

PP302/2017-1

9 Cara Court KENNETT RIVER

Lot: 20 LP: 56866 V/F: 8404/315

**Development of the land for a two storey
dwelling and associated works**

N J Thompson

Officer - Helen Evans

EXHIBITION FILE

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Submissions to this planning application will be accepted until a decision is made on the application.

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Planning Enquiries
 Phone: (03) 5232 9412
 Web: www.colacotway.vic.gov.au

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Application No.:

Date Lodged: / /

Date Allocated: / /

Allocated to:

Fee:

Receipt No.:

Ward:

Zone(s):

Overlay(s):

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Application for Planning Permit

Use this form to make an application for a planning permit and to provide the information required by section 47 of the *Planning and Environment Act 1987* and regulations 15 and 38 of the *Planning and Environment Regulations 2005*.

Supplementary information requested in this form should be provided as an attachment to your application. Please print clearly or complete the form electronically (refer to How to complete the Application for Planning Permit form).

Privacy notice

▲ Information collected with this application will only be used to consider and determine the application. It will be made available for public inspection in accordance with section 51 of the *Planning and Environment Act 1987*.

Need help with the application?

If you need help to complete this form, read *How to complete the Application for Planning Permit form*. For more information about the planning process, refer to *Planning: a Short Guide*. These documents are available from your local council, the Planning Information Centre (Ph: 03 9637 8610, 8 Nicholson Street, Melbourne), or www.dse.vic.gov.au/planning.

Contact council to discuss the specific requirements for this application and obtain a planning permit checklist. Insufficient or unclear information may delay your application.

- ① Has there been a pre-application meeting with a council officer?

Yes No

If yes, with whom?:

Date: D D / M M / Y Y Y Y

The land

- ② Address of the land. Complete the Street Address and one of the Formal Land Descriptions.

Street Address

Street No.: 9

Street Name: Cara Court

Suburb/Locality: Kennett River

Postcode: 3 2 3 4

Formal Land Description

▲ This information can be found on the certificate of title.

Lot No.: 20

on Lodged Plan, Title Plan or Subdivision Plan No.: LP 56866

OR

Crown Allotment No.:

Section No.:

Parish Name: Wongarra

- ③ Title information.

Attach a full, current copy of title information for each individual parcel of land, forming the subject site.

- ④ Describe how the land is used and developed now.

eg. single dwelling, three dwellings, shop, factory, medical centre with two practitioners, licensed restaurant with 80 seats.

Vacant Block, containing numerous significant trees and shrubs

- ⑤ Plan of the land.

Attach a plan of the existing conditions. Photos are also helpful.

The proposal

▲ You must give full details of your proposal and attach the information required to assess the application.

If you do not give enough detail or an adequate description of the proposal you will be asked for more information. This will delay your application.

- 6 For what use, development or other matter do you require a permit?

Read *How to complete the Application for Planning Permit form* if you need help in describing your proposal.

Application for a new 2 bedroom dwelling, with effluent field and rain water storage

- 7 Additional information about the proposal.

Contact council or refer to council planning permit checklists for more information about council's requirements.

Attach additional information providing details of the proposal, including:

- Any information required by the planning scheme, requested by council or outlined in a council planning permit checklist.
- Plans showing the layout and details of the proposal.
- If required, a description of the likely effect of the proposal (eg. traffic, noise, environmental impacts).

- 8 Encumbrances on title.

Encumbrances are identified on the certificate of title.

Is the land affected by an encumbrance such as a restrictive covenant, section 173 agreement or other obligation on title such as an easement or building envelope?

- No, go to 9.
- Yes, Attach a copy of the document (instrument) specifying the details of the encumbrance.
- Does the proposal breach, in any way, the encumbrance on title?
- No, go to 9.
- Yes, contact council for advice on how to proceed before continuing with this application.

▲ Note

Council must not grant a permit that authorises anything that would result in a breach of a registered restrictive covenant (sections 61(4) and 62 of the *Planning and Environment Act 1987*). Contact council and/or an appropriately qualified person for advice.

Costs of buildings and works/permit fee

Most applications require a fee to be paid. Where development is proposed, the value of the development affects the fee. Contact council to determine the appropriate fee.

- 9 Estimated cost of development for which the permit is required.

Cost \$ 450,000.00

▲ You may be required to verify this estimate.

Write 'NIL' if no development is proposed (eg. change of use, subdivision, removal of covenant, liquor licence)

- 10 Do you require a receipt for the permit fee?

Yes No

Contact, applicant and owner details

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⑪ Provide details of the contact, applicant and owner of the land.

Contact

The person you want Council to communicate with about the application.

Name: Matt Goodman				
Organisation (if applicable): MGAO				
Postal address: 10a Park St				
St Kilda West			Postcode:	3 1 8 2
Contact phone:	<input type="checkbox"/>	Indicate preferred contact method		
Mobile phone: 0401298561	<input checked="" type="checkbox"/>			
Email: Matt@mgao.com.au	<input type="checkbox"/>			
Fax:	<input type="checkbox"/>			

Applicant

The person or organisation who wants the permit.

<input type="checkbox"/> Same as contact. If not, complete details below.				
Name: Madeleine & Nicholas Thompon				
Organisation (if applicable):				
Postal address: 9 Cara Court				
Kennett River			Postcode:	3 2 3 4

Owner

The person or organisation who owns the land.

<input type="checkbox"/> Same as contact <input checked="" type="checkbox"/> Same as applicant				
Where the owner is different from the applicant or contact, provide the name of the person or organisation who owns the land.				
Name (if applicable):				
Organisation (if applicable):				
Postal address:				
			Postcode:	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>

Checklist

⑫ Have you?

<input checked="" type="checkbox"/>	Filled in the form completely?
<input checked="" type="checkbox"/>	Paid or included the application fee?
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> Attached all necessary supporting information and documents?
<input checked="" type="checkbox"/>	Completed the relevant council planning permit checklist?
<input checked="" type="checkbox"/>	Signed the declaration on the next page?

Declaration

- 13 This form must be signed. Complete one of A, B or C
- ⚠ Remember it is against the law to provide false or misleading information, which could result in a heavy fine and cancellation of the permit.

A Owner/Applicant

I declare that I am the applicant and owner of the land and all the information in this application is true and correct.

Signature

N. Hansen

Date: 13 / 12 / 2017

B Owner

I declare that I am the owner of the land and I have seen this application.

Signature

Date: / /

Applicant

I declare that I am the applicant and all of the information in this application is true and correct.

Signature

Date: / /

C Applicant

I declare that I am the applicant and:

- I have notified the owner about this application;
- and all the information in this application is true and correct.

Signature

Date: / /

Lodgement

Lodge the completed and signed form and all documents with:

Colac-Otway Shire ☐☐
 PO Box 283, ☐ COLAC VIC 3250 ☐
 2-6 Rae Street, COLAC VIC 3250 ☐☐
 Telephone: (03) 5232 9412 ☐☐
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 TTY: (03) 5231 6787 ☐☐

For help or more information



**LAND CAPABILITY ASSESSMENT
FOR PROPOSED DEVELOPMENT**

9 Cara Court, Kennett River

November 2017

**Prepared for:
Nicholas Thompson**

**Report No:
15055G-LCA**

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ST. QUENTIN

SITE PLAN APPENDIX A

BOREHOLE LOGS..... APPENDIX B

SITE PHOTOGRAPHS APPENDIX C

WATER BALANCE AND NUTRIENT BALANCE MODELS APPENDIX D

TYPICAL IRRIGATION SYSTEM LAYOUT..... APPENDIX E

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REPORT ADDENDUM ATTACHMENT

1.0 EXECUTIVE SUMMARY

Our Land Capability Assessment has found that the proposed construction site is acceptable for effluent disposal. Our assessment has identified some constraints that will need to be considered to enable safe and sustainable effluent disposal on site. Some critical 'major' constraints were identified however these constraints do not prevent the satisfactory completion of the proposed development but will require careful planning and specific design.

Critical site constraints are listed as follows:

- Allotment size (Major)
- High rainfall (Major)
- Soil permeability rate (Major)
- Rock depth (Moderate)
- Landslide risk (Moderate)
- Presence of fill / disturbed ground (Moderate)
- Allotment slope (Moderate)

On the basis of the above constraints we have determined this site has a sensitivity rating of 'High' in accordance with the Colac Otway Shire Council Domestic Wastewater Management Plan.

The limiting constraints do not prevent the satisfactory completion of the proposed development however the effluent system does require appropriate planning and design. Subject to constraints and our recommendations the dispersal of wastewater on the development poses a low and manageable environmental risk.

We recommend that the proposed household wastewater receive secondary treatment and that the treated effluent be dispersed by shallow pressure compensated sub-surface irrigation. Colac Otway Council require Secondary treatment to a minimum '20/30/10 standard' (i.e. 20 mg/l Biochemical Oxygen Demand, 30 mg/l Suspended Solids and E.coli <10 cfu /100mL) effluent is produced prior to dispersal on the land by sub-surface irrigation. Treatment of household wastewater to 20/30/10 standard with treated wastewater dispersion by sub-surface irrigation will maximise the potential for evapo-transpiration and minimise the risk of contamination of adjoining sites.

We recommend a minimum irrigation area of 160 m² be adopted for the proposed development.

The treated effluent field must be positioned in accordance with offset and siting requirements as outlined in section 7.4 of our report 'Effluent disposal area siting'.

Due to constraints, we recommend a terraced area be constructed to accommodate the effluent disposal field and positioned as suggested in Appendix A. Where retaining structures are used to support the effluent disposal area, they must not exceed 1m in height. We recommend design and construction follow landslide guidelines outlined by Australian Geomechanics Society (refer Appendix G).

We recommend onsite topsoil 'sandy loam' (or similar imported material) is used as bedding material in disposal tiers. It is important upslope and downslope cut-off drains are constructed for the effluent disposal area to reduce surface flows to and from the irrigated terraces, as shown in Appendix F. The surface runoff should be directed away from the effluent area and ultimately connected to the legal point of discharge.

