A.C. Geotechnical.

Land Capability Assessment

2 Carter Street, Katunga

Report Number: 24047

Distribution

Land Capability Assessment

2 Carter Street, Katunga

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Authorised by

Andrew Craig
BE (Civil) hon
Registered engineer 3574616
Registration of Professional Engineers (VIC) - PE0001410
Email: andrew@acgeotech.com – Phone 0422 097 205

For and on behalf of
A.C. Geotechnical Pty Ltd
ABN: 74 624 767 700
P.O Box 539
Beaconsfield Vic 3807

Accreditation	Land Capability Assessment for On-site Wastewater Management Certificate CET, 2015
Experience	10 years' experience in geotechnical engineering and environmental assessments, with a focus on wastewater management across all states of Australia.

Edition	Description	Date
Rev0	Version 1	14/03/2024

1. SUMMARY

The following summary table should be read in conjunction with the entire report.

Designs wastewater load	4 Bedroom dwelling	750 L/day
Soils characteristics	Horizon A	Horizon B
Soil category	2b sandy Loam	5b light clay
Indicative permeability	1.4-3.0 m/d	0.06-0.12 m/d
Critical site features	• Proposed small lot sizes. • Low permeable clay soils. • Bore located at south end of site.	
Minimum treatment requirements	Secondary	
Disposal system	Suitability	Area required
Absorption trenches	Not suitable	N/A
Subsurface Irrigation	Suitable	300 m^2
ETA Beds	Suitable	100 m^2
Mound	Suitable	50 m^2
Wastewater can be sustainably disposed to land		Yes
Minimum wastewater envelop per lot		(600) m^2

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2. INTRODUCTION:

A.C. Geotechnical Pty Ltd (AC) have been engaged to undertake a Land Capability Assessment (LCA) for the proposed subdivision at 2 Carter Street, Katunga.

The objectives of the assessment was to determine the following:

- Sub-surface ground profile and geological setting.
- The depth to groundwater (if encountered).
- The permeability of the soil profile.
- The capability of the proposed lots to sustainably manage wastewater within the allotment boundaries.
- A minimum wastewater envelope size for each proposed lot.
- A general management program for each proposed lot that should be put into place to minimise health and environmental impacts of on-site wastewater management, including the impact on surface water and groundwater.

2.1 Proposed Development:

It is proposed to subdivide the site into 12 lots with sizes ranging from 2140 m^2 m to 3134 m^2.

For the purpose of this assessment, a design wastewater load for a four (4) bedroom dwelling without water saving fixtures has been used to calculate the minimum required disposal reserve for each proposed lot.

3. SITE DESCRIPTION:

3.1 Site Location:

The subject site is located on the north side of Carter street, with access also via Katunga N Road The site is surrounded by similar size properties, the assumed land use of these properties is summarised in **Table 3.1**.

Table 3.1 -Surrounding land use

North	Agriculture
South	Agriculture
East	Agriculture
West	Residential

3.2 Site Topography and Condition:

The site is relatively level. A single storey dwelling is located in the south-west corner.

Vegetation on the site comprises open turf or pasture. Several small tress are located around the dwelling in the south-west corner.

Site photographs are included in **Appendix B.**

3.3 Key Site Information:

A summary of site characteristic and wastewater loading are included in **Table 3.3**.

Table 3.3 -Key site features

Site Address	2 Carter Street, Katunga
Owner/Applicant	Katunga Fresh
Local Council	Moira
Zoning	Township (TZ)
Total Land Area	Approximately 3.69 ha Proposed subdivision into 13 lots between (2,140 m^2 – 3,134 m^2)
Domestic Water Supply	Reticulated/Tank
Anticipated wastewater loads (Litres/day)	EPA Code of practice - onsite wastewater management (2016) Household without water reduction fixtures: 180 L / person / day. Persons = no. bedrooms + 1 (4 + 1 = 5 persons) **Design wastewater load.** 5 x 180 = 900 L / day
Organic Material Loading Design Rates	EPA Code of practice - onsite wastewater management (2016) 60 g per person per day (5 x 60) = 300 g/day
Availability of sewer	Sewer is not likely to become available to this area in the near future
Groundwater Quality	Groundwater is classified as Brackish (3500 - 7000 mg/L TDS) www.vvg.org.au
Water Table	Local registered bores in the area suggest the ground water is held approximately 5 m below the surface
Climate	Average annual rainfall 467.6 mm
Flood Potential	Negligible
Water catchment area	N/A
Proximity to waterways	Bore located at south end of site
Vegetation	Pasture
Exposure	Generally open
Slope	Relatively level
Landform	Plains
Erosion Potential	Negligible
Surface Drainage	Good
Rocks and Rock Outcrop	West side of site

3.4 Site Geology:

According to the Geological Survey of Victoria, the site is in an area of Cainozoic aged alluvial sediments belonging to Shepparton Formation. An extract from GeoVic 3 is included in **Figure 3.4**.

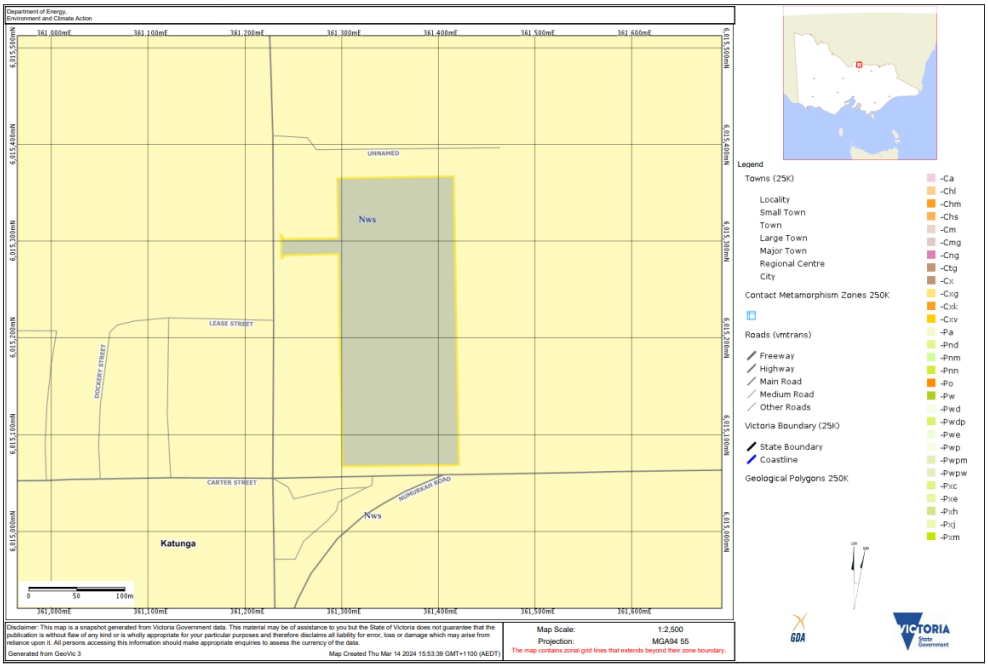

Figure 3.4 Extract of Geological from GeoVic 3

4. SOIL ASSESSMENT AND CONSTRAINTS:

4.1 Soil Profile:

The soil profile encountered during the investigation consisted of orange/brown sandy silt overlaying, medium plasticity, orange/brown, sandy clay.

The critical soil horizon are the medium plasticity, orange/brown, sandy clay.

No groundwater was encountered during this investigation. No abnormal moisture conditions were identified through this assessment.

Borelogs are included in **Appendix C.**

4.2 Site Exposure:

A general assessment of the site exposure is as follows:

The site is exposed to the prevailing winds. The proposed effluent disposal areas are generally exposed to sun and wind all year round.

4.3 Soil Assessment:

Laboratory analysis on each sample collected included the following:

- Texture Analysis using ribboning technique.
- Modified Emerson Analysis.
- Electrical Conductivity.
- pH analysis.

