARED FOR:
ACENERGY PTY LTD**

Report Reference: E3261.1 AB
Date: 9 May 2023

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PROJECT DETAILS

Project Reference	E3261.1	Rev	AB
Project Title	Glenbrae BESS Project		
Project Location	438 Lobbs Road, Glenbrae	State	VIC
Date	9 May 2023		

CLIENT DETAILS

Prepared for (Client)	ACEnergy Pty Ltd		
Client Contact	Jane Bai		
Client Address	502, 689 Burke Road, Camberwell 3124	State	VIC

DISTRIBUTION

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One (1) Electronic Copy	ACEnergy Pty Ltd		

This document presents the results of the Land Capability Assessment conducted for the above project and is detailed for the sole use of the intended recipient. Should you have any questions related to this report please do not hesitate to contact the undersigned.

PREPARED BY:

Jesse O'Connor, BBiolSc
Environmental Scientist

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TABLE OF CONTENTS

1. INTRODUCTION	1
2. BACKGROUND	1
3. OBJECTIVES	1
4. REGULATORY GUIDELINES	1
5. SITE DETAILS	2
5.1 PROPOSED DEVELOPMENT	2
5.2 MUNICIPAL REQUIREMENTS	2
6. DESKTOP STUDY	2
6.1 SPECIAL WATER SUPPLY CATCHMENT	2
6.2 GEOLOGY	2
6.3 TOPOGRAPHY	3
6.4 CLIMATE	3
6.5 HYDROGEOLOGY	3
6.6 SURFACE WATER	3
6.7 FLOOD POTENTIAL	3
7. SITE INSPECTION	3
7.1 SETBACK DISTANCES	4
7.2 AREA AVAILABLE FOR LAND APPLICATION	4
8. SOIL ASSESSMENT	4
8.1 LIMITING SOIL UNIT	5
8.2 SOIL PERMEABILITY	5
8.3 SOIL PROPERTIES	5
9. RISK ASSESSMENT	6
10. MANAGEMENT PROGRAM	6
10.1 WASTEWATER LOADING	6
10.2 WASTEWATER MANAGEMENT SYSTEM	6
10.3 LAND APPLICATION	7
10.4 WATER BALANCE MODELLING	7
10.5 NUTRIENT BALANCE	7
10.6 DESIGNATED AREA	7
10.7 RESERVE AREA	7
10.8 SOIL AMELIORATION	7
10.9 CONSTRUCTION, OPERATION AND MAINTENANCE	8
11. DISCUSSION AND CONCLUSIONS	8
12. LIMITATIONS	9
13. REFERENCES	10

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TABLES

TABLE 1: SUMMARY OF SITE DETAILS.....	2
TABLE 2: SITE OBSERVATIONS	4
TABLE 3: APPLICABLE SETBACK DISTANCES.....	4
TABLE 5: SOIL PROFILE	5
TABLE 6: SOIL ANALYSIS SUMMARY	5
TABLE 6: SITE CONSTRAINTS & MITIGATION MEASURES.....	6
TABLE 7: SYSTEM SPECIFICATIONS	7

FIGURES

FIGURE 1: SITE LOCALITY	13
FIGURE 2: SAMPLING & SYSTEM DETAILS.....	14

APPENDICES

APPENDIX A – CONCEPT LAYOUT
APPENDIX B – SITE PHOTOGRAPHS
APPENDIX C – SETBACK DISTANCES
APPENDIX D – BOREHOLE LOGS
APPENDIX E – PERMEABILITY TESTING
APPENDIX F – TREATMENT AND APPLICATION SYSTEMS
APPENDIX G – WATER BALANCE CALCULATIONS
APPENDIX H – NUTRIENT BALANCE CALCULATIONS
APPENDIX I – SYSTEM CONSTRUCTION, OPERATION AND MAINTENANCE

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1. INTRODUCTION

Ground Science Pty Ltd (Ground Science) has prepared this report to present the findings of a Land Capability Assessment (LCA) undertaken for the proposed residential development at 438 Lobbs Road, Glenbrae, Victoria (herein referred to as 'the site').

Ground Science was engaged by ACEnergy Pty Ltd (herein referred to as 'the Client') to conduct the LCA in general accordance with Ground Science Proposal GSPE2022190 AC dated 2 November 2022. All Ground Science personnel involved in the preparation of this LCA are suitably qualified and experienced. Should Council require verification, curricula vitae and relevant insurances can be made available.

2. BACKGROUND

Ground Science understands that the Client proposes to develop the site as a battery energy storage operation. As no reticulated sewer exists, an assessment is required to ensure wastewater generated from the development can be suitably managed onsite as part of planning approvals.

3. OBJECTIVES

The general objectives of the LCA are to:

- Gather geographical and social information relevant to the site;
- Determine high risk and sensitive areas within the allotment and identify relevant site conditions;
- Assess the capability of the site to sustainably manage wastewater within the allotment boundaries; and
- Formulate a sustainable management plan (if possible).

4. REGULATORY GUIDELINES

This assessment was performed in general accordance with the State Environment Protection Policy (SEPP), 2018 – *Waters*. The SEPP requires onsite domestic wastewater to be managed to prevent the transport of nutrients, pathogens and other pollutants to surface waters and to prevent any impacts on groundwater beneficial uses. To enable this, guidance has been sought from the following standards and documents:

- EPA Publication 891.4 *Code of Practice (Onsite Wastewater Management)* (2016);
- Municipal Association of Victoria *Victorian Land Capability Assessment Framework* (2014);
- AS/NZS: 1547:2012 *On-site Domestic Wastewater Management*.

In accordance with EPA 891.4 (2016) the assessment should follow the conservative and 'best practice' LCA report procedures for carrying out land and soil assessments and hydrological calculations for designing land application areas. The framework for LCA aims to direct the assessor to consider both quantitative and qualitative methodologies and identify constraints presented by the site and soil characteristics.

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5. SITE DETAILS

The information presented in Table 1 describes the site. A site locality plan is also provided in Figure 1.

Table 1: Summary of Site Details

Site Address	438 Lobbs Road Glenbrae, VIC
Standard Parcel Identifier (SPI)	1~21\PP2597
Council area	PYRENEES
Surface area	115.92ha
Domestic water supply	None
Availability of sewer	None
Planning zone	Farming Zone (FZ)
Planning overlays	Environmental Significance Overlay - Schedule 1 (ESO1)

5.1 PROPOSED DEVELOPMENT

The site is proposed to be developed as a battery energy storage operation including a control room in the north of the site. Information provided by the Client indicates up to five (5) permanent staff members will be on site during operations, which will be considered for design purposes.

Concept layout plans are presented Appendix A.

5.2 MUNICIPAL REQUIREMENTS

Under the provisions of the SEPP, the Pyrenees Shire Council released its latest Domestic Wastewater Management Plan (DWMP) in 2015. The DWMP is used to ensure that domestic wastewater for all existing and future developments is managed to protect human health and the environment.

The DWMP identifies risk factors for sites in regard to their ability to management wastewater on-site. The general area of the site is deemed low risk for potable water supply catchment areas within the Loddon River (Laanecoorie) Catchments.