Guidance is given concerning the design and layout of a suitable system.

Final approval is subject to any specific policy requirements or other limiting environmental constraints not previously brought to our attention.

2.0 INTRODUCTION

St Quentin Consulting was commissioned by the client Nicholas Thompson to provide a Land Capability Assessment (LCA) report for the site.

The aims of the assessment were:

1. To assess various features of the site in their present condition in accordance with published standards and guidelines, principally various Septic Tanks Codes published by EPA Victoria and others.
2. Recommend an appropriate and environmentally sustainable treatment and disposal method for domestic wastewater.

3.0 PRACTITIONER

The author of this report is Cameron Farrar who is a professional geotechnical engineer with a Bachelor of Engineering degree and registered member of Engineers Australia and of Australian Geomechanics Society. The author has more than 20 years of experience in the land capability assessment for effluent disposal.

4.0 PROPOSED DEVELOPMENT

This report provides recommendations for a two bedroom residence. We expect that local council may require a "study" or other habitable room to be counted as a bedroom. If the building type is changed significantly this report may be inappropriate. Planning report has revealed the site features a number of sensitive overlays and is included in Appendix H.

5.0 SITE FEATURES

The subject site is on the west side of the street. The site slopes toward the north-east with a slope angle of approximately 16°. The site aspect is fair with respect to exposure to sunshine and wind. Surface drainage is considered to be fair. The natural soil types comprise sands and clays prominently developed from Cretaceous age sediments (Otway Group). Existing vegetation consists native trees and grasses scattered across the site. A satellite view of the site is presented in Figure 1.



Figure 1: Aerial photograph of the site and surrounding area, nearmap.com.

6.0 TESTING PROGRAM AND RESULTS

6.1 Soil profile and geomorphology

Five (5) test sites were assessed to investigate predominate soil types across the site. The visual and tactile estimation as outlined in the site and soil evaluation procedure AS1547:2012 was used to identify the relevant soil characteristics. Disturbed soil samples were sampled over the full depth of the soil profile and examined and classified. The soil profiles encountered were compared to soil descriptions in published reports, maps and charts from Department of Primary Industries (DPI) and other sources.

An experienced and qualified geotechnical engineer conducted a thorough geomorphological survey and visual appraisal of the site features the surrounding area to identify any important land features. Slope angles were measured with an inclinometer.

The resulting soil and land description is as follows:

- Landform: Hills
- Geology: Residual sands and clay derived from Cretaceous age sediments
- Aust. Soil Classification: Brown dermosol

Our boreholes indicate clay loam followed by medium clay and shallow sandstone at about 1 m or so.

Geology mapping with contours is presented in Figure 2. A description of the soils typically encountered during our drilling and sampling is presented on the attached sheet in Appendix B.

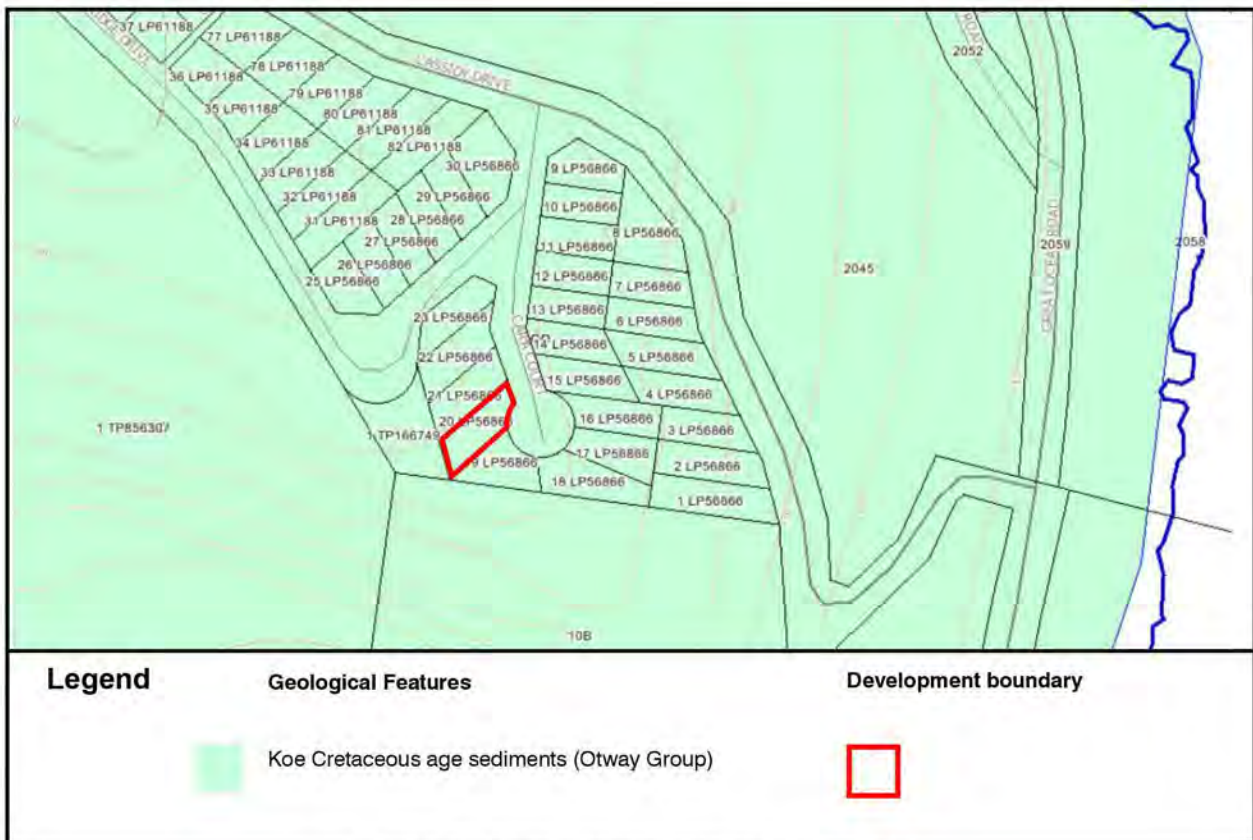


Figure 2: Site geology, source: geovic.vic.gov.au

6.2 Water table

There is limited published bore data available on permanent / transient water table for this area of Kennett River. No permanent or perched water table was encountered during testing however a transient perched water table may develop in very wet conditions above the clay layer. For this reason, it is

important upslope and downslope cut-off drains are provided to prevent/reduce transient water flows near the effluent area.

6.3 Land assessment and constraints

Various features of the site were assessed in accordance with the guidelines of the EPA Publications and reported in accordance with constraint levels outlined in VLCA-2nd Ed. Field measurements and observations were made and where necessary, samples were returned to our laboratory for further analysis. The results are shown in Table 1.

Table 1: Land assessment

Land feature	Result	Level of Constraint	Mitigation
Buffer Distances	Buffer distances achievable. Refer to section 7.4 for relevant offset requirements	Minor	Not Required
Climate	Rainfall Kennett River ~ 897 mm/yr, Evaporation* Kennett River ~ 897 mm/yr	Major	Construct tiered effluent disposal area
Drainage	Proposed effluent area well drained	Nil	Not Required
Erosion or Landslide Risk	No significant landslide risk evident on site	Moderate	Construct a terraced retaining structure for effluent disposal adopt guidance as outlined in AGS guidelines, refer Appendix G
Exposure & Aspect	Good exposure to wind and sun; surrounding area consisting of open grassland and isolated trees	Minor	Not Required
Flooding	Flooding not evident (> 1:100 year flood level)	Nil	Not Required
Groundwater	Groundwater not evident above 1m	Nil	Not Required
Imported Fill	Minor fill present on site	Moderate	Not Required, good characteristics for effluent disposal
Site Drainage	The site receives runoff and provides significant run-on.	Moderate	Position disposal field in well drained position to prevent water logging. Adopt cut off drains
Slope	~16°	Minor	Construct a terraced retaining structure for effluent disposal.
Landform	A single landform exists on this site. No significant features were noted on or near the site	Nil	Not Required
Vegetation	Good grass cover. Dense trees occupy the site	Nil	Not Required
Surface Waters	No significant surface water or easement noted nearby	Nil	Adopt secondary treatment - 20/30/10 std.
Rock Outcrops	Shallow Rock Encountered	Moderate	Construct a terraced retaining structure for effluent disposal
Lot size	Considering the site constraints and proposed development size the allotment has sufficient area for effluent disposal	Major	Not Required

* Closest / longest evaporation recording station record in the area (in accordance with Coffey Report: Wye River and Separation Creek - Geotechnical, Land Capability and Wastewater Solutions Land Capability Assessment.

Based on the land assessment criteria, we have judged the land capability of the site is acceptable, provided constraints are addressed with corresponding and appropriate mitigation measures.

6.4 Soil assessment and constraints

An appraisal of the soil was conducted by visual and tactile estimation in accordance with the site and soil evaluation procedure as outlined in AS1547:2012 and reported in accordance with constraint levels outlined in VLCA-2nd Ed.

Based on our analysis we have determined the limiting geological stratum as moderately structured 'sandy clay', however we have calculated the drip irrigation rate based on the overlying 'sandy loam' which we expect will be utilised in a tiered arrangement. As outlined in AS/NZS1547:2012 we have adopted an indicative permeability (K_{sat}) of 1.5-3.0 m/day and a design loading rate of 5 mm/day.

Testing including pH, Emerson Class No. and salinity were also conducted and results are presented in Table 2.