A summary of the analysis is included in Table 4.3

Table 4.3 -Summary of soil assessment

BORE HOLE 1	**SAMPLE DEPTH: 200mm**	**SAMPLE DEPTH: 600mm**
SOIL ASSESSMENT (AS1547-2012)	**SOIL HORIZON: A**	**SOIL HORIZON: B**
Soil Colour	Orange/brown-	Orange/brown-
Soil Texture	Sandy Loam	Light clay
Coarse Fragments (%)	None	None
Soil Structure	Massive	Moderate
Soil Dispersion	Non-dispersive	Non-dispersive
Soil Permeability	1.4-3.0 mm/d	0.06-0.12 mm/d
Soil Category	2b	5b
pH 1:5 Ratio Electronic Method	6.82	6.71
Electrical Conductivity	0.072 dS/m	0.083 dS/m
Salinity Hazard	Non-saline	Non-saline

Figure 4.3 Laboratory Analysis

4.4 Field Assessed Permeability:

Insitu permeability testing with a constant head permeameter was undertaken in multiple locations across the site, see site plan for locations in **Attachment A,** in accordance with AS 1547-2012 using the constant-head test method. The field assessed permeability was calculated using the Talsma-Hallam constantly maintained head of water equation identified in AS 1547-2012.

$$K_{sat} = \frac{4.4\ Q\ [0.5\sinh^{-1}(H/2r) - \sqrt{\{(r/H)^2 + 0.25\}} + r/H]}{2\pi H^2}$$

Where:
K_{sat} = saturated hydraulic conductivity of the soil in cm/min.
4.4 = correction factor for a systematic under-estimate of soil permeability in the mathematical derivation of the equation.
Q = rate of loss of water from the reservoir in cm^3/min.
H = depth of water in the test hole in cm.
r = radius of the test hole in cm.

A summary of permeability results are included in T**able 4.4**. Permeability Calculations are included in **Appendix D**.

Table 4.4 -Summary of insitu permeability

	Constant Head Permeability
Indicative permeability (K_{sat})	0.07 m/day

Note: The results in the table above are based on average readings taken from the test holes.

The corresponding Ksat value of 0.07m/day in EPA Onsite Wastewater Management – Code of Practice Publication No. 891.4 July 2016 Appendix A Table 9 is category 5 (light CLAY soil).

4.5 Critical site Features:

The critical site features are:

- Proposed small lot sizes.
- Low permeable clay soils.
- Bore located at south end of site.

5. LAND CAPABILITY ASSESSMENT MATRIX:

Table 5.1 and **Table 5.2** includes a Land Capability Assessment (LCA) matrix in accordance with EPA Publication 746.1. The LCA has been developed for the whole site however soils information relates to soils within the vicinity of the proposed wastewater envelope.

Table 5.1 -Land capability assessment matrix - Site

Land Features	Land Capability Class Rating					Site Rating	Comments	Mitigation
	Very Good (1)	Good (2)	Fair (3)	Poor (4)	Very Poor (5)			
		General Characteristics						
Site drainage	No visible signs of dampness	Moist soil but no standing water		Visible signs of dampness i.e. water tolerant plants	Water ponding on surface	1	No abnormal moisture conditions	N/A
Runoff	None	Low	Moderate	High	Very High	3	Proposed small lot size	Secondary treatment of all wastewater required to reduce minimum setback distances
Flood / inundation potential (yearly return exceedance)	Never		< 1 in 100	>1 in 100 to < 1 in 20	> 1 in 20	1	Negligible flood potential	N/A
Proximity to water courses	> 60 metres			< 60 metres		5	Bore located at south end of site	Bore is required to be decommissions as part of subdivision works
Slope (%)	0 - 2	2 - 8	8 – 12	12 – 20	> 20	1	Relatively level	N/A

Landslip	No potential for failure		Low potential for failure	High potential for failure	Present or Past Failure	1	No landslip potential	N/A
Groundwater table (m) seasonal watertable depth	>5.0	2.5 – 5.0	2.0 – 2.5	1.5 – 2.0	<1.5	1	Groundwater held at approximately 5.0 m below the surface	N/A
Rock Outcrops (% of land surface containing rocks >200mm)	0%	<10%	10-20%	20-50%	>50%	1	None	N/A
Erosion Potential	No erosion potential	Minor	Moderate	High	Severe erosion potential	1	Negligible erosion potential	Maintain current level of surface cover where practical
Exposure	High sun and wind exposure		Moderate	Low sun and wind exposure		1	High exposure to sun and wind	N/A
Landform	Hill crests, convex side slopes and plains		Concave side slopes and foot slopes		Floodplains and incised channels	1	Plains	N/A
Vegetation Type (land application area)	Turf or pasture				Dense Forest	1	Turf	N/A
Fill	No Fill present		Fill Present			1	No fill encountered	N/A
Rainfall (mm/yr)[2]	<450	450 - 650	650 – 750	750 - 1000	>1000	2	Average annual rainfall of 467.6 mm	LAA size to be determined by water balance calculations
Pan evaporation (mm/yr)[3]	>1500	1250 - 1500	1000 – 1250	-	<1000	1	Annual evaporation of 1575.5 mm	LAA size to be determined by water balance calculations

Table 5.2 -Land capability assessment matrix - Soils

	Soil Profile Characteristics							
Profile depth	>2.0m	1.5–2.0m	-	1.0–1.5m	<1.0m	1	Deep soil profile	N/A
Shrinkage* (%)	Low <4%	Moderate 4-12%	High 12-20%	Very High >20%		2	Medium plasticity silty clay	N/A
Permeability* (m/d)	0.15–0.30	0.08–0.15 0.30-0.60	0.06-0.08 0.60-1.50	- 1.50-2.00	<0.06 >2.00	2	Light clays	LAA size to be determined by water balance calculations
Soil Permeability Category [1]	2 and 3	4		5	1 and 6	4	Light clay	LAA size to be determined by water balance calculations
Coarse fragments* (%)	<10	10-20	20-40		>40	1	<10%	N/A
Emerson Test* (dispersion / slaking)	4,6,8	5	7	2,3	1	1	Non-dispersive	N/A
Electrical Conductivity (Ece) (dS/m)	<0.3	0.3-0.8	0.8-2.0	2.0-4.0	>4.0	1	Non-saline	N/A
pH	6-8		4.5-6		<4.5, >8	1	Neutral soils	N/A

[1] Source: AS1547-2012
[2] Source BOM station – Cobram - Goulburn Murray (080109)
[3] Source BOM station – Shepparton Airport (081125)2019
* Relevant to soil layer(s) associated with wastewater application

6. MANAGEMENT PROGRAM:

The onsite wastewater system design and management program must suit the capability of the site and will consider the proposed development. The following sections discuss the inputs used to assess the suitability and requirements of EPA approved land based systems. Detailed design for the system is beyond the scope of this study.

6.1 Treatment System:

Based on site conditions and constraints outlined in the previous sections, secondary treatment of effluent is considered necessary for sustainable management of wastewater.

Untreated domestic wastewater typically has values of 200-300mg/L biochemical oxygen demand (BOD5) and 200-300mg/L total suspended solids (TSS). Indicative target effluent quality for secondary treatment systems are < 20mg/L BOD5, < 30mg/L TSS and <10cfu/100mL E.Coli.

Aerated wastewater treatment systems (AWTS) are the most common form of secondary treatment systems.

6.1.1 Aerated Wastewater Treatment System (AWTS):

AWTS are pre-fabricated or pre-engineered treatment systems designed to treat small wastewater flows. They are tank-based systems that typically employ 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.

Good maintenance of AWTS (e.g. removal of sludge) is essential to ensure a consistently high level of performance. By law, AWTS are required to be serviced quarterly by an approved maintenance contractor.

6.2 Treatment System Location:

Based on requirements of EPA 891.4, above-ground and in-ground treatment systems must comply with the same setback distances to building footings and boundary fences as land application systems.

6.2.1 Septic Tank Sizing:

The minimum septic tank size should be 3,500 L.