6. DESKTOP STUDY

6.1 SPECIAL WATER SUPPLY CATCHMENT

A review of the Victorian Government Land and Water Management online resources identified the site within the Waubra Groundwater Supply Protection Areas and the north of the site existing within the Loddon River (Laanecoorie) Declared Water Supply Catchment.

6.2 GEOLOGY

Review of the Department of State Development, Business and Innovation data set Seamless Geology (2014) describes the local geology as Newer Volcanic Group (Neo). The unit at the site is described as alkali basalt and tholeiitic basalt of the Miocene to Holocene period.

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6.3 TOPOGRAPHY

Information gathered from the Department of Environmental, Land, Water and Planning (DELWP) Land and Survey Spatial Information (LASSI) database shows the site lying at approximately 430m Australian Height Datum (AHD). According to local contours, the site experiences a southwest slope of 1%.

6.4 CLIMATE

Representative climate data from the Bureau of Meteorology (BOM) is used to perform water balancing calculations and provide insight into the sites climatic condition. The climate station closest to the site with suitable rainfall data is the Lexton Climate Station, which reports a mean annual rainfall figure of 597mm/year.

No nearby climate stations currently record pan evaporation. As such, data was obtained from the Queensland Department of Science, Information Technology and Innovation SILO database. The SILO datasets are derived from observational records, extrapolated to be site-specific based on spatial and temporal information, with the last 30 years of data used for design considerations. An annual evaporation of 1,230mm/year has been adopted.

6.5 HYDROGEOLOGY

The Visualising Victoria's Groundwater (VVG) website maintains a database of registered groundwater bores across Victoria. A search of the groundwater database identified three (3) registered bores within 500m of the site. Based on available information and site conditions, groundwater is expected to be encountered at less than 5m below ground level (mbgl) within the western section of the site. Groundwater depth is expected to increase to between 10 and 20mbgl toward the site's southeast corner.

6.6 SURFACE WATER

A review of the DEPI Victorian Water Resources online mapping database and aerial imagery identified two (2) dams existing within the site. One (1) is present in the middle of the development area, while the other is located in the southwest corner. The closest significant watercourse is believed to be Burnbank Creek, located 1.2km northwest of the development area.

6.7 FLOOD POTENTIAL

The development area is expected to be outside all flood ways and areas subject to inundation.

7. SITE INSPECTION

Ground Science personnel conducted a site inspection and soil assessment on the 7 November 2022. Observations are detailed below, and site photographs are presented in Appendix B.

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Table 2: Site Observations

Observation	438 Lobbs Road, Glenbrae
Setting	Predominantly farmland, with patches of bushland approximately 1km to the west
Infrastructure	A high voltage powerline runs along the southern border of the development area. No other infrastructure was within the development area, beside post and wire farm fencing. A single dwelling was located in the southwest corner of the site, approximately 400m from the development area
Surface water	There were three (3) dams near the eastern boundary of the development area, surrounded by trees. Another two (2) dams were observed near the southern boundary of the site. No surface water features were observed within the development area boundary
Slope	There were slight undulations throughout the site, not believed to exceed 5%
Rock outcrops	Not observed
Coverage/exposure	The site exhibited healthy surface vegetation coverage. The development area was cleared of trees/bushes, except for scattered trees along the site boundary. A large patch of trees was in the northern centre of the site surrounding three dams. Other smaller patches of trees were observed on the site, including in the northeast corner and around the dwelling. This is not expected to limit exposure across the proposed LAA

7.1 SETBACK DISTANCES

Setback distances dependent on effluent type and to be observed for all sensitive features as specified in Table 5 of EPA 891.4. Relevant setback distances are outlined in Table 3, with a complete table provided in Appendix C.

Table 3: Applicable Setback Distances

Landscape feature or structure	Setback Distance (m)	
	Primary treated effluent	Secondary treated effluent
Wastewater field up-slope of building or adjacent Lot	6	3
Wastewater field down-slope of building or adjacent Lot	3	1.5
Waterways and surface water features (non-potable)	60	30

7.2 AREA AVAILABLE FOR LAND APPLICATION

The land application area (LAA) is the area into which treated effluent is applied via the chosen land application method. The site is expected to have sufficient area available for effluent application.

A reserve area is a duplicate land area of equal size to the designated LAA which should be used if the original LAA fails, is inadequate or needs to be rested. It is noted that a reserve area can be reduced or removed at Council's discretion if it is satisfied there is a low risk of negative impact on the environment and human health.

8. SOIL ASSESSMENT

A soil assessment conducted across the site included three (3) boreholes, targeting potential land application areas, shown in Figure 2. A maximum depth of 2.1mbgl was achieved. The soil conditions observed during the field program are summarised in Table 5 and further detailed in bore logs presented in Appendix D.

Table 5: Soil Profile

Soil Lithology	Depth (mbgl)	Description
Silty CLAY	0.0 – 0.1 to 0.2	Firm, W<PL, dark brown silty clay of low to medium plasticity with trace sand and rootlets
Silty CLAY	0.1 to 0.3 – 0.2 to 0.6	Firm - stiff, W<PL, brown silty clay of medium plasticity with trace sand
Silty CLAY	0.2 to 0.6 – 0.6 to 2.1+	Firm - stiff, W<PL - W≈PL, light brown/red brown/grey mottled orange red silty clay of medium to high plasticity. W<PL and red brown from 0.3mbgl.

8.1 LIMITING SOIL UNIT

The limiting soil unit was identified as a silty clay, which must be considered for the long-term absorption of effluent. The soil displays the properties of a light clay when manipulated into a moist bolus, with consideration of its plasticity, sand and clay content in line with McDonald (1990).

8.2 SOIL PERMEABILITY

Soil permeability is the rate which soil transmits water and air. EPA 891.4 outlines two procedures for estimating soil permeability; in-situ constant head permeability testing or indicative rates based on key soil properties (such as texture, structure, depth, colour and mottling). The indicative permeability rates detailed in EPA 891.4 for a light clay are <0.06-0.5m/d (soil category 5a/c).

The *Talsma Constant Head Soil Permeability Measurement* as outlined in AS/NZS 1547:2012 was used to measure in-situ the permeability of the limiting soil layer at BH03. The permeability rate was calculated at 0.0218m/day, indicative of a **weakly structured light clay (soil category 5c)**. Soil permeability results are presented in Appendix E.

8.3 SOIL PROPERTIES

Samples of discrete soil layers were collected at selected borehole locations for subsequent laboratory analysis of pH, electrical conductivity (EC) and stability. The soil pH and EC of 1:5 soil/water suspensions were measured using a hand-held meter, with modified Emerson Aggregate tests undertaken for a preliminary assessment of stability.

Table 6: Soil Analysis Summary

Sample no.	Soil Unit	Depth (m)	pH	EC (dS/m)	EAC
BH01-0.2	Growing Unit	0.1	5.38	0.003	Slaking
BH01-0.5	Limiting Unit	0.5	6.65	0.003	Slaking
BH02-0.1	Growing Unit	0.1	4.84	0.002	Slaking
BH02-0.5	Limiting Unit	0.5	5.67	0.003	Slaking
BH03-0.2	Growing Unit	0.1	4.86	0.002	Slaking
BH03-0.5	Limiting Unit	0.5	5.72	0.002	Slaking

Sample analysis reported average pH and EC within acceptable ranges to support plant growth within the soil units. Emerson aggregate test results indicate slaking potential within both the growing and limiting units. Soil amelioration is recommended as outlined in Section 10.8.