Table 2: Soil assessment

Land feature	Result	Level of Constraint	Mitigation
Soil Depth	1 m*	Major	Adopt a low DIR. Adopt shallow subsurface irrigation
Permeability	Limiting layer: sandy loam ~ 1.5-3.0 m/d Subsoil: sandy clay ~ < 0.06 m/d	Major	Adopt a low DIR. Adopt shallow subsurface irrigation. Import material if insufficient site derived material available
Soil Structure	Topsoil: weakly structured sandy loam (soil category 2, AS 1547:2012) Subsoil: moderately structured sandy clay (soil category 1, AS 1547:2012)	Moderate	Construct a terraced retaining structure for effluent disposal. Adopt shallow subsurface irrigation.
Soil Plasticity	Low to moderate shrink swell potential	Moderate	Consider ameliorate with addition of lime at a rate of 0.5 kg/m ²
Emerson	Topsoil: sandy loam (Sandy Silt): Class 2, some dispersion Subsoil: sandy clay (Silty Clay): Class 1, dispersion	Moderate	Ameliorate with addition of gypsum at a rate of 0.5 kg/m ²
Salinity	< 0.3 dS/m	Minor	Not Required
pH	5.5 (neutral)	Minor	Not Required

*Extremely weathered sandstone evident at about 1 m.

Based on the above soil assessment criteria, we have judged the soil capability of the site is acceptable subject to relevant outlined mitigation procedures.

6.5 Sensitivity Rating

Further to our land and soil assessment we have completed a sensitivity rating included a Sensitivity Proforma Checklist in accordance with Colac Otway Shire Domestic Wastewater Plan shown in

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Table 3. Based on the information gathered and our knowledge of the area we have assessed the site sensitivity rating as 'High'.

Table 3: Sensitivity Proforma Checklist

Land feature	Site specific input
PFI Identification Number	41111467
Property/Parcel Address	9 Cara Court, Kennett River
Locality	Kennett River
Zoning	Township
Area (m ²)	640 m ²
Soil Texture	sandy loam overlying sandy clay
Soil Depth (m)	1 m
Soil Structure	weakly structured
Soil Limitations	Low permeability rate of subsoil
Permeability (Ksat) (m/day)	1.5-3.0 m/d
Slope (%)	~16%
Presence of Surface Waters	Not present
Useable Lot Area (m ²)	~ 250m ²

A corresponding checklist has been completed and is attached in Appendix I.

6.6 Wastewater volume

According to the EPA Code of Practice Onsite Wastewater Management 891.4 July 2016 and Australian Standard AS/NZS1547:2012 On-site Domestic Wastewater Management the following daily wastewater flows can be adopted:

Unlimited water supply (where a reticulated water supply is proposed)

$$\text{Daily flow} = (\text{No of bedrooms} + 1) \times 150 \text{ litres per day}$$

Limited water supply (where water is sourced only from rain water collection from roofs)

$$\text{Daily flow} = (\text{No of bedrooms} + 1) \times 120 \text{ litres per day}$$

Given the location of the site, it is unlikely this site will be supplied with reticulated water supply for the foreseeable future. However, to allow for potential increased seasonal loading we have adopted unlimited water supply to provide a more conservative outcome.

We understand the proposed dwelling includes 2 bedrooms and on this basis, we recommend the estimated wastewater volume produced to be **450 L/day**.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Our Land Capability Assessment has found the proposed site is acceptable for effluent disposal. Our assessment however has concluded the site sensitivity is 'High' and we have identified some constraints which will need to be considered to enable safe and sustainable effluent disposal on site. Our assessment has found the site is constrained due to limiting factors including allotment size, soil permeability of subsoil, rock depth and rainfall. These constraints however can be mitigated by careful planning and design.

Subject to constraints and our recommendations the dispersal of wastewater on the development poses a low and manageable environmental risk.

We recommend that the proposed household wastewater receive secondary treatment and that the treated effluent be dispersed by pressure compensated sub-surface irrigation. The use of pressure compensation is important for so that a constant flow rate is achieved throughout the effluent disposal area. This also results in better long-term performance of the irrigation lines and disposal field area.

Colac Otway Council require Secondary treatment to a minimum '20/30/10 standard' (i.e. 20 mg/l Biochemical Oxygen Demand, 30 mg/l Suspended Solids and E.coli <10 cfu /100mL) effluent is produced prior to dispersal on the land by sub-surface irrigation. Treatment of household wastewater to 20/30/10 standard with treated wastewater dispersion by sub-surface irrigation will maximise the potential for evapo-transpiration and minimise the risk of contamination of adjoining sites.

Without continual treatment via UV or chlorination dosing the system will not output at a minimum 20/30/10 standard. It is therefore important that regular maintenance is performed by a qualified professional so that this higher level of treatment is sustained for the life of the system.

Due to the rock depth and limited available area we recommend the effluent disposal field be sited in a terraced disposal field and positioned on stable areas as indicated in Appendix A. We recommend sleeper retaining wall construction with individual wall heights of about 0.6m and no greater than 1.0m. We recommend design and construction follow landslide guidelines outlined by Australian Geomechanics Society (refer Appendix G).

An example of a terraced irrigation system is shown in Figure 3, section 7.3. We recommend irrigation lines are installed at a depth of 150-200mm below the finished surface level (in "A" horizon soil, loam 'sandy loam'). Onsite material loam (topsoil) won from site excavation may be used in as backfill material in the retained irrigation platforms or terraces.

It is important upslope and downslope cut-off drains are constructed for the effluent disposal area to reduce surface flows to and from the irrigated terraces, as shown in Appendix F. The surface runoff should be directed away from the effluent area and ultimately connected to the legal point of discharge.

We recommend adding both lime and gypsum at a rate of 0.5 kg/m² to the base of irrigation excavations to improve soil absorption and reduce shrinkage characteristics of the underlying clay. We recommend re-application every 2-3 years (at surface level) due to long term leaching effects.

The irrigation field should preferably be located down slope from septic tank to enable effluent to discharge by gravity flow. However, due to shallower rock present to the west side of the proposed house location, the field may be located on the north-east side of the proposed house location, where existing fill and deeper natural surface soils will allow an increase depth to rock of 1300mm or so. In this case, adequate design and installation of the pumping system will be required to prevent system failure.

7.1 Treatment system

20/30/10 standard treatment can be achieved using both a septic tank (anaerobic treatment) and a pressure dosed sand filter (aerobic treatment) or by using a powered aerated water treatment system (AWTS) combined with additional treatment (using UV, ozone or chlorination).

All AWTS require a current EPA certificate of approval for operation. Regular maintenance of AWTS is essential to ensure correct performance and it is usually a requirement of the approval certificate that a service contract be maintained for the unit. Various AWTS are available on the market and these are generally the preferred method of treatment, note however that an AWTS may not be suitable where irregular or intermittent flows are likely such as from a holiday house.

For a wastewater volume of 450 L/day we recommend a minimum sand filter size of 15 m² with filter media characteristics in accordance with the table shown below, in accordance with EPA standards (CA 1.3/03).

Table 4: Filter media characteristics

Dosage rate	Clay & Fine Silt Content	Effective Size*	Uniformity Coefficient**
≤50 L/m ² /day	<5%	0.25 to 0.6 mm	<4

* Effective size: maximum particle size of smallest 10% by mass of the sand

** Uniformity coefficient: the ratio of the maximum particle size of the smallest 60% by mass of sand to the maximum particle size of the smallest 10% by mass of the sand

7.2 Land application area

7.2.1 Disposal area size based on material type

Based on the material type and through interpretation of Table 5.1 & 5.2 in AS/NZS1547:2012 for "sandy loam", the minimum disposal area required to successfully disperse treated household wastewater based on the material type on the site is **90 m²**.

Note: the minimum disposal area will need to be further modified dependant on water balance and nutrient balance calculations shown in section 7.2.2.

7.2.2 Disposal area size based on water balance model & nutrient balance model

Based on the water balance model and nutrient balance model (refer Appendix D) minimum required to successfully disperse treated household wastewater on the site is **159 m²** and **149 m²** respectively.

The water balance model was calculated using the following input data:

- Design wastewater flow: 2 bedroom residence – 450 L/day from AS1547:2012
- Precipitation – Kennett River ~ 897 mm/yr
- Evaporation – Kennett River ~ 897 mm/yr
- Crop factor – seasonally variable from 0.6 to 0.8
- Coefficient of runoff – 0.85

The nutrient balance model was calculated using the following input data:

- Design wastewater flow: 2 bedroom residence – 450 L/day and from AS1547:2012
- Effluent Nitrogen Concentration – 25 mg/L
- Crop Nitrogen Uptake – 220 kg/ha/yr

7.2.3 Minimum design effluent area for combined blackwater/greywater treatment

Based on our tests and calculations and using design loading rates from AS/NZS1547:2012 we have determined the following irrigation areas are required to successfully disperse treated household effluent for the proposed residence as shown in Table 5.

Table 5: Design effluent area for 2-bedroom residence

Calculation method	Irrigation area required
DIR from AS/NZS1547	90 m ²
Water balance model	159 m ²
Nutrient balance model	149 m ²

Our calculations have shown the water balance model is the critical factor in determining the irrigation area and on this basis, we recommend a minimum irrigation area of **160 m²**.

7.3 Effluent system design

It is beyond the scope of this report to provide a detailed design and layout of the treatment and disposal system. We have provided an indicative suggestion of the irrigation area shape used for illustrative purposes in Appendix A. We endorse variation in irrigation form and location, provided the design is in accordance with our recommendations.

We recommend that an experienced contractor or consultant be engaged to design and install the system. The system manufacturer may be able to provide this service. A typical irrigation system layout and cross section are shown on Appendix E & F (by way of example only).

Due to the site slope, shallow soil profile and allotment size we recommend a terraced system may be constructed on the site. The irrigation fill tiered construction should feature a height of about 0.6m above the existing surface level and a spacing of about 1.5m. This will allow at least 2 rows of irrigation lines in each terrace. Potentially more irrigation lines are possible on flatter slopes, were encountered. An example of a tiered irrigation area is shown in Figure 3.



Figure 3: Typical multi-tiered irrigation disposal

Onsite material loam (topsoil) won from site excavation may be used in as backfill material in the retained irrigation platforms or terraces. We expect the disposal field media to have good long-term characteristics for effluent disposal similar to that of in-situ naturally occurring loam assuming irrigated area is supplying treated effluent to at least 20/30/10 standard.