6.3 Land Application:

A range of possible land application systems have been considered, such as absorption trenches/beds, evapotranspiration/absorption (ETA) beds, mound systems and sub-surface irrigation. AS1547:2012 outlines factors affecting the construction and operation of common land application systems and a guide to selecting a system taking into consideration site features, subsurface soil conditions and identified constraints. The suitability of EPA approved land based systems are discussed in **Table 6.3.**

Table 6.3 Land Application System

Land Application	Description	Site 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.	No suitable due to small lot size
ETA Beds	Beds are shallower forms of trenches. Because beds have smaller sidewall area compared with trenches, the absorption provided by sidewall loading is reduced. This is compensated for by reducing the design loading rate.	Suitable
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 placed at the top of the mound. The sand media in the mound system acts as a secondary treatment system, removing the need for a separate sand filter or AWTS	Suitable
Sub-surface Irrigation	Subsurface 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	Suitable

6.3.1 Disposal systems:

Water balance modelling has been undertaken to calculate the minimum size of the LAA. The water balance takes into account the average annual rainfall, evaporation data, the daily effluent load, the design irrigation/loading rates for secondary treated effluent, the seasonal crop factor and the retained rainfall. The water balance model is designed so that the land application area is based upon a depth of saturated soil (i.e. water stored within indicative soil porosity) that meets the upper limits of acceptance for each land application method. The water balance must ensure that the soil can sustain growth during the summer months. The design system parameters used for the water balance calculations are summarised in **Table 6.3.1**.

Table 6.3.1 Design System Parameter

Treatment system	Application System	DIR / DLR	Runoff coefficient	Maximum storage depth
Primary treatment	Absorption trenches		Not suitable	
Secondary treatment	ETA Beds	5	25%	0 mm
	Wick beds	8	-	-
	Mound System*	8	25%	0 mm
	Sub-surface irrigation	3	25%	0 mm

* Mound disposal system incorporates a secondary treatment sand media, removing the requirement for a separate secondary treatment system

6.4 Land Application Outputs:

Minimum Land Application Area (LAA) sizing for each application method was calculated using water balance calculations. LAA sizing calculations are included in **Appendix D**. The minimum required disposal area for each system is summarised in **Table 6.4**.

Table 6.4 Required Land Application Area (LAA)

Disposal system	Minimum reserve size required
Wastewater output	900 L / day
Wick Beds	70 m (1.6 m wide trenches)
Subsurface irrigation	300 m^2
ETA Beds	170 m^2
Mound	100 m^2

6.5 Proposed Wastewater envelope:

It is recommended that a wastewater envelop with a minimum size of 600 m^2 be included on each lot. A wastewater envelope of this size with allow adequate space to locate septic tanks/treatment plants and provide multiple disposal options.

6.6 Designated Area:

The Land Application Area (LAA) shall be located in a designated area to enhance evapotranspiration and shall:

- Not be used for purposes that compromise the effectiveness of the system or access for maintenance.
- Be used only for effluent application.
- Have boundaries clearly delineated by appropriate vegetation or other type of border.
- Have no run-off seepage or effluent beyond the designated area.

The site plan in **Appendix A** presents several potential areas suitable for LAA placement as well as setback areas from site features which must be maintained. Please note that the final LAA placement is the responsibility of the owner and should be included in a detailed design providing the minimum LAA and setback distances are maintained.

The required LAA will be smaller than that marked on the site plan. An appropriately sized LAA, as discussed in **Section 6.4,** must be located entirely within the area nominated on the site plan

Setback distances for secondary treated wastewater disposal are included in **Section 6.6.1**.

6.6.1 Setback Distances:

The minimum setback distances for secondary treated wastewater are summarised in **Table 6.6.1.** The proposed LAA must adhere to these minimum setback distances.

Table 6.6.1 Minimum Setback Distances

Landscape feature or structure	Setback distance (m) (primary treated wastewater)	Setback distance (m) (secondary treated wastewater)
Building		
Wastewater field up-slope of building	6	3
Wastewater field down-slope of building	3	1.5
Wastewater field up-slope of cutting/escarpment	30	15
Allotment boundary		
Wastewater field up-slope of Allotment boundary	6	3
Wastewater field down-slope of Allotment boundary	3	1.5
Services		
Water supply pipe	3	1.5
Wastewater field up-slope of potable supply channel	300	150
Wastewater field down-slope of potable supply channel	20	10
Gas supply pipe	3	1.5
In-ground water tank	15	7.5
Stormwater drain	6	3
Recreational areas		
Children's grassed playground	6	3
In-ground swimming pool	6	3
Surface water – up-slope of		
Waterway, non-potable creeks, dams, channels	60	30
Groundwater bores		
Category 2b to 6 soils	40	20

6.6.2 Bore Decomissioning:

The existing bore location at the south end of the site must be decommissioned as part of the subdivision works. If the bore is not decommissioned, no LAA can be located within a 20 m radius of the bore.

6.7 Soil Renovation:

Due to the low permeability clay soils encountered at the site, soil renovation is recommended if a trench or bed disposal system is proposed. The following method should be adopted:

- Gypsum should be initially applied to the trench base at a rate of 1kg/m^2

This information should be included on the Council Permit.

6.8 Monitoring, Operation and Maintenance:

The septic tank is de-sludged every 3 years; however, this frequency may vary depending on the following conditions.

• whether the tank is an adequate size for the daily wastewater flow
• the composition of the household and personal care products
• the amount of organic matter, fat, oil and grease washed down the sinks
• the use of harsh chemicals such as degreasers
• overuse of disinfectants and bleaches
• the use of antibiotics and other drugs, especially dialysis and chemotherapy drugs
• whether any plastic or other non-organic items are flushed into the tank.

After pump-out, tanks must not be washed out or disinfected. They should be refilled with water to reduce odours and ensure stability of plumbing fixtures. A small residue of sludge will always remain and will assist in the immediate re-establishment of bacterial action in the tank.

To ensure the treatment systems function adequately, residents must:

- Use soapy water (made from natural unscented soap), vinegar and water or bi-carbonate of soda and water to clean toilets and other water fixtures and fittings.
- Read labels to learn which bathroom and laundry products are suitable for septic tanks. Generally plain, noncoloured, unscented and unbleached products will contribute to a well-functioning septic tank.
- Use detergents with low levels of salts (e.g. liquid detergents), sodium absorption ratio, phosphorus and chlorine (see www.lanfaxlabs.com.au).
- Wipe oils and fats off plates and saucepans with a paper towel and dispose of in the kitchen compost bin.
- Use a sink strainer to restrict food scraps entering the septic system.
- Ensure no structures such as pavements, driveways, patios, sheds or playgrounds are constructed over the tank or absorption trench area.
- Ensure the absorption trench area is not disturbed by vehicles or machinery.
- Engage a service technician to check the sludge and scum levels, pumps and alarms annually.
- Keep a record of the location of the tank and the trenches and all maintenance reports (including the dates of tank pump-outs, tank inspections and access openings) and ensure the service technician sends a copy of the maintenance report to the local Council
- Have the tank desludged when the combined depth of the scum and sludge is equal to the depth of the middle-clarified layer.

Indications of failing septic tanks and soil absorption trenches

- Seepage along effluent absorption trench lines in the soil.
- Lush green growth down-slope of the soil absorption trench lines.
- Lush green growth down-slope of the septic tank.
- Inspection pits and/or the soil absorption trenches consistently exhibiting high water levels.
- Soil absorption trench lines become waterlogged after storms.
- General waterlogging around the land disposal area.
- Presence of dead and dying vegetation (often native vegetation) around and down-slope of the land disposal areas.
- A noxious odour near the tank and the land disposal area.
- Blocked water fixtures inside the house, with sewage overflowing from the relief point.
- High sludge levels within the primary tank (within about 150 mm of inlet pipe).
- Flow obstructed and not able to pass the baffle in the tank.
- The scum layer blocking the effluent outflow.