9. RISK ASSESSMENT

Based on the site and soil characteristics, a risk assessment has been undertaken to consider typical constraints affecting the onsite management of wastewater. Major and moderate constraints are discussed in Table 6:

Table 6: Site Constraints & Mitigation Measures

Characteristic	Description	Level of constraint	Mitigation measure / comments
Declared Water Supply Catchment	Site located within Loddon River Declared Water Supply Catchments.	Major	<ul style="list-style-type: none"> Adopt secondary treatment as minimum standard
Surface water features	Multiple dams exist at the site	Major	<ul style="list-style-type: none"> Adopt secondary treatment to reduce required setbacks Observe minimum setback distance requirements
Indicative permeability	Category 5c soils identified	Moderate	<ul style="list-style-type: none"> Prepare receiving soil by deep ripping Treat with gypsum Utilisation application methods reliant on evapotranspiration
pH levels	pH < 5	Moderate	<ul style="list-style-type: none"> Treat receiving soils with agricultural lime as described in Section 10.8
Emerson aggregate class	Slaking soils identified	Moderate	<ul style="list-style-type: none"> Treat LAA with gypsum as described in Section 10.8

The mitigation measures listed above must be implemented to reduce any potential impact on human health and the environment.

10. MANAGEMENT PROGRAM

10.1 WASTEWATER LOADING

The hydraulic loading of treated effluent is contributed to by numerous factors including occupancy and proposed site use. EPA guidelines indicate that the hydraulic loading can be calculated by potential occupancy and the applicable design hydraulic flow rates.

The EPA 891.4 (2016) wastewater flow allowance for offices (20L/person/day) is considered a suitable rate for the proposed development. Water balance calculations will be made based on an anticipated hydraulic loading of 100L/day, with an associated organic loading of 75g BOD/day.

10.2 WASTEWATER MANAGEMENT SYSTEM

Untreated domestic wastewater typically has values of 200-300mg/L biochemical oxygen demand (BOD₅) and 200-300mg/L total suspended solids (TSS). Primary treated effluent ranges from 100-140mg/L BOD and 20-55mg/L TSS with an outlet filter, while indicative target effluent quality for secondary treatment systems are <20mg/L BOD₅, < 30mg/L TSS and <10cfu/100mL E. Coli.

Secondary treatment is required due to developments location within a Declared Water Supply Catchment. Possible secondary treatment options include aerated wastewater treatment systems (AWTS), a combination of a primary treatment with sand/media filters and reed beds, or alternative treatments (vermiculture or composting) with secondary clarification of residual effluent. Further information regarding treatment systems is presented in Appendix F.

10.3 LAND APPLICATION

A range of possible land application systems have been considered, such as absorption trenches/beds, evapotranspiration/absorption (ETA) beds and trenches, Wick Trench and Bed Systems, mound systems and sub-surface irrigation. AS1547:2012 outlines factors affecting the construction and operation of common land application systems with consideration of site features, sub-surface soil conditions and identified constraints.

Sub-surface irrigation is considered the most suitable effluent application method due to the low permeability of the soils observed at the site.

Further assessment of land application systems is presented in Appendix F.

10.4 WATER BALANCE MODELLING

Water balance modelling has been undertaken to calculate the minimum area for sub-surface irrigation. The water balance considers climate data and is designed so that the LAA is based upon a depth of saturated soil that meets the upper limits of acceptance. The parameters and results of the water balance and calculations are outlined in Table 7 and further detailed in in Appendix G.

Table 7: System Specifications

Treatment system	Application system	Daily wastewater flow (L/day)	Max. storage depth (mm)	Design irrigation rate (mm/day)	Minimum LAA (m ²)	Reserve area (m ²)
Secondary treatment	Sub-surface irrigation	100	0	3.0	68	-

10.5 NUTRIENT BALANCE

A nutrient balance was undertaken to determine the minimum size for assimilation of nitrogen by soil processes. The nitrogen balance is based upon the MAV (2014) method and assumes a nitrogen concentration in secondary effluent of 25mg/L. A copy of the nutrient balance is presented in Appendix H.

Without considering further expected denitrification below the root zone, the nutrient balance requires a minimum of approximately 34m². This area is covered by the recommended minimum LAA for absorption trenches.

No nutrient balance was undertaken for phosphorus as soil with high clay content will be capable of utilising the anticipated phosphorus loading through biological processes prior to vertical or lateral migration.

10.6 DESIGNATED AREA

The LAA should be constructed in a designated area to enhance evapotranspiration and must not be used for purposes that compromise the effectiveness of the system (including access for maintenance) or have seepage beyond the designated area.

The recommended LAA location is presented in Figure 2, although the final LAA alignment may be modified, provided the minimum size and setback distances are met.

10.7 RESERVE AREA

In accordance with EPA Guidelines, a reserve area is not required for sub-surface irrigation systems where the size of the system has been calculated and designed using the recommended irrigation rates.

10.8 SOIL AMELIORATION

The base of the LAA should be subject to ripping / cultivation to a depth of 150mm and treated with Gypsum at a dosage rate of 0.5kg/m² and agricultural lime at a dosage rate of 0.5kg/m² prior to construction to improve soil

permeability. This renovation method should also act to raise the pH and manage further dispersion of soils caused by salt loading from the treated effluent.

Gypsum must be applied to the LAA surface every 4 years as a form of ongoing soil renovation.

10.9 CONSTRUCTION, OPERATION AND MAINTENANCE

All works should be carried out in accordance with the Council permit and relevant Australian Standards to ensure effective long-term operation of the treatment and land application systems.

Further detail regarding specific system requirements and general recommendations are presented in Appendix I.

11. DISCUSSION AND CONCLUSIONS

This LCA has been conducted for the onsite management of wastewater to be generated by the proposed Glenbrae BESS Project at 438 Lobbs Road. It is understood five (5) full-time staff will occupy the site during operations.

The desktop study and site investigation indicated low soil permeability at the site as the primary constraint associated with domestic wastewater management.

We consider the secondary treatment of wastewater and effluent disposal via sub-surface irrigation as the most suitable option for onsite wastewater management. The cumulative risk to human health and the environment will be low based on implementation of the following recommendations and conditions:

- Wastewater to be treated to secondary effluent standard;
- The treatment system must provide a minimum 24-hour day retention time, with 3-day retention ideal;
- Design, construction, operation and maintenance of the treatment system must be carried out in accordance with the relevant Australian Standard and Council requirements;
- Sub-surface irrigation system must be installed by a suitably licensed contractor based on the minimum LAA of **68m²**, with irrigation lines installed parallel to the sites contours;
- Soils within the LAA should be treated with gypsum and agricultural lime, and subject shallow ripping to improve soil absorption;
- Stormwater diversion must be installed up-slope of the LAA;
- Following construction, vegetation should be maintained around the LAA to promote evapotranspiration and reduce erosion; and
- Low phosphorus and low sodium (liquid) detergents should be used to improve effluent quality.