The irrigation system should use irrigation lines especially designed for wastewater and should incorporate features such as filters to prevent clogging, vacuum breaker valves to prevent air and soil being drawn into the lines, flushing valves to assist in periodic maintenance etc. Trenches for irrigation lines should be properly backfilled and the irrigation area should be left as undisturbed as possible before and after construction and must be protected from traffic by vehicles.

Stormwater and roof runoff water must be diverted around the disposal field to an appropriate point of discharge for stormwater. Cut-off drains should be installed at the top and bottom of the irrigation field to reduce surface runoff. Drains should include lined agriculture drains and backfilled with free draining coarse aggregate.

7.4 Effluent disposal area siting

The effluent irrigation area must be located as follows:

1. In an area not subject to vehicular traffic.
2. No closer than 3.0m from a gas or water pipe (primary treatment).
3. No closer than 3.0m on the low side or 6.0m on the high side of a property boundary (primary treatment).
4. No closer than 1.5m from a gas or water pipe (secondary treatment).
5. No closer than 1.5m on the low side or 3.0m on the high side of a property boundary (secondary treatment).
6. No closer than 3.0m from a swimming pool or stormwater drain.
7. No closer than 7.5m from an underground tank, cutting or escarpment.
8. No closer than 10m from a non-potable groundwater bore.
9. No closer than 30m from a dam, stream or channel (non-potable).
10. No closer than 100m from a stream or river in a potable water supply catchment.

The irrigation area must be permanently dedicated and marked with at least two clear warning signs and the sub-surface irrigation drippers must be permanently fixed to distribution lines buried at least 200mm deep.

Our analysis has shown there is sufficient available land for an effluent disposal area of 160 m², as shown in Appendix A.

7.5 Reserve field

The EPA Septic Tanks Code of Practice requires that provision for a "reserve" effluent disposal field in the event that the primary disposal field fails, proves to be inadequate or needs to be rested. The reserve field must be not less than the size of the primary field and must be located on the site in compliance with all the minimum setback distances etc. as described above.

Note that a reserve field is not required for wastewater that has been treated to 20/30/10 standard, as is proposed for this site.

7.6 Vegetation cover

Efficient effluent disposal assumes good vegetative cover. Therefore, it is recommended to establish and maintain grasses over distribution lines, with suitable trees and shrubs in the spaces between the lines. Such vegetation can significantly assist the overall disposal process by transpiration from leaves and by maintaining soil permeability through fine root channels. Refer to the attached "Land Capability Assessment Addendum" for additional information and indicative list of suitable plant species.

Large trees should be retained wherever possible. Where large tree removal is necessary, they should be cut off at ground level with the root structures left intact. We also recommend that a re-vegetation program be instigated for the site, particularly due to removed trees that were affected by recent bushfire activity.

7.7 Drainage management

Careful attention to drainage is essential to reduce risk of system failure. Surface water must therefore be prevented from ponding anywhere on or near the site.

We recommend installation of upslope cut-off drains above and below the effluent disposal area with run-off directed to the legal point of discharge.

The drains must be positioned and constructed with sufficient fall to discharge completely to prevent water from accumulating in the soil anywhere near the buildings. Any blockages must be cleared and repaired promptly.

Care must also be taken to ensure that all levelled areas (vehicle parking bays, recreation areas etc.) have a slight fall ($\geq 2^\circ$) to prevent surface water from ponding or seeping into the ground and diverted away from the buildings.

7.8 Management, monitoring, care and operation

Colac Otway Council require secondary treatment to a minimum '20/30/10 standard' (i.e. 20 mg/l Biochemical Oxygen Demand, 30 mg/l Suspended Solids and E.coli <10 cfu /100mL) effluent is produced prior to dispersal on the land by sub-surface irrigation. Treatment of household wastewater to 20/30/10 standard with treated wastewater dispersion by sub-surface irrigation will maximise the potential for evapo-transpiration and minimise the risk of contamination of adjoining sites.

A septic system requires regular servicing and maintenance by an approved contractor to meet the conditions on the council approval certificate and the requirements of the manufacturer to ensure that the minimum 20/30/10 standard of effluent is consistently achieved.

E.coli <10 cfu /100mL can be achieved via chlorine, UV and Ozone however from experience dosing using chlorine may provide the simplest solution for the site conditions. An appropriate dose for secondary treatment is generally 15-45mg/L however recommend specialist advice from supplier of the domestic wastewater treatment supplier. Further specific requirements with regard to disinfection is discussed in AS1547:2102 Appendix P.

We reiterate the importance of maintaining dosing throughout the life of the system so that continual treatment to a 20/30/10 standard is achieved.

A healthy system should include a biological scum on the surface and be relatively free from strong odours. We recommend the effluent disposal system be checked by a suitably qualified plumber / drainer every 12 months. The tank level and quality should also be assessed. If necessary, the tank should be 'desludged' i.e. pumped out and any faulty mechanics repaired. Desludging is required concurrently at 3 to 5 year intervals. Similarly, when constructed, sand filter media should be checked concurrently every 3 to 5 years and media replaced where required. Drainage lines should be checked for blockages or fixture failures. Grease trap should be checked for blockages and pumped every 6-12 months.

The following guidelines regarding the care and operation of septic tanks as recommend in the EPA Septic Tanks Code of Practice:

- Restrict the use of germicides (strong detergents, disinfectants, nappy sanitisers, bleaches etc.),
- Use cleaning products, detergents etc. sparingly and check their suitability for septic tank systems,
- Use detergents with low levels of salt, phosphorus and chlorine. Detergents with low phosphorus and sodium are best suited for septic tanks and the environment. For more information regarding detergents we highly recommend visiting Lanfax Laboratories at lanfaxlabs.com.au under "Laundry Products Research" and click the downloadable "laundry brochure".
- Do not flush sanitary napkins, disposable nappies or similar products into the system,
- Minimise the amounts of oil and fat washed into the system,
- Use a sink strainer to restrict food scrapes entering system,
- Do not use garbage disposal units,
- Do not modify the system without council approval,
- Conserve water.

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St Quentin Consulting Pty Ltd

A handwritten signature in black ink, appearing to read "C Farrar".

C Farrar

Geotechnical Engineer B.Eng. MIE Aust (Reg. No. 4367740)

References

EPA Publication 891.4 Code of Practice - Onsite Wastewater Management, July 2016

EPA Publication 746.1 Land Capability Assessment for Onsite Domestic Wastewater Management, March 2003

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Appendix A

Site Plan

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Borehole Locations



Legend:

- Borehole locations
- Development site
- Site slope
- Proposed disposal area
- Proposed dev. area
- Site cut-top
- Site cut-bottom

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Geomorphological plan

Location: 9 Cara Court,
 Kennett River

Source: Google

Project No: 15055G

Inv. date: 4.07.17

Drawing No: 1

Scale: NOT TO SCALE

Drawn by: C.F.

Date: 20.11.17

Approved by: C.F.

Date: 20.11.17



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Appendix B

Borehole Logs

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BOREHOLE LOG

Client: Nicholas Thompson
Location: 9 Cara Court,
 Kennett River

Project No.: 15055G
Borehole No: BH 1
Inv. Date: 4.07.17

Sheet: 1 of 1
Logged by: C.F.
Checked by: C.F.

Depth (metres)	Graphic Log	Material Description Type, Plasticity, Colour, Particle characteristics	Soil Texture	Structure	Moisture	Consistency / Density	Sample / Test	Test Results	Geology and additional observations
0.2		Silty CLAY (Medium Clay) Mottled brown and red Massive structure Firm, dry	MC	Ma	D	F			
0.30		Borehole 1 terminated at 0.3m Refusal on extremely weathered sandstone							
0.4									
0.6									
0.8									
1.0									
1.2									
1.4									
1.6									
1.8									
2.0									
2.2									

moisture: D Dry SM Slightly Moist M Moist W Wet Sat Saturated	Sample / Test PP Pocket Penetrometer (kPa) V Picon Shear Vane (kPa) DCP Dynamic Cone Penetrometer Test N Standard Penetration Test DS Disturbed Sample	Consistency/density: VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense	Structure Ma Massive SG Single grained We Weak Mo Moderate Str Strong	Method:  Hand Auger  Auger Drilling  Roller/Tricone  Washbore  Non Destructive Digging
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<h1 style="margin: 0;">BOREHOLE LOG</h1>	<p style="margin: 0; font-size: small;">Surveyors Town Planners Engineers</p>
--	---

Client: Nicholas Thompson	Project No.: 15055G
Location: 9 Cara Court, Kennett River	Borehole No: BH 2
	Inv. Date: 4.07.17
	Sheet: 1 of 1
	Logged by: C.F.
	Checked by: C.F.