6.8.1 Storm Water Management:

All stormwater must be disposed of to the legal point of discharge.

Note: An agricultural drain (AG) must be installed on the high side of the wastewater envelope. The drain is to be installed a minimum of 100mm into the naturally occurring clay soils and allow sufficient fall to intercept and drain all overland and subsurface run-off to a legal point of discharge. If a legal point of discharge cannot be obtained, the drainage line may discharge directly to the surface soils, a minimum distance of 10 metres beyond the wastewater disposal area.

7. CONCLUSIONS:

From this investigation it is concluded that the use of an on-site wastewater treatment and disposal system is environmentally sustainable on each proposed lot, if the recommendations made in this report are followed.

8. REFERENCES:

- Environmental Protection Authority – Guidelines for Environmental Management Code of Practice – Onsite Wastewater Management, July 2016 ~ Publication 891.4
- Municipal Association Victoria (MAV) January 2014, Model Land Capability Assessment Framework
- Australian/New Zealand Standard AS/NZS 1547-2012 – On-site domestic wastewater management.
- A.C. Geotechnical Pty Ltd - Field and Laboratory data (where applicable) collected and recorded.
- Environmental Protection Authority - "Code of Practice - Septic Tanks", March 1996" ~ Publication 451.
- Environmental Protection Authority, Information Bulletin- "Land Capability Assessment for onsite Domestic Wastewater Management", March 2003 ~ Publication 746.1.

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Not to Scale
Investigation locations are approximate

Legend
Investigation Location.

Attachment A: Site Plan
2 Carter Street
Katunga

Notes

1. LAA must be setback a minimum of 3.0 m from all boundaries.
2. LAA area must be setback a minimum of 3.0 m from any proposed structures.
3. Minimum setback distances are outlined in **Section 6.6.1.**
4. The actual LAA will be small than the area indicated on this plan.
5. The existing bore on proposed Lot 9, must be decommissioned as part of these works.

A.C. Geotechnical.	Not to Scale Investigation locations are approximate	Legend Suitable Wastewater envelope to be located with within this suitable area.	Attachment A: Site Plan 2 Carter Street Katunga

Appendix B

Site Photographs

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Appendix C

Borelog

Borehole Record BH01

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Project Number	24047	Date	1/03/2024
Project	Land Capability Assessment	Drilling Method	SFA
Location	2 Carter Street, katunga	Logged	AC

Depth (m)	Description	
0.00	Sandy SILT (ML): Orange/brown, loose, dry.	
		Disturbed sample - 0.2 m
0.30	Sandy CLAY (SC): medium plasticity, orange/brown, stiff, moist, dry of plastic limit.	
		Disturbed sample - 0.6 m
2.00	Borehole terminated - target depth achieved	

Borehole Record BH02

A.C. Geotechnical.

Project Number	24047	Date	1/03/2024
Project	Land Capability Assessment	Drilling Method	SFA
Location	2 Carter Street, katunga	Logged	AC

Depth (m)	Description	
0.00	Sandy SILT (ML): Orange/brown, loose, dry.	
0.30	Sandy CLAY (SC): medium plasticity, orange/brown, stiff, moist, dry of plastic limit.	
2.00	Borehole terminated - target depth achieved	

Borehole Record BH03

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Project Number	24047	Date	1/03/2024
Project	Land Capability Assessment	Drilling Method	SFA
Location	2 Carter Street, katunga	Logged	AC

Depth (m)	Description	
0.00	Sandy SILT (ML): Orange/brown, loose, dry.	
0.20	Sandy CLAY (SC): medium plasticity, orange/brown, stiff, moist, dry of plastic limit.	
2.00	Borehole terminated - target depth achieved	

Borehole Record BH04

A.C. Geotechnical.

Project Number	24047	Date	1/03/2024
Project	Land Capability Assessment	Drilling Method	SFA
Location	2 Carter Street, katunga	Logged	AC

Depth (m)	Description	
0.00	Sandy SILT (ML): Orange/brown, loose, dry.	
0.40	Sandy CLAY (SC): medium plasticity, orange/brown, stiff, moist, dry of plastic limit.	
2.00	Borehole terminated - target depth achieved	

Borehole Record BH05

A.C. Geotechnical.

Project Number	24047	Date	1/03/2024
Project	Land Capability Assessment	Drilling Method	SFA
Location	2 Carter Street, katunga	Logged	AC

Depth (m)	Description	
0.00	Sandy SILT (ML): Orange/brown, loose, dry.	
0.30	Sandy CLAY (SC): medium plasticity, orange/brown, stiff, moist, dry of plastic limit.	
2.00	Borehole terminated - target depth achieved	

Borehole Record BH06

A.C. Geotechnical.

Project Number	24047	Date	1/03/2024
Project	Land Capability Assessment	Drilling Method	SFA
Location	2 Carter Street, katunga	Logged	AC

Depth (m)	Description	
0.00	Sandy SILT (ML): Orange/brown, loose, dry.	
0.30	Sandy CLAY (SC): medium plasticity, orange/brown, stiff, moist, dry of plastic limit.	
2.00	Borehole terminated - target depth achieved	

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Appendix D

Constant Head Calculations & Water Balance

INSITU CONSTANT HEAD PERMEABILITY

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Project Address:	2 Carter Street	**Project Number:**	24047
Location:	Katunga	**Date:**	14/03/2024
Client:	Katunga Fresh		

INPUT DATA

Borehole			**Reservoir**		
Borehole diameter	100	cm	**Diameter**	97	mm
Borehole Depth	500	cm	**Base area**	295.4426	mm2
Water level from surface	250	cm			
Depth of water in hole	250	cm			

FIELD DATA

	Test 1	Test 2	Test 3	Test 4	
Time intervals (min)	Water depth in reservoir				
Initial Depth	200	200	200	200	
5					
10					
15					
20	193	195	196	196	**Average**
Q (cm2/min)	10.340491	7.386065	5.908852	5.908852	**7.386065**
Ksat (cm/min	0.006645917	0.004747083	0.003797667	0.003797667	**0.004747083**
Ksat (m/d)	0.095701199	0.068357999	0.054686399	0.054686399	**0.068357999**

WICK TRENCH SIZE CALCULATIONS

A.C. Geotechnical.

Project Address:	2 Carter Street	**Project Number:**	24047
Location:	Katunga	**Date:**	14/03/2024
Client:	Katunga Fresh		

INPUT DATA

Daily flow allowance (per person)	150	L
Daily wastewater volume	750	L
Effluent quality	Secondary	
Soil texture	Sandy loam	
Soil structure	Massive	
Soil category	2b	
Indicative Permeability	1.4-3.0	Ksat
Design Loading Rate	8	mm/d
Factor of Safety	1.2	

ABSORPTION TRENCHES

L = Q / (DLR x (W/F))

Where:

L = length of trench

Q = Design daily flow in L/day

DLR = Design Loading rate in mm/d

W = width of trench in m

F = Factor of safety

Width of trench	1.6	m	Width of trench	2.5	m
Length =	**70**	**m**	**Length =**	**45**	

WATER BALANCE
ETA BEDS

A.C. Geotechnical.