Ground Science notes that the final system selection and placement should be detailed in a septic permit application to be submitted to Council.

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12. LIMITATIONS

Ground Science has prepared this document in accordance with Ground Science Proposal GSPE2022190 AC dated 2 November 2022

The advice given in this report is based on the assumption that the test results are representative of the overall soil conditions. However, it should be noted that actual conditions in some parts of the site might differ from those found. If further sampling reveals soil conditions significantly different from those shown in our findings, Ground Science must be consulted.

It is recognised that the passage of time affects the information and assessment provided in this document. Ground Science's assessment is based on information that existed at the time of the preparation of this document. It is understood that the services provided allowed Ground Science to form no more than an opinion of the actual site conditions observed and cannot be used to assess the effects of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.

Where data has been supplied by the client or a third party, it is assumed that the information is correct unless otherwise stated. No responsibility is accepted by Ground Science for incomplete or inaccurate data supplied by others.

Any drawings or figures presented in this report should be considered only as pictorial evidence of our work. Therefore, unless otherwise stated, any dimensions should not be used for accurate calculations or dimensioning.

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It is noted that the Pyrenees Shire Council may include provisions of this LCA as conditions on the planning permit for the site.

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13. REFERENCES

- Bureau of Meteorology <http://www.bom.gov.au>
- Department of Primary Industries <http://www.dpi.vic.gov.au>
- Environmental Protection Authority Publication 891.4 *Code of Practice – Onsite Wastewater Management* (2016)
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- State Environment Protection Policy (*Waters of Victoria*) (2003)
- Victorian Water resources <http://www.dse.vic.gov.au/waterdata/>
- Visualising Victoria's Groundwater <http://www.vvg.org.au/>

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FIGURES


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Rev		Drawn	Date	Checked	Scale	Legend — SITE BOUNDARY — COUNTOURS (10m) — WATERCOURSE ★ DEVELOPMENT AREA	LAND CAPABILITY ASSESSMENT 438 LOBBS ROAD, GLENBRAE, VIC		 Ground Science
0	FIGURE 1: SITE LOCALITY	MP	8/11/22	JO	NTS		Prepared For: ACEnergy Pty Ltd		
							Job No: E3261.1		

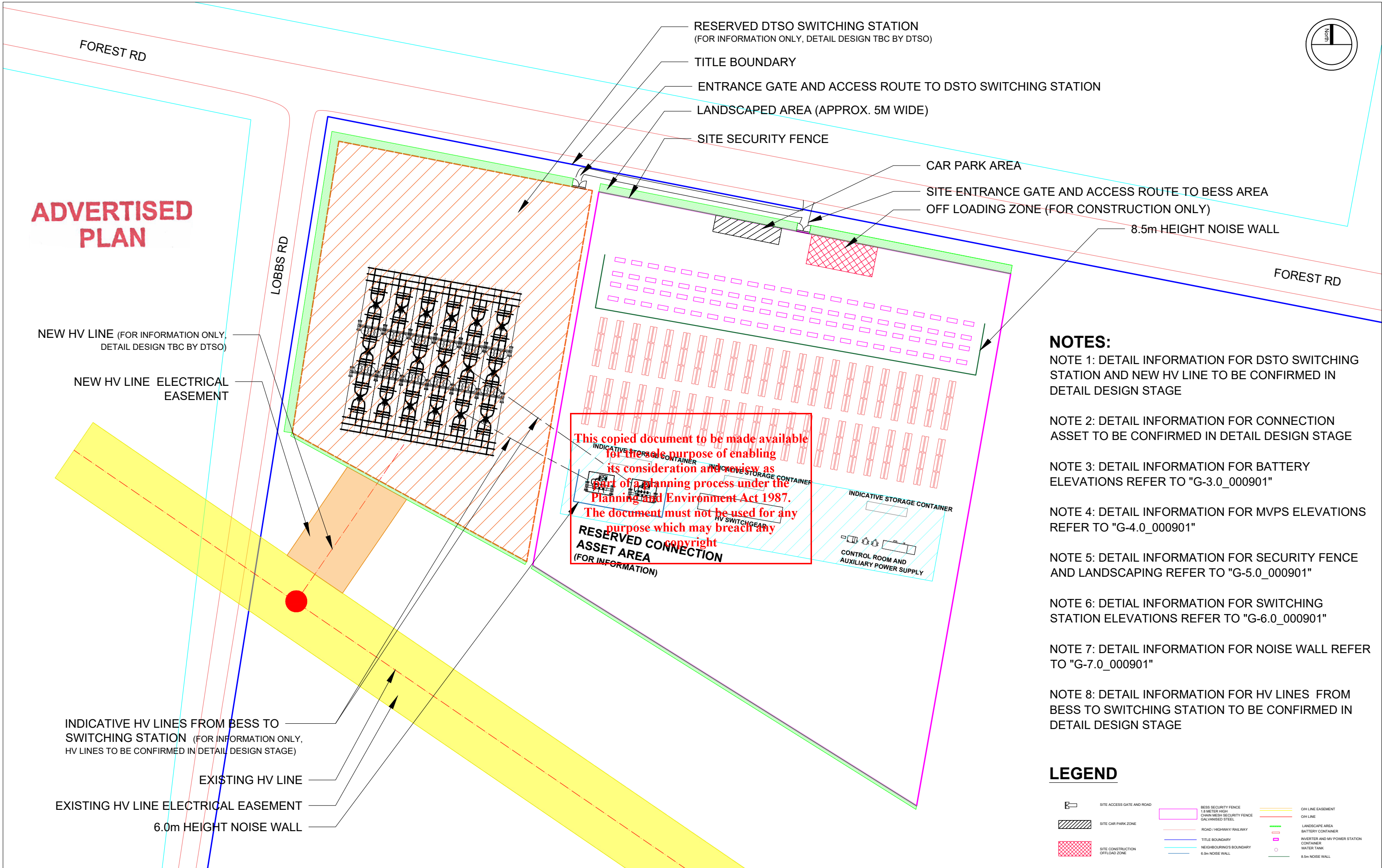


Rev		Drawn	Date	Checked	Scale	<div>Legend</div> <div><div><div></div>Potential LAA – 68m²</div><div><div></div>Approx. Borehole Location</div></div> <div>LAND CAPABILITY ASSESSMENT</div> <div>438 Lobbs Road,</div> <div>Glenbrae VIC</div> <div>Prepared For: ACenergy Pty Ltd</div> <div>Job No: E3261.1</div> <div><div></div><div>Ground Science</div></div>
0	FIGURE 2: SYSTEM DETAILS	HB	9/05/23	JO	NTS	