Depth (metres)	Graphic Log	Material Description <small>Type, Plasticity, Colour, Particle characteristics</small>	Soil Texture	Structure	Moisture	Consistency / Density	Sample / Test	Test Results	Geology and additional observations
0.2		Sandy Clayey Silt (Sandy Loam) Mottled brown and red Massive structure Firm, dry Grass cover	SL	We	M	D			
0.30									
0.4		Silty CLAY (Light Clay) Mottled brown and red Massive structure Firm to stiff, low to medium plasticity, moist	MC	Ma	D	F			
0.6									
0.8									
0.80		Borehole 2 terminated at 0.8m Refusal on extremely weathered sandstone							
1.0									
1.2									
1.4									
1.6									
1.8									
2.0									
2.2									

moisture:	Sample / Test	Consistency/density:	Structure	Method:
D Dry	PP Pocket Penetrometer (kPa)	VS very soft	Ma Massive	<input checked="" type="checkbox"/> Hand Auger
SM Slightly Moist	V Picon Shear Vane (kPa)	S soft	SG Single grained	<input type="checkbox"/> Auger Drilling
M Moist	DCP Dynamic Cone Penetrometer Test	F firm	We Weak	<input type="checkbox"/> Roller/Tricone
W Wet	N Standard Penetration Test	St stiff	Mo Moderate	<input type="checkbox"/> Washbore
Sat Saturated	DS Disturbed Sample	VSt very stiff	Str Strong	<input type="checkbox"/> Non Destructive Digging
		H hard		
		VD very dense		

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<h1>BOREHOLE LOG</h1>	 ST. QUENTIN Surveyors Town Planners Engineers
-----------------------	---

Client: Nicholas Thompson Location: 9 Cara Court, Kennett River	Project No.: 15055G Borehole No: BH 3 Inv. Date: 4.07.17	Sheet: 1 of 1 Logged by: C.F. Checked by: C.F.
---	---	---

Depth (metres)	Graphic Log	Material Description <small>Type, Plasticity, Colour, Particle characteristics</small>	Soil Texture	Structure	Moisture	Consistency / Density	Sample / Test	Test Results	Geology and additional observations
0.2 0.30		Sandy Clayey Silt (Sandy Loam) Mottled brown and red Massive structure Firm, dry Grass cover	SL	We	M	D			
0.4 0.6 0.8 1.0 1.00		Silty CLAY (Light Clay) Mottled brown and red Massive structure Firm to stiff, low to medium plasticity, moist	MC	Ma	D	F			
1.2 1.4 1.6 1.8 2.0 2.2		Borehole 3 terminated at 1m Refusal on extremely weathered sandstone							

moisture:	Sample / Test	Consistency/density:	Structure	Method:
D Dry	PP Pocket Penetrometer (kPa)	VS very soft	Ma Massive	<input checked="" type="checkbox"/> Hand Auger
SM Slightly Moist	V Picon Shear Vane (kPa)	S soft	SG Single grained	<input type="checkbox"/> Auger Drilling
M Moist	DCP Dynamic Cone Penetrometer Test	F firm	We Weak	<input type="checkbox"/> Roller/Tricone
W Wet	N Standard Penetration Test	St stiff	Mo Moderate	<input type="checkbox"/> Washbore
Sat Saturated	DS Disturbed Sample	VSt very stiff	Str Strong	<input type="checkbox"/> Non Destructive Digging
		H hard		
		VD very dense		

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BOREHOLE LOG



Client: Nicholas Thompson
Location: 9 Cara Court,
 Kennett River

Project No.: 15055G
Borehole No: BH 4
Inv. Date: 4.07.17

Sheet: 1 of 1
Logged by: C.F.
Checked by: C.F.

Depth (metres)	Graphic Log	Material Description <small>Type, Plasticity, Colour, Particle characteristics</small>	Soil Texture	Structure	Moisture	Consistency / Density	Sample / Test	Test Results	Geology and additional observations
0.2		FILL:Sandy Clayey Silt (Sandy Loam) Mottled brown and red Massive structure Poorly compacted Grass cover	SL	We	M	D			
0.50		Sandy Clayey Silt (Sandy Loam) Mottled brown and red Massive structure Firm, dry	SL	We	M	D			
1.00		Silty CLAY (Light Clay) Mottled brown and red Massive structure Firm to stiff, moist	MC	Ma	D	F			
1.50	Borehole 4 terminated at 1.5m Refusal on extremely weathered sandstone								
1.6									
1.8									
2.0									
2.2									
moisture:		Sample / Test		Consistency/density:		Structure		Method:	
D	Dry	PP	Pocket Penetrometer (kPa)	VS	very soft	Fb	friable	Ma	Massive
SM	Slightly Moist	V	Pilcon Shear Vane (kPa)	S	soft	VL	very loose	SG	Single grained
M	Moist	DCP	Dynamic Cone Penetrometer Test	F	firm	L	loose	We	Weak
W	Wet	N	Standard Penetration Test	St	stiff	MD	medium dense	Mo	Moderate
Sat	Saturated	DS	Disturbed Sample	VSt	very stiff	D	dense	Str	Strong
				H	hard	VD	very dense		
								<input checked="" type="checkbox"/>	Hand Auger
								<input type="checkbox"/>	Auger Drilling
								<input type="checkbox"/>	Roller/Tricone
								<input type="checkbox"/>	Washbore
								<input type="checkbox"/>	Non Destructive Digging

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BOREHOLE LOG



Client: Nicholas Thompson
Location: 9 Cara Court,
 Kennett River

Project No.: 15055G
Borehole No: BH 5
Inv. Date: 4.07.17

Sheet: 1 of 1
Logged by: C.F.
Checked by: C.F.

Depth (metres)	Graphic Log	Material Description <small>Type, Plasticity, Colour, Particle characteristics</small>	Soil Texture	Structure	Moisture	Consistency / Density	Sample / Test	Test Results	Geology and additional observations
0.2		FILL:Sandy Clayey Silt (Sandy Loam) Mottled brown and red Massive structure Poorly compacted	SL	We	M	D			
0.4		Sandy Clayey Silt (Sandy Loam) Mottled brown and red Massive structure Firm, dry	SL	We	M	D			
1.0		Silty CLAY (Light Clay) Mottled brown and red Massive structure Firm to stiff, moist	MC	Ma	D	F			
1.30	Borehole 5 terminated at 1.3m Refusal on extremely weathered sandstone								

moisture: D Dry SM Slightly Moist M Moist W Wet Sat Saturated	Sample / Test PP Pocket Penetrometer (kPa) V Pilcon Shear Vane (kPa) DCP Dynamic Cone Penetrometer Test N Standard Penetration Test DS Disturbed Sample	Consistency/density: VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense	Structure Ma Massive SG Single grained We Weak Mo Moderate Str Strong	Method: <input checked="" type="checkbox"/> Hand Auger <input type="checkbox"/> Auger Drilling <input type="checkbox"/> Roller/Tricone <input type="checkbox"/> Washbore <input type="checkbox"/> Non Destructive Digging
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Appendix C

Site Photographs



North view: proposed development site, photo from front of site



South view: proposed development site, photo from rear of site



Adjacent site (west)




Adjacent site (east)

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Appendix D

Water Balance & Nutrient Balance Models

VICTORIAN LAND CAPABILITY ASSESSMENT FRAMEWORK		 Surveyors - Town Planners - Engineers	
WATER BALANCE MODEL			
Client: Nicholas Thompson	Location: 9 Cara Court, Kennett River	Project No.: 15055G	
Project: 9 Cara Court, Kennett River	Assessor: Cameron Farrar	Date: 24.11.17	

IRRIGATION AREA SIZING USING NOMINATED AREA WATER BALANCE FOR ZERO STORAGE		
INPUT DATA		
Number of bedrooms:	2	Actual number of bedrooms of proposed building
Water supply:	150	Limited (water sourced only from rain water collection) or unlimited (reticulated water supply proposed)
Design Wastewater Flow (Q):	450 L/day	Based on maximum potential occupancy and derived from Table 4 in the EPA Code of Practice (July 2016)
Design Irrigation Rate (DIR):	5.0 mm/day	Based on soil texture class/permeability and derived from Table 9 in the EPA Code of Practice (July 2016)
Minimum Irrigation Area:	90 m ²	Based on material type and through interpretation of Table 5.1 & 5.2 of AS/NZS 1547:2012
Crop Factor (C):	0.6-0.8	Estimates evapotranspiration as a fraction of pan evaporation; varies with season and crop type (suitable for pasture grass)
Rainfall Runoff Factor (RF):	0.85	Proportion of rainfall that remains onsite and infiltrates, allowing for any runoff
Rainfall Data:	Kennett River	BoM Station and number or 70th Percentile from Council Specific Data
Pan Evaporation Data:	Kennett River	BoM Station and number

Parameter	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
Rainfall (R):		mm/month	43	45	57	71	85	91	98	110	93	84	65	54	896
Evaporation (E):		mm/month	129	106	90	58	39	28	32	44	61	87	102	121	897
Crop Factor (C):		unitless	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.6	0.7	0.8	0.8	0.8	
OUTPUTS															
Evapotranspiration (ET):	ExC	mm/month	103	85	63	41	23	17	19	26	43	70	82	97	668.1
Percolation (B):	DIRxD	mm/month	155	140	155	150	155	150	155	155	150	155	150	155	1825
Outputs:	ET+B	mm/month	258.2	224.8	218.0	190.6	178.4	166.8	174.2	181.4	192.7	224.6	231.6	251.8	2493.1
INPUTS															
Retained Rainfall (RR):	RxRF	mm/month	36.55	38.25	48.45	60.35	72.25	77.35	83.3	93.5	79.05	71.4	55.25	45.9	761.6
Applied Effluent (W):	(QxD)/L	mm/month	87.2	78.8	87.2	84.4	87.2	84.4	87.2	87.2	84.4	87.2	84.4	87.2	1026.8
Inputs:	RR+W	mm/month	123.7	117.1	135.7	144.8	159.5	161.8	170.5	180.7	163.5	158.6	139.7	133.1	1788.4
STORAGE CALCULATION															
Storage remaining from previous month		mm/month	0	0	0	0	0	0	0	0	0	0	0	0	0
Storage for the month (S):	(RR+W)-(ET+B)	mm/month	-134.5	-107.8	-82.4	-45.9	-19.0	-5.1	-3.7	-0.7	-29.3	-66.0	-92.0	-118.7	
Cumulative Storage (M):		mm	0	0	0	0	0	0	0	0	0	0	0	0	
Max. Storage for Nominated Area (N):		mm	0												
Max. Volume for Nominated Area (V):	NxL	L	0												
LAND AREA REQUIRED FOR ZERO STORAGE															
		m ²	63	68	82	104	131	151	153	159	119	91	77	68	
MINIMUM AREA REQUIRED FOR ZERO STORAGE:			159 m²			Nominated Land Application Area :					160 m²				

VICTORIAN LAND CAPABILITY ASSESSMENT FRAMEWORK			
NUTRIENT BALANCE MODEL			
Client: Nicholas Thompson	Location: 9 Cara Court, Kennett River	Project No.: 15055G	
Project: 9 Cara Court, Kennett River	Assessor: Cameron Farrar	Date: 24.11.17	