Project Address:	2 Carter Street	**Project Number:**	24047
Location:	Katunga	**Date:**	14/03/2024
Client:	Katunga Fresh		

INPUT DATA		
Daily flow allowance (per person)	150	L
Daily wastewater volume	750	L
Effluent quality	Secondary	
Effective rainfall	0.75	%
Soil texture	Sandy loam	
Soil structure	Massive	
Soil category	1.4-3.0	
Indicative Permeability	1.4-3.0	Ksat

ETA BEDS		
DLR	5	mm/d
Porosity	40	%
Maximum Storage Depth	0	mm

Crop Factor - standard pasture	0.85	0.85	0.85	0.6	0.6	0.6	0.6	0.6	0.6	0.85	0.85	0.85	
crop factors -Lucene	0.95	0.9	0.85	0.8	0.7	0.55	0.55	0.65	0.75	0.85	0.95	1	
Crop factor - Shade	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
Crop factor - woodlot	1	1	1	1	1	1	1	1	1	1	1	1	

Rainfall Data	Cobram - Goulburn Murray (080109)
Evaporation Data	Shepparton Airport (081125)

Parameter	Unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days in month		31	28	31	30	31	30	31	31	30	31	30	31	365
Rainfall (mm)		37.9	29.1	33	36	42.1	39.1	41.8	44.4	42.8	42.7	40.8	37.9	467.6
Evaporation (mm)		275.1	189.6	161.5	98.8	44.7	31.4	34.3	53.3	85.6	149.2	192.5	259.5	1575.5
Output														
Evapotranspiration (mm)		233.84	161.16	137.28	59.28	26.82	18.84	20.58	31.98	51.36	126.82	163.63	220.58	1252.2
Percolation (mm)		155	140	155	150	155	150	155	155	150	155	150	155	1825
Total Output (mm)		388.84	301.16	292.28	209.28	181.82	168.84	175.58	186.98	201.36	281.82	313.63	375.58	3077.2
Inputs														
Effective Rainfall (mm)		28.425	21.825	24.75	27	31.575	29.325	31.35	33.3	32.1	32.025	30.6	28.425	350.7
Application Rate (mm)		136.76	123.53	136.76	132.35	136.76	132.35	136.76	136.76	132.35	136.76	132.35	136.76	1610.3
Total Inputs (mm)		165.19	-301.2	161.51	159.35	168.34	161.68	168.11	170.06	164.45	168.79	162.95	165.19	1961
Storage Calculations														
Waste Loading (mm)		360.41	279.34	267.53	182.28	150.25	139.52	144.23	153.68	169.26	249.8	283.03	347.15	
Volume of Wastewater (mm)		23250	21000	23250	22500	23250	22500	23250	23250	22500	23250	22500	23250	273750
Cumulative Storage (mm)		0	0	0	0	0	0	0	0	0	0	0	0	
Area													**170**	**m2**
Width													**3**	**m**
Length													**34**	**m**

WATER BALANCE
SUBSURFACE IRRIGATION

A.C. Geotechnical.

Project Address:	2 Carter Street	**Project Number:**	24047
Location:	Katunga	**Date:**	14/03/2024
Client:	Katunga Fresh		

INPUT DATA		
Daily flow allowance (per person)	150	L
Daily wastewater volume	750	L
Effluent quality	Secondary	
Effective rainfall	0.75	%
Soil texture	Sandy loam	
Soil structure	Massive	
Soil category	2b	
Indicative Permeability	1.4-3.0	Ksat

SUBSURFACE IRRIGATION		
DLR	3	mm/d
Porosity	45	%
Maximum Storage Depth	0	mm

Crop Factor - standard pasture	0.85	0.85	0.85	0.6	0.6	0.6	0.6	0.6	0.6	0.85	0.85	0.85	
crop factors -Lucene	0.95	0.9	0.85	0.8	0.7	0.55	0.55	0.65	0.75	0.85	0.95	1	
Crop factor - Shade	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
Crop factor - woodlot	1	1	1	1	1	1	1	1	1	1	1	1	

Rainfall Data	Cobram - Goulburn Murray (080109)
Evaporation Data	Shepparton Airport (081125)

Parameter	Unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days in month		31	28	31	30	31	30	31	31	30	31	30	31	365
Rainfall (mm)		37.9	29.1	33	36	42.1	39.1	41.8	44.4	42.8	42.7	40.8	37.9	467.6
Evaporation (mm)		275.1	189.6	161.5	98.8	44.7	31.4	34.3	53.3	85.6	149.2	192.5	259.5	1575.5
Output														
Evapotranspiration (mm)		233.84	161.16	137.28	59.28	26.82	18.84	20.58	31.98	51.36	126.82	163.63	220.58	1252.2
Percolation (mm)		93	84	93	90	93	90	93	93	90	93	90	93	1095
Total Output (mm)		326.84	245.16	230.28	149.28	119.82	108.84	113.58	124.98	141.36	219.82	253.63	313.58	2347.2
Inputs														
Effective Rainfall (mm)		28.425	21.825	24.75	27	31.575	29.325	31.35	33.3	32.1	32.025	30.6	28.425	350.7
Application Rate (mm)		77.5	70	77.5	75	77.5	75	77.5	77.5	75	77.5	75	77.5	912.5
Total Inputs (mm)		105.93	-245.2	102.25	102	109.08	104.33	108.85	110.8	107.1	109.53	105.6	105.93	1263.2
Storage Calculations														
Waste Loading (mm)		298.41	223.34	205.53	122.28	88.245	79.515	82.23	91.68	109.26	187.8	223.03	285.15	
Volume of Wastewater (mm)		23250	21000	23250	22500	23250	22500	23250	23250	22500	23250	22500	23250	273750
Cumulative Storage (mm)		0	0	0	0	0	0	0	0	0	0	0	0	
Land area required													**300**	**m2**

WATER BALANCE
MOUND SYSTEM

A.C. Geotechnical.

Project Address:	2 Carter Street	**Project Number:**	24047
Location:	Katunga	**Date:**	14/03/2024
Client:	Katunga Fresh		

INPUT DATA		
Daily flow allowance (per person)	150	L
Daily wastewater volume	750	L
Effluent quality	Secondary	
Effective rainfall	0.75	%
Soil texture	Sandy loam	
Soil structure	Massive	
Soil category	2b	
Indicative Permeability	1.4-3.0	Ksat

MOUND SYSTEM		
DLR	8	mm/d
Porosity	40	%
Storage Depth	0	mm

Crop Factor - standard pasture	0.85	0.85	0.85	0.6	0.6	0.6	0.6	0.6	0.6	0.85	0.85	0.85	
crop factors -Lucene	0.95	0.9	0.85	0.8	0.7	0.55	0.55	0.65	0.75	0.85	0.95	1	
Crop factor - Shade	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
Crop factor - woodlot	1	1	1	1	1	1	1	1	1	1	1	1	

Rainfall Data	Cobram - Goulburn Murray (080109)
Evaporation Data	Shepparton Airport (081125)

Parameter	Unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days in month		31	28	31	30	31	30	31	31	30	31	30	31	365
Rainfall (mm)		37.9	29.1	33	36	42.1	39.1	41.8	44.4	42.8	42.7	40.8	37.9	467.6
Evaporation (mm)		275.1	189.6	161.5	98.8	44.7	31.4	34.3	53.3	85.6	149.2	192.5	259.5	1575.5
Output														
Evapotranspiration (mm)		233.84	161.16	137.28	59.28	26.82	18.84	20.58	31.98	51.36	126.82	163.63	220.58	1252.2
Percolation (mm)		248	224	248	240	248	240	248	248	240	248	240	248	2920
Total Output (mm)		481.84	385.16	385.28	299.28	274.82	258.84	268.58	279.98	291.36	374.82	403.63	468.58	4172.2
Inputs														
Effective Rainfall (mm)		28.425	21.825	24.75	27	31.575	29.325	31.35	33.3	32.1	32.025	30.6	28.425	350.7
Application Rate (mm)		232.5	210	232.5	225	232.5	225	232.5	232.5	225	232.5	225	232.5	2737.5
Total Inputs (mm)		260.93	-385.2	257.25	252	264.08	254.33	263.85	265.8	257.1	264.53	255.6	260.93	3088.2
Storage Calculations														
Waste Loading (mm)		453.41	363.34	360.53	272.28	243.25	229.52	237.23	246.68	259.26	342.8	373.03	440.15	
Volume of Wastewater (mm)		23250	21000	23250	22500	23250	22500	23250	23250	22500	23250	22500	23250	273750
Cumulative Storage (mm)		0	0	0	0	0	0	0	0	0	0	0	0	
Basal Area													**100**	**m2**

NUTRIENT BALANCE

Project Address:	2 Carter Street	**Project Number:**	24047
Location:	Katunga	**Date:**	14/03/2024
Client:	Katunga Fresh		