APPENDIX A
CONCEPT LAYOUT

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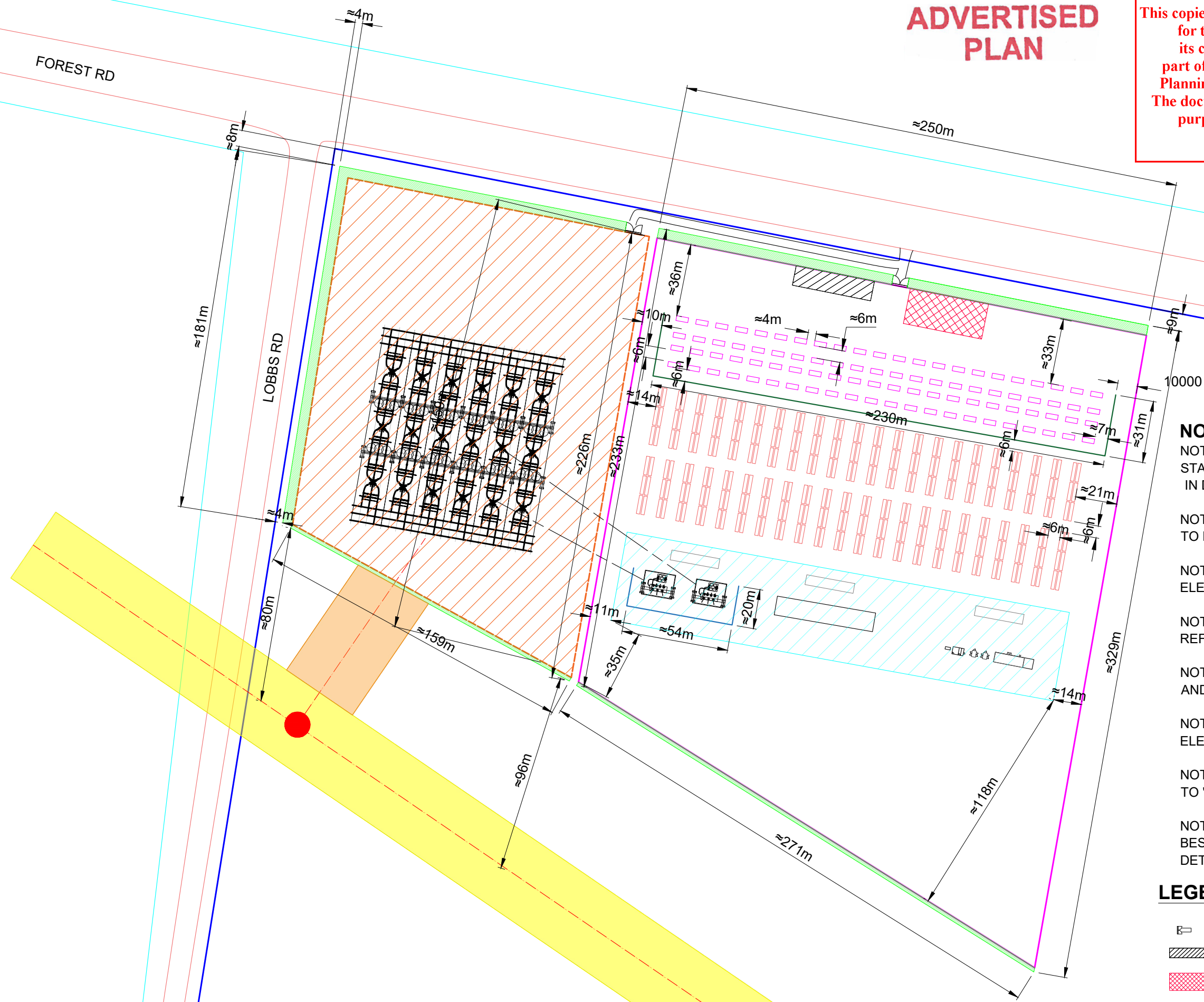
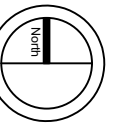
6.0m HEIGHT NOISE WALL

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	SITE ACCESS GATE AND ROAD		BEST SECURITY FENCE 1.8 METRE HIGH CHAIN MESH SECURITY FENCE GALVANISED STEEL		OH LINE EASEMENT
	SITE CAR PARK ZONE		ROAD / HIGHWAY/ RAILWAY		OH LINE
	SITE CONSTRUCTION OFFLOAD ZONE		LANDSCAPE AREA BATTERY CONTAINER		INVERTER AND MPV POWER STATION CONTAINER
			TITLE BOUNDARY		WATER TANK
			NEIGHBOUR'S BOUNDARY		8.5m NOISE WALL
			6.0m NOISE WALL		



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NOTE 1: DETAIL INFORMATION FOR DSTO SWITCHING STATION AND NEW HV LINE TO BE CONFIRMED IN DETAIL DESIGN STAGE

NOTE 2: DETAIL INFORMATION FOR CONNECTION ASSET TO BE CONFIRMED IN DETAIL DESIGN STAGE

NOTE 3: DETAIL INFORMATION FOR BATTERY ELEVATIONS REFER TO "G-3.0_000901"

NOTE 4: DETAIL INFORMATION FOR MVPS ELEVATIONS REFER TO "G-4.0_000901"

NOTE 5: DETAIL INFORMATION FOR SECURITY FENCE AND LANDSCAPING REFER TO "G-5.0_000901"

NOTE 6: DETIAL INFORMATION FOR SWITCHING STATION ELEVATIONS REFER TO "G-6.0_000901"

NOTE 7: DETAIL INFORMATION FOR NOISE WALL REFER TO "G-7.0_000901"

NOTE 8: DETAIL INFORMATION FOR HV LINES FROM BESS TO SWITCHING STATION TO BE CONFIRMED IN DETAIL DESIGN STAGE

	SITE ACCESS GATE AND ROAD		BESS SECURITY FENCE 1.8 METER-HIGH CHAIN MESH SECURITY FENCE GALVANISED STEEL		ON LINE EASEMENT
	SITE CAR PARK ZONE		ROAD / HIGHWAY / RAILWAY		ON LINE
	SITE CONSTRUCTION OFFLOAD ZONE		LANDSCAPE AREA		BATTERY CONTAINER
			TITLE BOUNDARY		INVERTER AND MV POWER STATION CONTAINER
			NEIGHBOURING'S BOUNDARY		WATER TANK
			6.0m NOISE WALL		8.5m NOISE WALL

REVISIONS					
REV	STATUS	DESCRIPTION	DATE	D.B.	C.B.
A	FA	INITIAL ISSUE	15/08/22	XT	RZ
B	FA	SITE PLAN UPDATED	05/03/23	XT	RZ
C	FA	UPDATED ACCORDING TO CUSTOMER COMMENTS	20/04/23	VS	RZ

PROJECT DETAILS:	GLENBRAE BESS 438 Lobbs Rd Glenbrae -37.328781, 143.554825
CLIENT DETAILS:	ACENERGY PTY LTD
DRAWING TITLE:	SITE PLAN 2 OF 2

SCALE: 1:2000

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DRAWING NR:			G-1.2_000901		
DRAWN BY : VS		APPROVED BY : RZ		PROJECT MGR : LZ	
SCALE : AS INDICATED		ISSUE : FOR APPROVAL		ISSUE DATE : 20/04/2023	
SHEET SIZE: A3		PROJECT NO: 901		REV. NO: C	



APPENDIX B
SITE PHOTOGRAPHS

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Surface water – dam east of development area