LAND APPLICATION AREA REQUIRED BASED NITROGEN BALANCE

INPUT DATA¹

Wastewater Loading			Nutrient Crop Uptake					
Hydraulic Load	450	L/day	Crop N Uptake	220	kg/ha/yr	Which equals	60.27	mg/m ² /day
Effluent N Concentration	25	mg/L						
% N Lost to Soil Processes (Geary & Gardner 1996)	0.2	Decimal						
Total N Loss to Soil	2250	mg/day						
Remaining N Load after soil loss	9000	mg/day						

NITROGEN BALANCE BASED ON ANNUAL CROP UPTAKE RATES

Minimum Area required with zero buffer			Determination of Buffer Zone Size for a Nominated Land Application Area (LAA)			
Nitrogen		149	m ²	Nominated LAA Size from Water Balance	160	m ²
				Predicted N Export from LAA	-0.24	kg/year
				Minimum Buffer Required for excess nutrient	0	m ²

MINIMUM AREA REQUIRED FOR ZERO BUFFER: 149 m²

NOTES

¹ Model sensitivity to input parameters will affect the accuracy of the result obtained. Where possible site specific data should be used. Otherwise data should be obtained from a reliable source such as:

- EPA Guidelines for Effluent Irrigation
- Appropriate Peer Reviewed Papers
- Environment and Health Protection Guidelines: Onsite Sewage Management for Single Households
- USEPA Onsite Systems Manual

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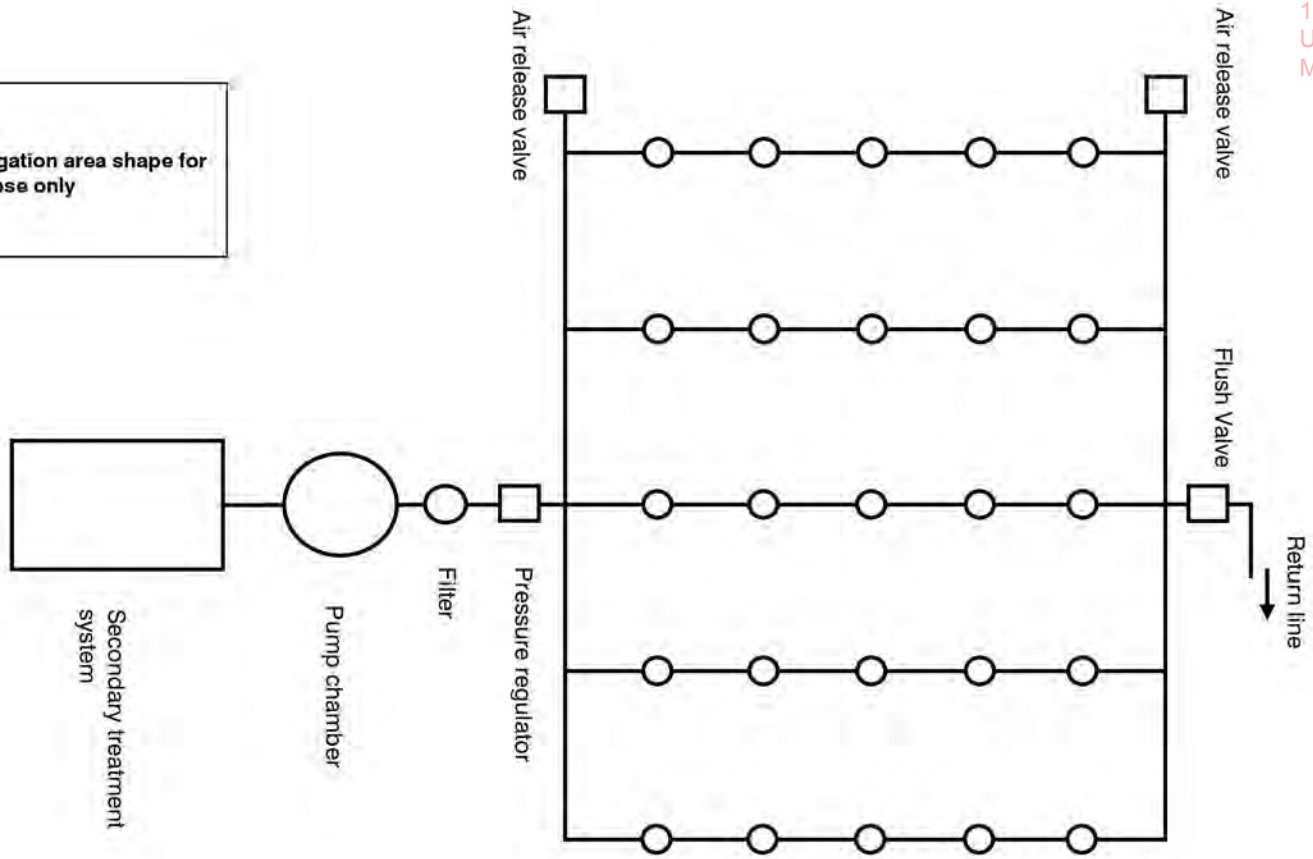


Appendix E

Typical Irrigation System Layout

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Notes:
1. Indicative irrigation area shape for illustrative purpose only



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**Typical Presure Compensated
Subsurface Drip irrigation Layout**

Location: 9 Cara Court, Kennett River
Project No: 15055G
Drawing No: 1
Scale: NOT TO SCALE

Drawn by: O.R.
Date: 24.11.17
Approved by: C.F.
Date: 24.11.17

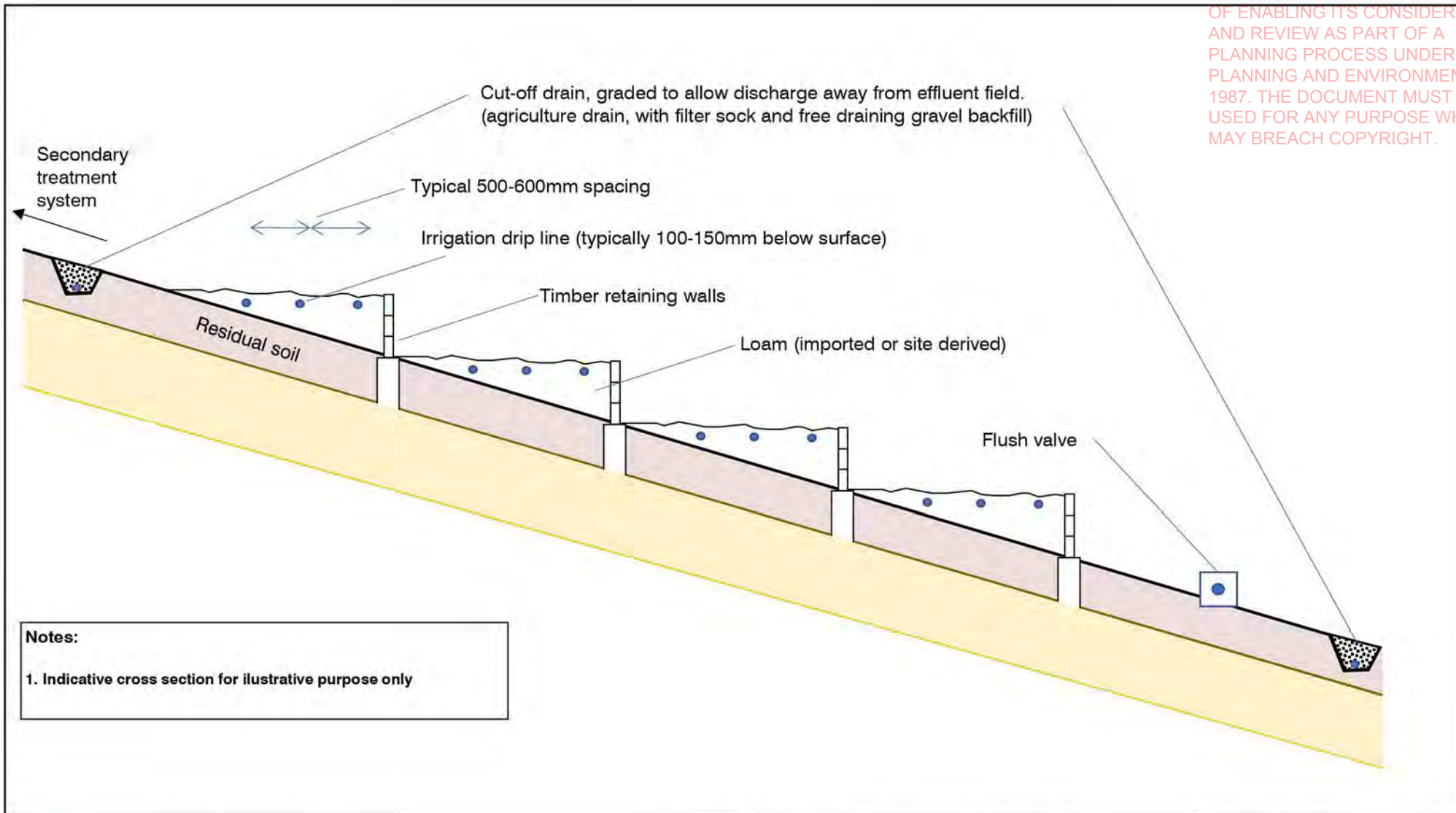
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Appendix F

Typical Effluent Disposal Cross Section

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Notes:
 1. Indicative cross section for illustrative purpose only

 <p>ST. QUENTIN Surveyors · Town Planners · Engineers 51 LITTLE FYANS STREET, P.O. BOX 919, GEELONG 3220 TELEPHONE (03) 5201 1811 FAX (03) 5229 2909</p>	<p>Typical Irrigation Design Cross Section</p>	<p>Location: 9 Cara Court, Kennett River Project No: 15055G Drawing No: 1 Scale: NOT TO SCALE</p>	<p>Drawn by: O.R. Date: 24.11.17 Approved by: C.F. Date: 24.11.17</p>
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Appendix G

Australian Geoguides LR9 (Effluent Disposal)

AUSTRALIAN GEOGUIDE LR9 (EFFLUENT DISPOSAL)

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Avoid concave slopes, depressions and benches

Locate disposal field preferably on downhill side of the house with trenches following the contour, manage landslide risk if this is an issue



Land application area size is determined by soil dependent loading rate

Disposal area planted with shallow rooting grasses and shrubs

Keep access and buildings away from disposal field to retain full soil absorption and evaporation capabilities.