Nitrogeb Balance -Nitrogen		
Hydraulic Loading	750	l/day
Effluent N concentration	25	mg/l
Daily N loading	18750	mg/day
Annual N loading	6843750	mg/year
Denitrification loss	20	%
Denitrification loss	5475000	mg/year
Total annual N loading	5.475	kg/year
Plant uptake	220	kg/ha/year
Minimum area for uptake	**249**	**m2**

Appendix E

Property Reports

PROPERTY REPORT

Energy, Environment and Climate Action

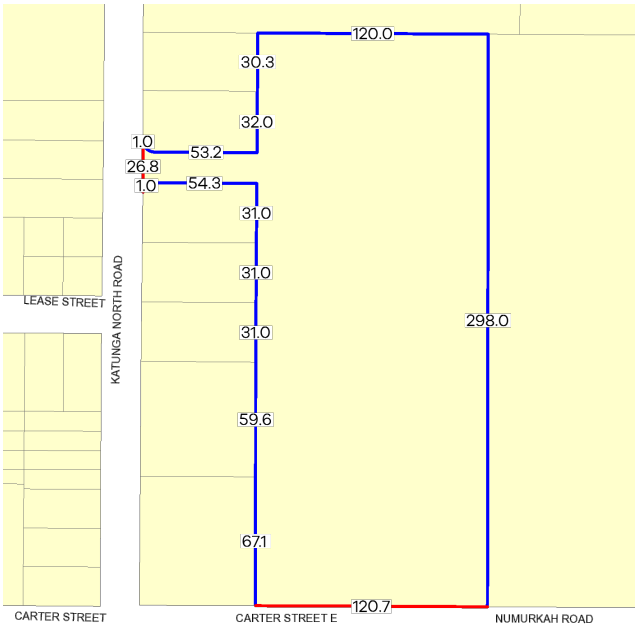
From www.land.vic.gov.au at 29 February 2024 08:09 PM

PROPERTY DETAILS

Address:	**2 CARTER STREET E KATUNGA 3640**
Lot and Plan Number:	**Lot A PS300731**
Standard Parcel Identifier (SPI):	**A\PS300731**
Local Government Area (Council):	**MOIRA** www.moira.vic.gov.au
Council Property Number:	**136192**
Directory Reference:	**Vicroads 22 J9**

SITE DIMENSIONS

All dimensions and areas are approximate. They may not agree with those shown on a title or plan.



Area: 36892 sq. m (3.69 ha)
Perimeter: 972 m
For this property:
Site boundaries
Road frontages

Dimensions for individual parcels require a separate search, but dimensions for individual units are generally not available.

16 overlapping dimension labels are not being displayed

Calculating the area from the dimensions shown may give a different value to the area shown above

For more accurate dimensions get copy of plan at Title and Property Certificates

UTILITIES

Rural Water Corporation:	**Goulburn-Murray Water**
Urban Water Corporation:	**Goulburn Valley Water**
Melbourne Water:	**Outside drainage boundary**
Power Distributor:	**POWERCOR**

STATE ELECTORATES

Legislative Council:	**NORTHERN VICTORIA**
Legislative Assembly:	**SHEPPARTON**

PLANNING INFORMATION

Property Planning details have been removed from the Property Reports to avoid duplication with the Planning Property Reports from the Department of Transport and Planning which are the authoritative source for all Property Planning information.

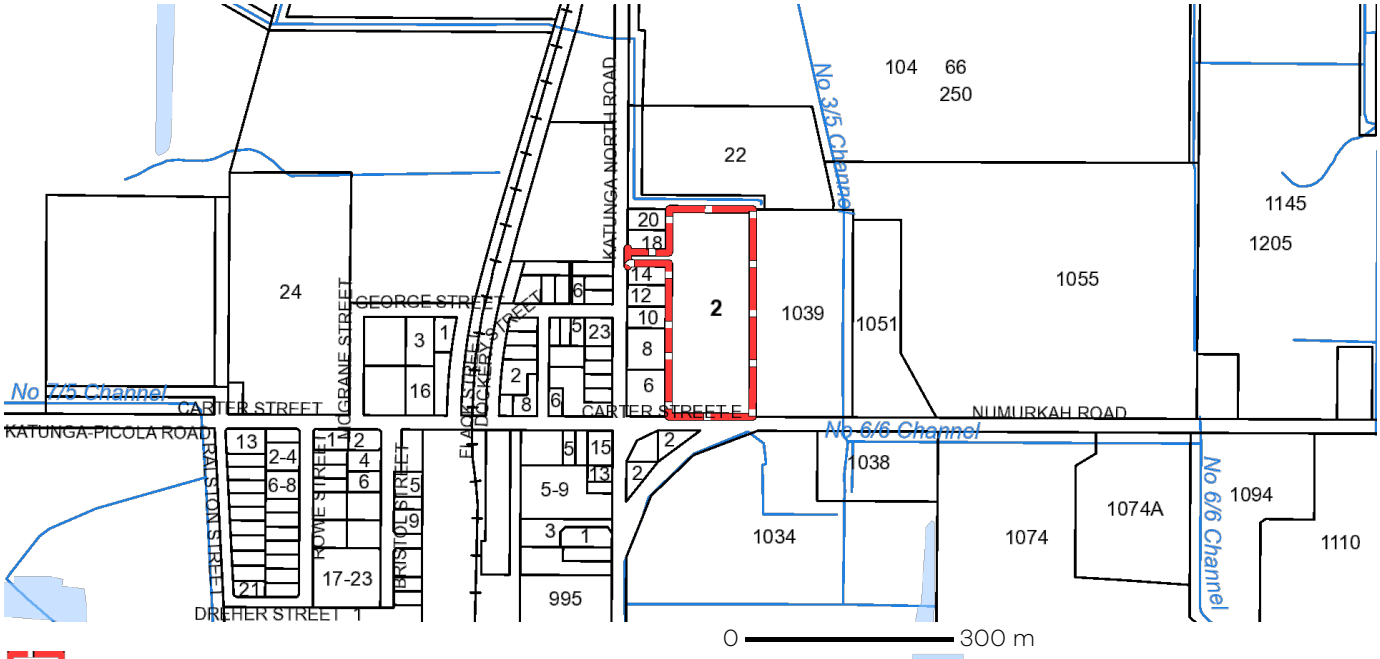
The Planning Property Report for this property can found here - Planning Property Report

Planning Property Reports can be found via these two links
Vicplan https://mapshare.vic.gov.au/vicplan/
Property and parcel search https://www.land.vic.gov.au/property-and-parcel-search

PROPERTY REPORT

Energy, Environment and Climate Action

Area Map



PLANNING PROPERTY REPORT

Environment, Land, Water and Planning

From www.planning.vic.gov.au at 29 February 2024 08:09 PM

PROPERTY DETAILS

Lot and Plan Number:	**Lot A PS300731**
Address:	**2 CARTER STREET E KATUNGA 3640**
Standard Parcel Identifier (SPI):	**A\PS300731**
Local Government Area (Council):	**MOIRA** www.moira.vic.gov.au
Council Property Number:	**136192**
Planning Scheme:	**Moira** Planning Scheme - Moira
Directory Reference:	**Vicroads 22 J9**

UTILITIES

Rural Water Corporation:	**Goulburn-Murray Water**
Urban Water Corporation:	**Goulburn Valley Water**
Melbourne Water:	**Outside drainage boundary**
Power Distributor:	**POWERCOR**