Soil profile – BH02



Soil profile – BH03

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APPENDIX C

SETBACK DISTANCES

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Landscape Feature/Structure	Setback (m)		
	Primary effluent	Secondary effluent	Advance secondary effluent
Building			
Wastewater field upslope of building	6	3	3
Wastewater field down slope of building	3	1.5	1.5
Allotment boundary			
Wastewater field upslope of adjacent lot	6	3	1
Wastewater field down slope of adjacent lot	3	1.5	0.5
Services			
Water supply pipe	3	1.5	1.5
Potable supply channel (wastewater field upslope)	300	150	150
Potable supply channel (wastewater down slope)	20	10	10
Gas supply pipe	3	1.5	1.5
Underground water tank	15	4	3
Stormwater drain	6	3	2
In-ground swimming pool	6	3	2
Cutting / escarpment (wastewater field upslope)	15	15	15
Surface waters (upslope from)			
Dam, Lake, reservoir (potable, including food production)	300	150	150
Waterways (potable water supply)	100	100	50
Dam, lake, reservoir (stock & non potable)	60	30	30
Waterways, wetlands, ocean beach (continuous or ephemeral, non-potable, includes high-tide mark ocean)	60	30	30
Groundwater bore			
Category 1 to 2a soils	NA	50	20
Category 2b to 6 soils	20	20	20
Water table			
Vertical depth from base of trench to ground water table	1.5	1.5	1.5
Vertical depth from irrigation pipes to ground water table	NA	1.5	1.5

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APPENDIX D
BOREHOLE LOGS

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Ground Science		Engineering Log - Borehole							
		13 Brock Street, Thomastown VIC 3074 Phone: (03) 9464 4617				Borehole No: BH01			
UTM : 54H	Driller Rig : Hand Auger	Job Number : E3261.1							
Easting : 726744.8	Driller Supplier : Ground Science	Client : AC Energy							
Northing : 5866322.1	Logged By : Henry Bellette	Project : 480 Lobbs Road							
RL : N/A	Reviewed By :	Location : Glenbrae							
Total Depth : 0.6m	Date : 07/11/2022								
Drilling Method	Water	Depth (m)	Graphic Log	Soil Origin	Classification Code	Material Description	Moisture	Consistency	Samples
120mm Hand Auger		0.1		Topsoil	CL-CI	Silty CLAY, low to medium plasticity, dark brown, trace fine grained sand (with rootlets.) ,	w < PL	F	
		0.2		Natural	CI	Medium plasticity, brown, trace fine to medium grained sand	w < PL	F-St	BH01-0.2
		0.3		Natural	CI-CH	Medium to high plasticity, light brown, (seepage noted) ,	w ≈ PL	F-St	
				Natural	CI-CH	Red brown,	w < PL	F-St	
		0.5							
				BH01 Terminated at 0.6m					
		1							
		1.5							
		2							
		2.5							
		3							
		3.5							
		4							
		4.5							
		5							
		6							

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Ground Science		Engineering Log - Borehole						
		13 Brock Street, Thomastown VIC 3074 Phone: (03) 9464 4617				Borehole No: BH02		
UTM : 54H	Driller Rig : Hand Auger	Job Number : E3261.1						
Easting : 726910.5	Driller Supplier : Ground Science	Client : AC Energy						
Northing : 5866129.5	Logged By : Henry Bellette	Project : 480 Lobbs Road						
RL : N/A	Reviewed By :	Location : Glenbrae						
Total Depth : 2.1m	Date : 07/11/2022							

Drilling Method	Water	Depth (m)	Graphic Log	Soil Origin	Classification Code	Material Description	Moisture	Consistency	Samples
									u
120mm Hand Auger		0.2		Topsoil	CL-CI	Silty CLAY, low to medium plasticity, dark brown, trace fine grained sand (with rootlets.) ,	w < PL	F	BH2-0.1
		0.3		Natural	CI	Medium plasticity, brown, trace fine to medium grained sand	w < PL	F-St	
		0.5		Natural	CI-CH	Medium to high plasticity, orange brown mottled yellow and dark red, trace fine sized gravel	w < PL	F-St	BH2-0.5
		0.6							
		0.8		Natural	CI-CH	Silty CLAY, medium to high plasticity, red brown, trace fine to medium grained sand	w < PL	F-St	
		0.95		Natural	CI-CH	Trace medium sized gravel trace medium grained sand (seepage noted) ,	w > PL	F-St	
		1		Natural	CI-CH	Red brown mottled orange and grey, trace fine to medium grained sand	w < PL	F-St	
		1.25							
		1.5		Natural	CL	Silty CLAY, low plasticity, red brown, with fine to medium sized gravel with fine to medium grained sand trace fine grained sand (seepage noted) ,	w ≈ PL	St	
		1.9							
	2		Natural	CH	Silty CLAY, high plasticity, grey mottled orange red, trace fine to medium grained sand (seepage noted) ,	w < PL	St-Vst		
		2.1							
		2.5							
		3							
		3.5							
		4							
		4.5							
		5							

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BH02 Terminated at 2.1m



Job Number : E3261.1
Client : AC Energy
Project : 480 Lobbs Road
Location : Glenbrae

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APPENDIX E
PERMEABILITY TESTING

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PERMEABILITY TEST REPORT

Client : **ACEnergy Pty Ltd**
Project : **438 Lobbs Road**
Location : **Glenbrae**

Job Number : **E3261.1**
Test Date : **07-Nov-22**
Tested By : **HB**

Job ref / borehole ref: **BH03**
Test Method : **AS /NZS 1547:2012**

Applies where $S > 2H_c$

Test Fluid : **Potable water**

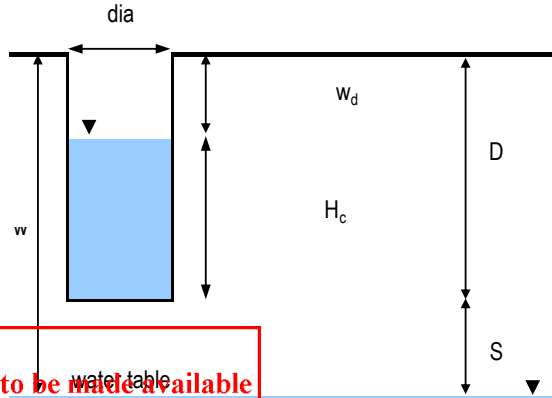
Hole Radius, R : **0.06** m

Hole Depth, D : **0.60** m

Depth to Water, w_d : **0.40** m

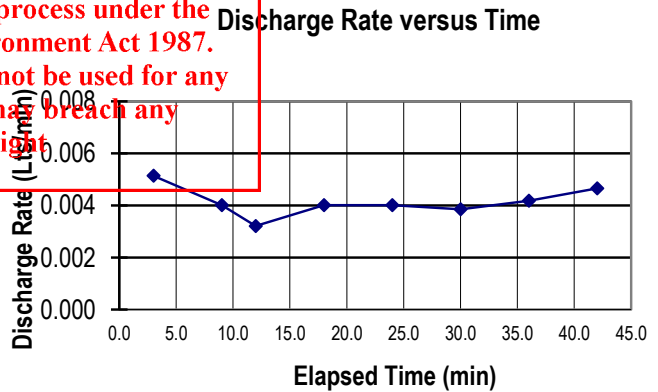
Constant Head, H_c : **0.20** m

Depth to Water
Table, w (if known) : **NE** m



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Reading No.	Elapsed Time t (mins)	Time Interval dt (mins)	Water Added per dt (litres)	Discharge Rate (litres/min)
1	0:03:00	3.00	0.015	0.00514
2	0:09:00	6.00	0.024	0.00401
3	0:12:00	3.00	0.010	0.00321
4	0:18:00	6.00	0.024	0.00401
5	0:24:00	6.00	0.024	0.00401
6	0:30:00	6.00	0.023	0.00385
7	0:36:00	6.00	0.025	0.00417
8	0:42:00	6.00	0.028	0.00466



Discharge Rate Q : **0.0041** litres/min

Hydraulic

$$\text{Conductivity, } K = \frac{Q \{ \sinh^{-1} (H_c/R) - 1 \}}{2 \pi H_c^2}$$

= **2.5E-07** m/sec
= **0.0218** m/day

Site conditions

soil moisture condition : dry
vegetation cover at test site: grass
slope: negligible
surface cracks: not observed
water logging: none

Notes : 1) Test material consists of: 0.0-0.6m: silty clay trace sand.