Disposal field better located on flatter area and away from the water

Avoid areas of high groundwater

Special design considerations are required for floodprone land

Disposal trench should be constructed so that landslide risk is tolerable. Seek professional advice if in doubt

Disposal trench too close to waters edge

Reduce effluent volumes through highly rated appliances and grey water re-use systems

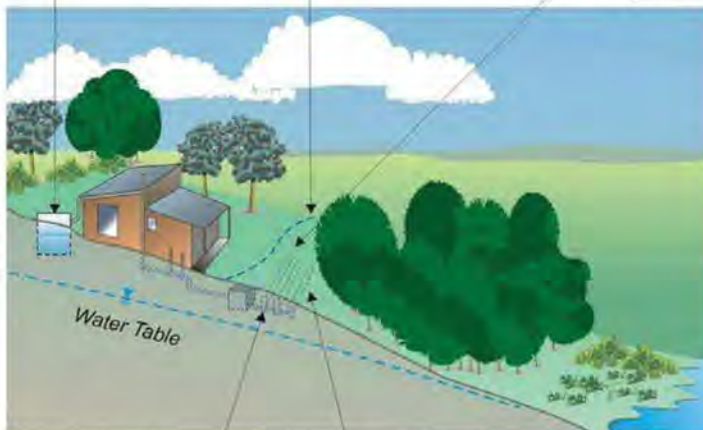
Avoid concentrations of surface water and direct away from effluent fields

Other effluent disposal systems can include soak wells, surface/spray irrigation, drip irrigation and subsurface drippers

Locate underground household water storage uphill and away from disposal field

Direct rainfall runoff away from disposal field with a cut-off drain

Disposal field set back from property boundary in accordance with local provisions



Ensure overflow at water tank is spread broadly across slope

Retain vegetation where possible and plant area with grasses and shrubs to improve operation of disposal field

Disposal system located away from surface waters. Check local provisions

Ensure point of application is above the highest seasonal water table

Locate disposal field (if that is what is required) along the contours of the slope in accordance with local provisions and landslide risk assessment

Note: Adapted from EPA Vic. Publication 451 (March 1996) "Code of Practice - Septic Tanks", which was sourced from Vic. Department of Planning and Loddon-Campaspe Regional Planning Authority.

More information relevant to your particular situation may be found in other Australian GeoGuides:

- GeoGuide LR1 - Introduction
- GeoGuide LR2 - Landslides
- GeoGuide LR3 - Landslides in Soil
- GeoGuide LR4 - Landslides in Rock
- GeoGuide LR5 - Water & Drainage
- GeoGuide LR6 - Retaining Walls
- GeoGuide LR7 - Landslide Risk
- GeoGuide LR8 - Hillside Construction
- GeoGuide LR10 - Coastal Landslides
- GeoGuide LR11 - Record Keeping

The Australian GeoGuides (LR series) are a set of publications intended for property owners; local councils; planning authorities; developers; insurers; lawyers and, in fact, anyone who lives with, or has an interest in, a natural or engineered slope, a cutting, or an excavation. They are intended to help you understand why slopes and retaining structures can be a hazard and what can be done with appropriate professional advice and local council approval (if required) to remove, reduce, or minimise the risk they represent. The GeoGuides have been prepared by the [Australian Geomechanics Society](#), a specialist technical society within Engineers Australia, the national peak body for all engineering disciplines in Australia, whose members are professional geotechnical engineers and engineering geologists with a particular interest in ground engineering. The GeoGuides have been funded under the Australian governments' National Disaster Mitigation Program.

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Appendix H

Planning Report

Planning Property Report

from www.planning.vic.gov.au on 28 August 2017 11:44 AM

Address: 1265 SKENES CREEK ROAD TANYBRYN 3249

Lot and Plan Number: Lot 1 TP84112

Local Government (Council): COLAC OTWAY **Council Property Number:** 20318

Directory Reference: VicRoads 101 D4

See next page for planning information

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Environment,
Land, Water
and Planning

Planning Zones

ROAD ZONE - CATEGORY 1 (RDZ1)

RURAL CONSERVATION ZONE (RCZ)

SCHEDULE TO THE RURAL CONSERVATION ZONE (RCZ)



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

Zones Legend

ACZ - Activity Centre	IN1Z - Industrial 1	R1Z - General Residential
B1Z - Commercial 1	IN2Z - Industrial 2	R2Z - General Residential
B2Z - Commercial 1	IN3Z - Industrial 3	R3Z - General Residential
B3Z - Commercial 2	LDRZ - Low Density Residential	RAZ - Rural Activity
B4Z - Commercial 2	MUZ - Mixed Use	RCZ - Rural Conservation
B5Z - Commercial 1	NRZ - Neighbourhood Residential	RDZ1 - Road - Category 1
C1Z - Commercial 1	PCRZ - Public Conservation & Resource	RDZ2 - Road - Category 2
C2Z - Commercial 2	PDZ - Priority Development	RGZ - Residential Growth
CA - Commonwealth Land	PPRZ - Public Park & Recreation	RLZ - Rural Living
CCZ - Capital City	PUZ1 - Public Use - Service & Utility	RUZ - Rural
CDZ - Comprehensive Development	PUZ2 - Public Use - Education	SUZ - Special Use
DZ - Dockland	PUZ3 - Public Use - Health Community	TZ - Township
ERZ - Environmental Rural	PUZ4 - Public Use - Transport	UFZ - Urban Floodway
FZ - Farming	PUZ5 - Public Use - Cemetery/Crematorium	UGZ - Urban Growth
GRZ - General Residential	PUZ6 - Public Use - Local Government	Urban Growth Boundary
GWAZ - Green Wedge A	PUZ7 - Public Use - Other Public Use	
GWZ - Green Wedge	PZ - Port	

Railway	Tram	River, stream	Lake, waterbody
---------	------	---------------	-----------------

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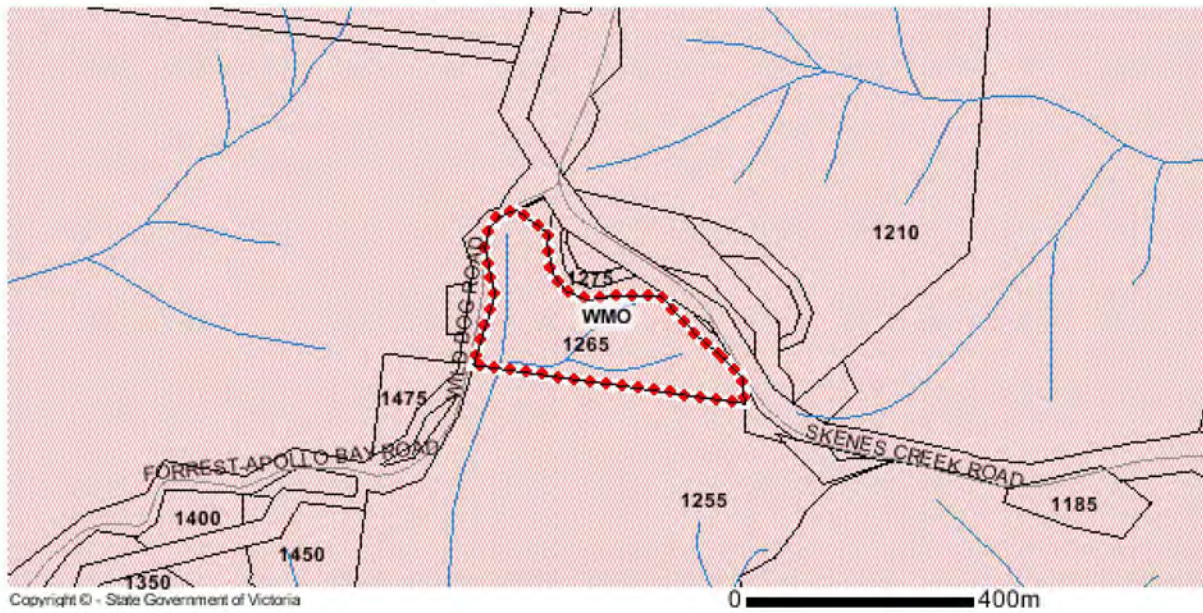
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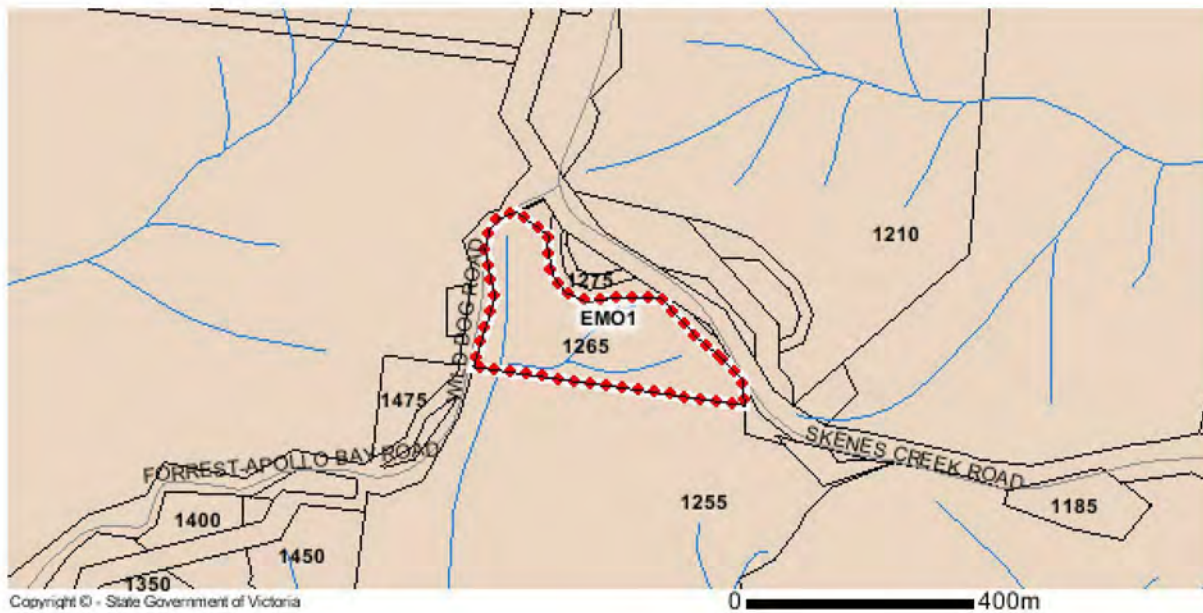
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Planning Overlays