STATE ELECTORATES

Legislative Council:	**NORTHERN VICTORIA**
Legislative Assembly:	**SHEPPARTON**

OTHER

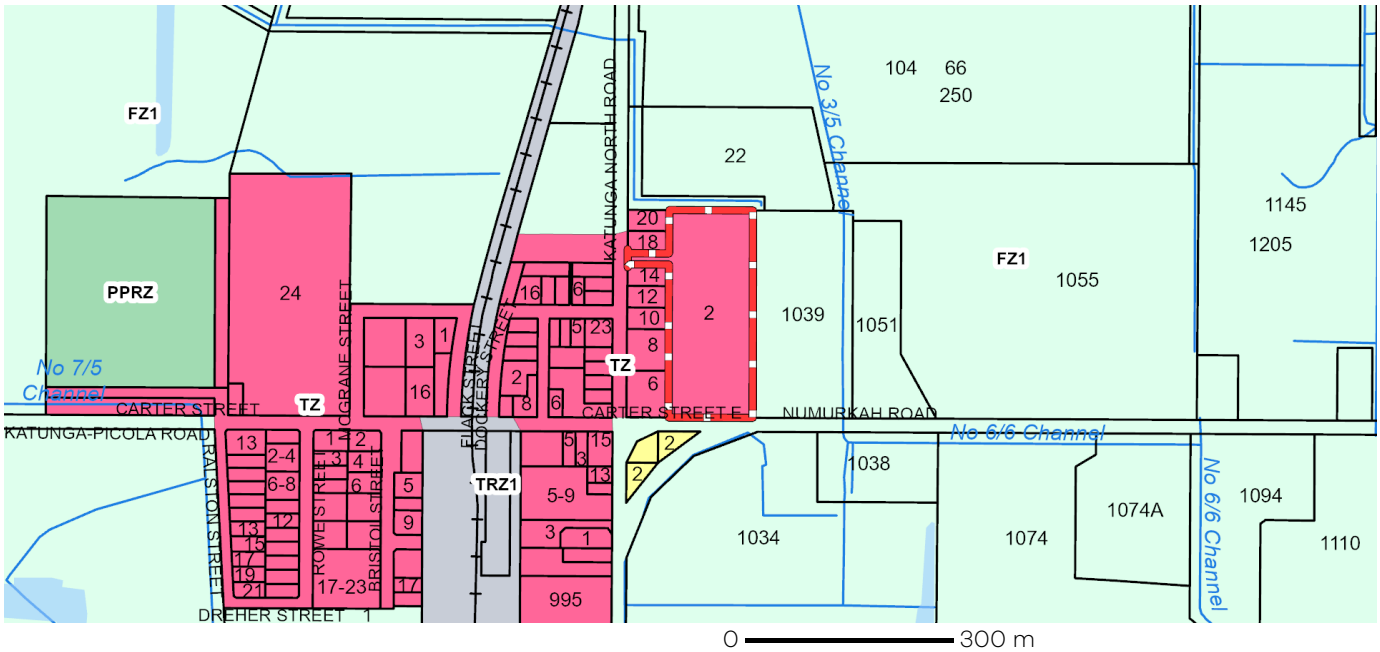
Registered Aboriginal Party:	**Yorta Yorta Nation Aboriginal Corporation**

View location in VicPlan

Planning Zones

TOWNSHIP ZONE (TZ)

SCHEDULE TO THE TOWNSHIP ZONE (TZ)



FZ - Farming
PPRZ - Public Park and Recreation
PUZ1 - Public Use-Service and Utility
PUZ6 - Public Use-Local Government
TRZ1 - State Transport Infrastructure
TZ - Township
Railway line
Water area
Water course

Note: labels for zones may appear outside the actual zone - please compare the labels with the legend.

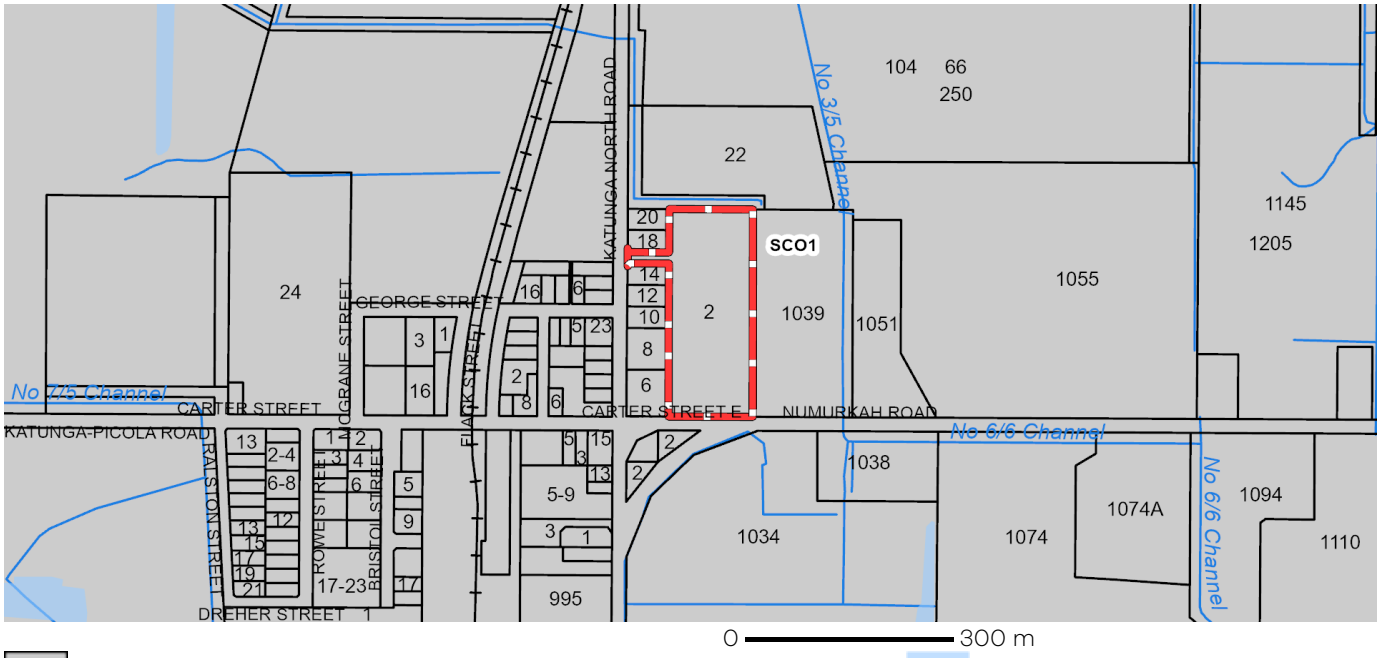
PLANNING PROPERTY REPORT

Environment, Land, Water and Planning

Planning Overlays

SPECIFIC CONTROLS OVERLAY (SCO)

SPECIFIC CONTROLS OVERLAY - PS MAP REF SCO1 SCHEDULE (SCO1)