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APPENDIX F

TREATMENT AND APPLICATION SYSTEMS

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TREATMENT SYSTEMS

Primary Treatment System – Septic Tank

Septic tanks provide preliminary treatment of wastewater by allowing solids to settle out of solution and oils/fats to float to the top, forming a scum layer. Anaerobic bacterial digestion of the settled solids produces sludge, which accumulates in the bottom of the tank. Primary treated effluent flows from the septic tank to a secondary system for further treatment or land application.

Aerated Wastewater Treatment System (AWTS)

AWTS are pre-fabricated treatment systems designed to treat wastewater to secondary effluent standard through the following processes:

- Settling of solids and flotation of scum in an anaerobic primary chamber;
- Oxidation and consumption of organic matter through aerobic biological processes;
- Clarification – secondary settling of solids; and
- Disinfection prior to disposal (in some systems).

Good maintenance of an AWTS (e.g. removal of sludge) is essential to ensure a consistently high level of performance, with quarterly service by an approved maintenance contractor required.

Biological Filters

Biological filters such as wet composting systems are comprised of different filter media which utilise worms and bacteria to breakdown and consume solid residuals and liquid organics within a wastewater load under aerobic conditions. Compost is removed from the humus layer and the residual wastewater that collects at the base of the tank is either pumped or flows by gravity to a land application area. Residual effluent from wet composting systems is generally representative of primary treated effluent only and further treatment may be required to ensure secondary effluent quality.

Sand Filters

Sand filters provide advanced secondary treatment to water that has already undergone primary treatment in a septic tank or similar device. They contain approximately 600mm depth of filter media (usually medium to coarse sand, but other media can be incorporated) within a lined excavation containing an underdrain system. Selection of the filter media is critical, and a carefully designed distribution network is necessary. A dosing well and pump is normally used to allow periodic dosing. Depending on the desired level of treatment, sand filters can be single-pass or may incorporate partial recirculation.

Reed Beds

Reed beds are typically a constructed aquatic system using macrophytes (plants) to provide an oxygen source and uptake nutrients and include Rhizopod Systems. Reed beds provide secondary treatment for BOD, TN, TSS and faecal coliforms for wastewater which has already undergone primary treatment in a septic tank or similar device. A reed bed is typically a 0.5m deep polyethylene tub/planter box approximately 8m long that contains various grades of granular fill media and suitable vegetation. An effluent outlet pump is stored in a dosing sump which is then pumped to the LAA. Reed beds are typically low maintenance and relatively inexpensive.

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LAND APPLICATION METHODS

Land application	Description	Limitations & Suitability
Absorption trenches	Trenches are the most common type of land application system and are generally used on lots which are reasonably flat and where water soaks into the soil readily in all weather conditions. Commonly, distribution pipes, self-supporting arch trenching or box trenching are laid in trenches filled with aggregate/rock. Effluent then soaks into the surrounding soil.	<ul style="list-style-type: none"> Relies on soil absorption Limitations for use within Category 6 soils
ETA beds	ETA beds are shallower and wider forms of traditional absorption trenches. Because ETA systems have smaller sidewall area compared with absorption trenches, the absorption provided by sidewall loading is reduced. ETA systems maximise effluent disposal/reuse through evapotranspiration.	<ul style="list-style-type: none"> Utilises soil absorption and evapotranspiration Not suitable in high rainfall areas Requires secondary treatment for use within Category 6 soils
Sub-surface irrigation	Sub-surface drip irrigation requires secondary treated effluent dosing lines buried in the topsoil at shallow depth. Irrigation systems operate by both soil absorption and evapotranspiration from plants/trees.	<ul style="list-style-type: none"> Primarily utilises evapotranspiration Requires secondary treatment
Mound system	A mound system permits the absorption area to be sited in a location where the natural water table or impermeable rock approaches the ground surface. The mound is filled with medium-grade sand to provide suitable filtering before intercepting the natural soils. A pump/siphon dosing system distributes effluent uniformly through a bed of aggregate at the top of the mound.	<ul style="list-style-type: none"> Suitable for shallow rock or shallow groundwater / inundation conditions Not suitable on steep slopes Limitations regarding construction experience Requires imported material

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APPENDIX G

WATER BALANCE CALCULATIONS

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Ground Science

WATER BALANCE & LAND APPLICATION AREA

CLIENT:				ACENERGY Pty Ltd				JOB NUMBER:				E3261.1				
PROJECT:				Glenbrae BESS Project				DATE:				9/05/2023				
LOCATION:				Glenbrae				ASSESSOR:				Jesse O'Connor				
INPUT DATA																
Design Hydraulic Loading		Q	100	L/day	Based on anticipated hydraulic loading derived from Table 4 in the EPA 891.4 (2016)											
Design Irrigation Rate		DIR	3.0	mm/day	Based on soil texture class/permeability and derived from Table 9 in the EPA 891.4 (2016)											
Crop Factor		C	0.6-0.8	unitless	Estimates evapotranspiration as a fraction of pan evaporation: varies with season and crop type 2											
Retained Rainfall		RF	1.00	unitless	Proportion of rainfall that remains onsite and infiltrates LAA											
Mean Monthly Rainfall Data		Lexton Climate Station				BoM Station										
Mean Daily Pan Evaporation Data		SILO Data Drill				BoM Station										
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Parameter	Symbol	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days in month	D		days	31	28	31	30	31	30	31	31	30	31	30	31	365
Monthly Rainfall	R		mm/month	33.8	37	31.6	40.7	57.2	60.5	64.8	65.2	59.4	55.9	45.4	38.7	590.2
Monthly Evaporation	E		mm/month	133.4407	132.822581	133.0006	125.793258	109.48687097	25.722581	29.441935	46.019355	67.825806	109.19677	139.2439	183.97667	1230.2
Crop Factor	C		unitless	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.8	0.8	0.8	
OUTPUTS																
Monthly Evapotranspiration	ET	ExC	mm/month	164.10581	133.4407	132.822581	125.793258	109.48687097	15.033548	17.665161	27.611613	47.478065	87.357419	111.39512	147.18133	927.0
Percolation	B	DIRxD	mm/month	93	84	93	90	93	90	93	93	90	93	90	93	1095.0
Outputs		ET+B	mm/month	257.10581	217.44877	185.822581	145.88258	119.03226	106.03355	110.66516	120.61161	137.47806	180.35742	201.39512	240.18133	2022.0
INPUTS																
Retained Rainfall	RR	RxRF	mm/month	33.8	37	31.6	40.7	57.2	60.5	64.8	65.2	59.4	55.9	45.4	38.7	590.2
Applied Effluent	W	(QxD)/L	mm/month	45.588235	41.176471	45.58823529	44.117647	45.588235	44.117647	45.588235	45.588235	44.117647	45.588235	44.117647	45.588235	536.8
Inputs		RR+W	mm/month	79.388235	78.176471	77.18823529	84.817647	102.78824	104.61765	110.38824	110.78824	103.51765	101.48824	89.517647	84.288235	1127.0
STORAGE CALCULATION																
Storage for the month	S	(RR+W)-(ET+B)	mm/month	-177.7176	-139.2723	-108.6340228	-61.06493	-16.24402	-1.415901	-0.276926	-9.823378	-33.96042	-78.86918	-111.8775	-155.8931	
Cumulative Storage	M		mm	0	0	0	0	0	0	0	0	0	0	0	0	
Monthly Land Area Required for Zero Storage			m²	13.882308	15.51687	20.10085988	28.521833	50.135643	65.885487	67.589428	55.944952	38.423084	24.908117	19.231371	15.386041	
Minimum LAA Required for Zero Storage				m²	68											
Water Balance prepared in accordance with Municipal Association of Victoria Victorian Land Capability Assessment Framework (2014)																