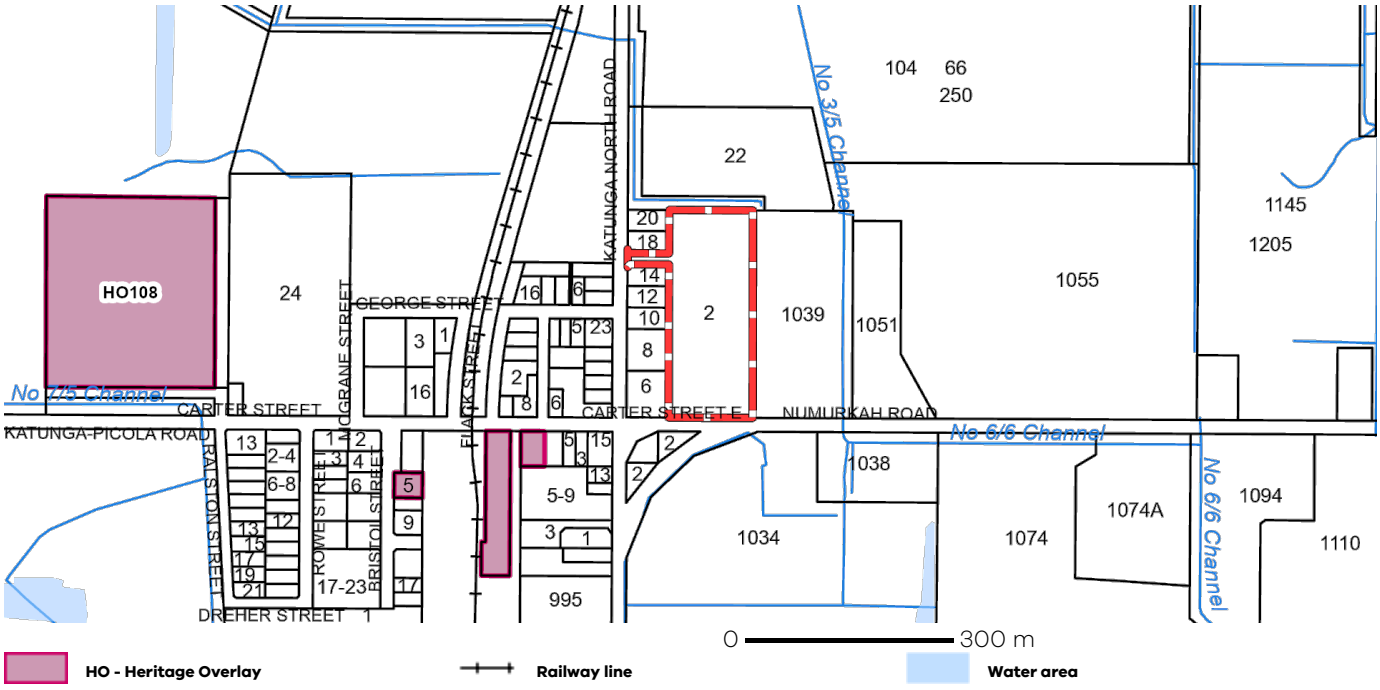


Note: due to overlaps, some overlays may not be visible, and some colours may not match those in the legend

OTHER OVERLAYS

Other overlays in the vicinity not directly affecting this land

HERITAGE OVERLAY (HO)



Note: due to overlaps, some overlays may not be visible, and some colours may not match those in the legend

PLANNING PROPERTY REPORT

Further Planning Information

Planning scheme data last updated on 7 December 2023.

A **planning scheme** sets out policies and requirements for the use, development and protection of land.
This report provides information about the zone and overlay provisions that apply to the selected land.
Information about the State and local policy, particular, general and operational provisions of the local planning scheme that may affect the use of this land can be obtained by contacting the local council or by visiting https://www.planning.vic.gov.au

This report is NOT a **Planning Certificate** issued pursuant to Section 199 of the ***Planning and Environment Act 1987.***
It does not include information about exhibited planning scheme amendments, or zonings that may abut the land.
To obtain a Planning Certificate go to Titles and Property Certificates at Landata - https://www.landata.vic.gov.au

For details of surrounding properties, use this service to get the Reports for properties of interest.

To view planning zones, overlay and heritage information in an interactive format visit https://mapshare.maps.vic.gov.au/vicplan

For other information about planning in Victoria visit https://www.planning.vic.gov.au

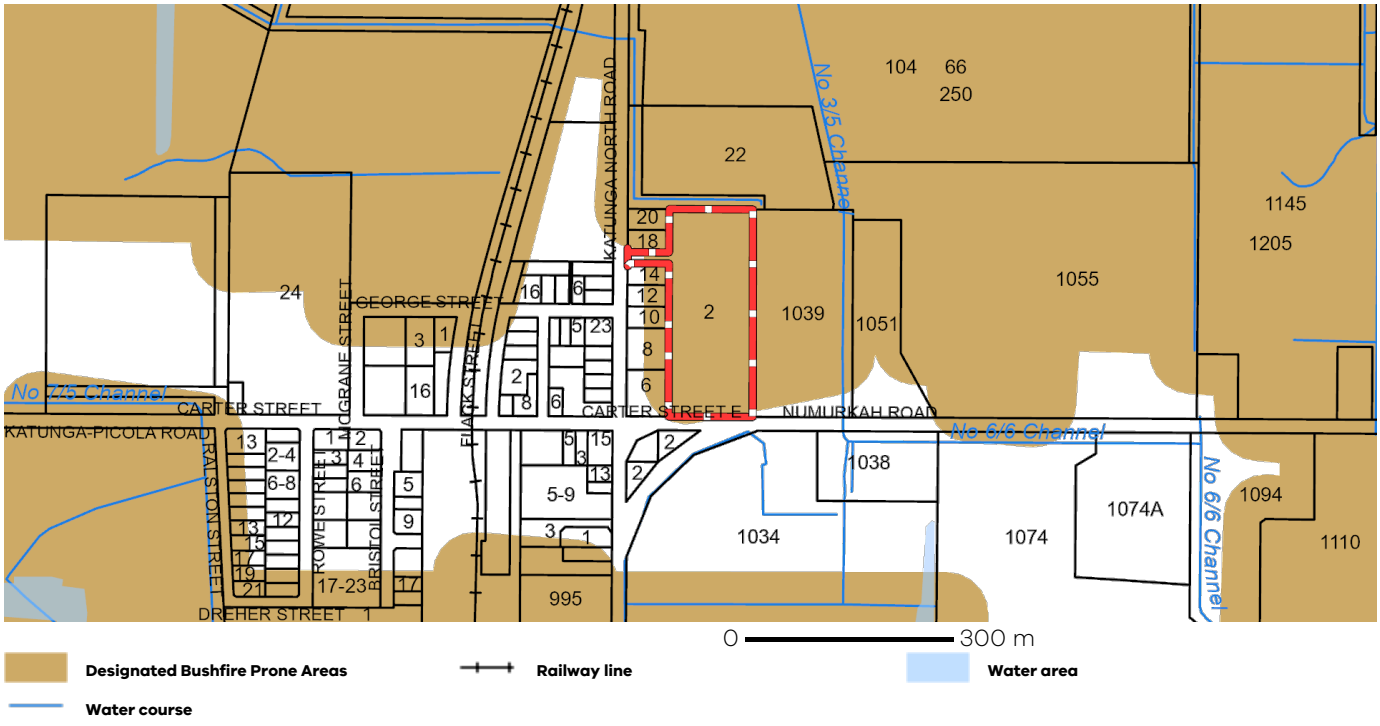
PLANNING PROPERTY REPORT

Designated Bushfire Prone Areas

This parcel is in a designated bushfire prone area. Special bushfire construction requirements apply to the part of the property mapped as a designated bushfire prone area (BPA). Planning provisions may apply.

Where part of the property is mapped as BPA, if no part of the building envelope or footprint falls within the BPA area, the BPA construction requirements do not apply.

Note: the relevant building surveyor determines the need for compliance with the bushfire construction requirements.



Designated BPA are determined by the Minister for Planning following a detailed review process. The Building Regulations 2018, through adoption of the Building Code of Australia, apply bushfire protection standards for building works in designated BPA.

Designated BPA maps can be viewed on VicPlan at https://mapshare.vic.gov.au/vicplan/ or at the relevant local council.

Create a BPA definition plan in VicPlan to measure the BPA.

Information for lot owners building in the BPA is available at https://www.planning.vic.gov.au.

Further information about the building control system and building in bushfire prone areas can be found on the Victorian Building Authority website https://www.vba.vic.gov.au. Copies of the Building Act and Building Regulations are available from http://www.legislation.vic.gov.au. For Planning Scheme Provisions in bushfire areas visit https://www.planning.vic.gov.au.

Native Vegetation

Native plants that are indigenous to the region and important for biodiversity might be present on this property. This could include trees, shrubs, herbs, grasses or aquatic plants. There are a range of regulations that may apply including need to obtain a planning permit under Clause 52.17 of the local planning scheme. For more information see Native Vegetation (Clause 52.17) with local variations in Native Vegetation (Clause 52.17) Schedule

To help identify native vegetation on this property and the application of Clause 52.17 please visit the Native Vegetation Information Management system https://nvim.delwp.vic.gov.au/ and Native vegetation (environment.vic.gov.au) or please contact your relevant council.

You can find out more about the natural values on your property through NatureKit NatureKit (environment.vic.gov.au)