Water Balance prepared in accordance with Municipal Association of Victoria Victorian Land Capability Assessment Framework (2014)


APPENDIX H

NUTRIENT BALANCE CALCULATIONS

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 <h2 style="display: inline;">NUTRIENT BALANCE</h2>									
CLIENT:		ACENERGY Pty Ltd			JOB NUMBER:		E3261.1		
PROJECT:		Glenbrae BESS Project			DATE:		9/05/2023		
LOCATION:		Glenbrae			ASSESSOR:		Jesse O'Connor		
INPUT DATA									
Wastewater Loading					Nutrient Crop Uptake				
Hydraulic Load	L/day	100	Crop Uptake	220	kg/ha/yr.	equating to	60.27	mg/m ² /day	
Effluent N Concentration	mg/L	25							
Percentage Nitrogen Loss (Geary & Gardener, 1996)	Decimal	0.2							
Daily Nitrogen Load	mg/day	2500							
Annual Nitrogen Load	kg/year	0.91							
Total Nitrogen Loss To Soil	kg/year	0.18							
Remaining Nitrogen Load	kg/year	0.73							
NITROGEN BALANCE BASED ON ANNUAL CROP UPTAKE RATES									
Minimum Land Application Area required for Nitrogen Uptake	m ²	34							
Nominated LAA Size	m ²	68							
Minimum Buffer Required for Excess Nutrient	m ²	0							
Nutrient Balance prepared in accordance with Municipal Association of Victoria Victorian Land Capability Assessment Framework (2014)									

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APPENDIX I

SYSTEM CONSTRUCTION, OPERATION AND MAINTENANCE

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CONSTRUCTION METHODS

Any wastewater system should be installed in compliance with the manufacturer's recommendations, AS/NZS 3500.2:2003 *Plumbing and Drainage* and Council requirements. An EPA Certificate of Approval is no longer required to certify that the installation has been performed in accordance with relevant requirements, however a Council inspection will be undertaken to confirm compliance.

The following excavation techniques shall be observed to minimise the risk of damage to the soil:

- Plan to excavate only when the weather is fine;
- Avoid excavation when the soil has a moisture content above the plastic limit;
- All trenching used to install pipes/lines must be backfilled adequately to prevent preferential flow; and
- Irrigation lines must be installed parallel to the contour of the site slope.

OWNERS RESPONSIBILITIES

Owners and occupiers must ensure the onsite wastewater management system is operated, maintained and monitored in accordance with the Council permit and EPA requirements. If a person other than the property owner will be using the system, the property owner must ensure the person is aware of any responsibilities they have in relation to the system, especially the mandatory requirement for ongoing regular servicing. A person who fails to comply with the permit conditions could be subject to Council enforcement action and penalties under sections 53MA and/or 53N of the Act. Property owners may need to review their public liability insurance policy to ensure the onsite wastewater management system is included.

Treatment System:

A suitably qualified maintenance contractor should perform maintenance procedures including but not limited to:

- Checking the structural integrity of the tank/s and lid/s;
- Checking the condition and operation of the, float switches and other components, and replacing or repairing any faulty parts;
- Ensuring adequate air delivery and timing of aeration;
- Ensuring correct operation of sludge return systems and skimmers;
- Checking biomass accumulation on the media (fixed growth systems) or settleability using Imhoff Cone (suspended growth systems);
- Assessing liquid characteristics such as colour, odour, pH, clarity and dissolved oxygen, to measure treatment performance or making adjustments as required to improve effluent quality; and
- Testing of effluent biochemical oxygen demand and suspended solids by a NATA registered laboratory in accordance with the time period set out in the system's EPA Certificate of Approval.

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Land Application System:

- Regularly maintain vegetation within the LAA to maximise uptake of water and nutrients;
- Monitor and maintain the system as per the manufacturer's recommendations, including flushing of lines;
- Regularly clean in-line filters;
- Do not erect any structures over the LAA;
- Minimise vehicle access to the LAA, to prevent compaction;
- Ensure that a minimum of two warning signs complying with AS 1319 and AS 1547 regarding the use of recycled water is posted within the irrigation area; and
- Divert storm water away from the land application area as much as practicable.

Water Conservation and Improving Wastewater Quality

Good water conservation is an important aspect in the overall management of onsite systems. It is important to the ongoing performance of both the treatment and land application systems that they are not overloaded hydraulically, or by particular chemical constituents contained in wastewater.

AAA rated plumbing is recommended for all water fixtures. Using the following water saving devices, the property's water consumption can be reduced substantially:

- AAA rated shower heads to limit flow to 6L/minute;
- AAA rated dishwasher, using not more than 18L/wash; and
- AAA rated washing machine, front loading, limiting water use to 22L/dry kg of clothes or less;
- dual flush 6/3L pan and cistern; and
- AAA rated taps, limiting flow to less than 9L/minute.

Organic matter, oils and fats can enter the waste stream from various sources. These pollutants can be reduced by avoiding disposal of food wastes, oils and fats down the sink. Compost food and other organic wastes where possible and place oils and fats in sealed containers for disposal with the Council waste collection system. Never install "Insinkerator" style garbage disposal units. A grease trap should be installed to capture any grease and oils that make their way into the waste stream.

Bleaches, disinfectants and other cleaning compounds can harm wastewater treatment systems, such as septic tanks, because they kill bacteria that colonies the treatment system and help treat wastewater. Use these products sparingly and always check that they are safe for septic systems.

Avoid placing oil, paint, petrol, acids, degreasers, photography chemicals, cosmetics, lotions, pesticides and herbicides in the wastewater system. Even small amounts of these products can harm the performance of the onsite effluent management system.

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