BUSHFIRE MANAGEMENT OVERLAY (BMO OR WMO)



EROSION MANAGEMENT OVERLAY (EMO) EROSION MANAGEMENT OVERLAY - SCHEDULE 1 (EMO1)



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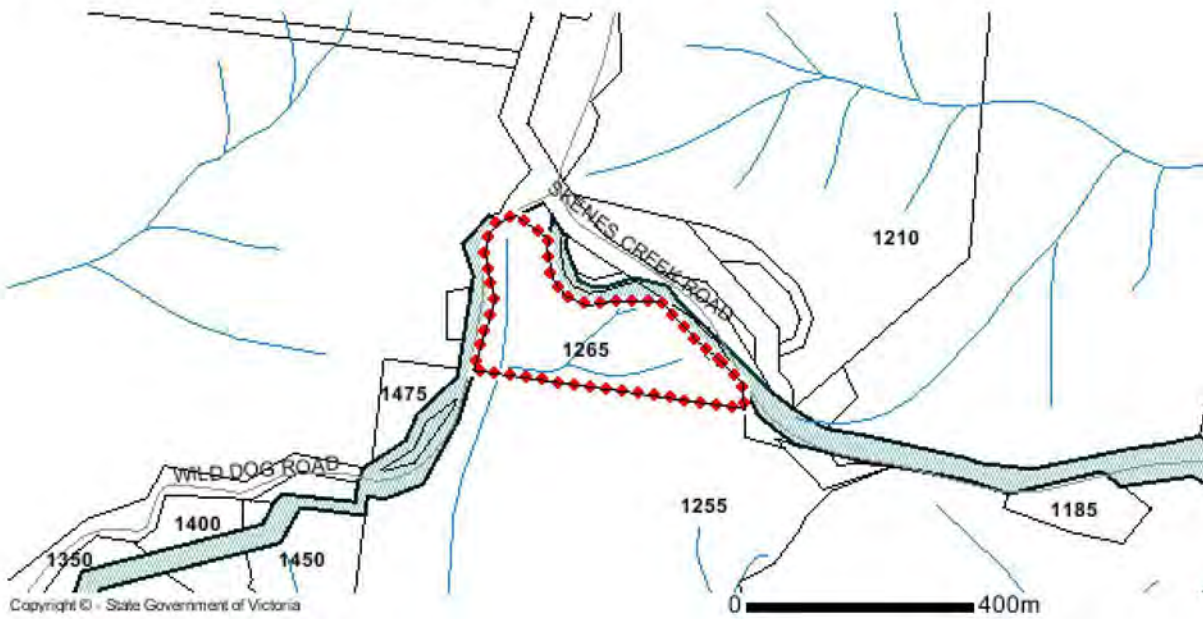


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Planning Overlays

VEGETATION PROTECTION OVERLAY (VPO)

VEGETATION PROTECTION OVERLAY - SCHEDULE 2 (VPO2)



Overlays Legend

- | | |
|---------------------------------------|--------------------------------------|
| AEO - Airport Environs | LSIO - Land Subject to Inundation |
| BMO - Bushfire Management (also WMO) | MAEO1 - Melbourne Airport Environs 1 |
| CLPD - City Link Project | MAEO2 - Melbourne Airport Environs 2 |
| DCPO - Development Contributions Plan | NCO - Neighbourhood Character |
| DDO - Design & Development | PO - Parking |
| DDOPT - Design & Development Part | PAO - Public Acquisition |
| DPO - Development Plan | RO - Restructure |
| EAO - Environmental Audit | RCO - Road Closure |
| EMO - Erosion Management | SBO - Special Building |
| ESO - Environmental Significance | SLO - Significant Landscape |
| FO - Floodway | SMO - Salinity Management |
| HO - Heritage | SRD - State Resource |
| IPO - Incorporated Plan | VPO - Vegetation Protection |
| Railway | Tram |
| River, stream | Lake, waterbody |

Note: due to overlaps some colours on the maps may not match those in the legend.

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Environment, Land, Water and Planning

Further Planning Information

Planning scheme data last updated on 23 August 2017.

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, local, particular and general 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 [Planning Schemes Online](#)

This report is NOT a **Planning Certificate** issued pursuant to Section 199 of the Planning & Environment Act 1987.

It does not include information about exhibited planning scheme amendments, or zonings that may affect the land.

To obtain a Planning Certificate go to [Titles and Property Certificates](#)

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 [Planning Maps Online](#)

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

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Appendix I

Land Capability Assessment Detailed Information Checklist

Minimum Requirements for a Detailed LCA Assessment and Report (High Risk)

Report Element	Detailed Requirements	Completed
1. Introduction and Background	Report summary/ executive summary.	<input checked="" type="checkbox"/>
	Confirmation of Sensitivity Rating.	<input checked="" type="checkbox"/>
	Confirmation of any relevant sensitivity overlays (e.g. landslip) as per communications with Council.	<input checked="" type="checkbox"/>
	Confirmation that property/parcel(s) meets minimum lot size criteria for COS Planning Scheme Zone.	<input checked="" type="checkbox"/>
	Current land use and development overview (including occupancy); single property/parcel, increase in building entitlements (subdivision) or non-domestic development.	<input checked="" type="checkbox"/>
	Name, contact details and qualifications (insurances) of LCA assessor (author).	<input checked="" type="checkbox"/>
	Site location (including address and property/parcel details) and owner.	<input checked="" type="checkbox"/>
	Property/parcel area.	<input checked="" type="checkbox"/>
	Proposed/existing water supply.	<input checked="" type="checkbox"/>
	Availability of sewer.	<input checked="" type="checkbox"/>
	Locality map showing the site in relation to surrounding region.	<input checked="" type="checkbox"/>
	Site survey plan (2m contours) will need to be conducted by a qualified surveyor.	<input checked="" type="checkbox"/>
2. Site Inspection and Field Investigations	Gather information on relevant Council, Water Corporation, Catchment Management Authority and State Government requirements, including restrictions and caveats on title, and planning/building/bushfire/flood controls, e.g. zones and overlays. Note Environmental Significant Overlays, potable water supply and DWSCs. Impose this information on a base map (or site plan) which shows their location with respect to title boundaries.	<input checked="" type="checkbox"/>
	Broad overview of locality and landscape characteristics that may pose a constraint to the sustainable application of wastewater on the Site and adjacent land, e.g. climatic information, groundwater and bore water information. (Refer to stage 3 pp.34 EPA Code of Practice (2013)).	<input checked="" type="checkbox"/>
	Details of date, time and methodology of site inspection and field investigations.	<input checked="" type="checkbox"/>
	Site assessment that considers all of the parameters as per Table 1 of the Victorian LCA Framework (2014). Detailed explanation of the level of constraint with regards to DWM and recommended mitigation measures to overcome these constraints.	<input checked="" type="checkbox"/>
	Minimum of two soil test pits or auger holes within the identified available effluent management area with additional test pits required for more than one soil type (multiple soil landscapes or facets) as per the current EPA Code of Practice.	<input checked="" type="checkbox"/>
	Soil assessment that considers all of the parameters in Table 2 of the Victorian LCA Framework (2014): <ul style="list-style-type: none"> • colour and mottling; • electrical conductivity; • Emerson Aggregate Class; • permeability and design loading rate (using soil texture); • pH; • rock fragments; • soil depth; • soil texture (field textural analysis); • watertable (depth to); • cation exchange capacity (CEC); 	<input checked="" type="checkbox"/>

Report Element	Detailed Requirements	Completed
	<ul style="list-style-type: none"> • sodicity (Exchangeable Sodium Percentage ESP); and • Sodium Absorption Ratio (SAR). <p>Detailed explanation of the level of constraint with regards to DWM and recommended mitigation measures to overcome these constraints.</p> <p>Soil permeability testing conducted in situ for the soil within the available effluent management area as per constant head well permeameter method (AS/NZS 1547:2012) can be undertaken if desired, otherwise soil texture classification and application of effluent using the loading rates within the AS/NZS 1547:2012 is satisfactory.</p>	
	Detailed review of available published soils information for the site. Soil landscapes and different soil facets should be mapped on the Site Plan.	☑
3. Available Area and Setback Distances	Calculation of available effluent management area and location on Site Plan.	☑
	Discussion regarding the achievability of the applicable setback distances (Table 5 of the EPA Code of Practice (2013)). Justification required.	☑
4. LCA Confirmation	Confirm the results from Stages 1-3 of the LCA checklist with Council to assess the final Sensitivity Rating for the site to confirm LCA requirements for system selection and design. Provide a Site Plan showing the available effluent management area(s) and completed Sensitivity Pro-forma Checklist.	☑
5. Cumulative Impacts	Using the desktop and site assessment information for the site, comment on any possible cumulative detrimental impacts that the development may have on beneficial uses of the surrounding land, surface water and groundwater.	☑
6. System Selection and Design	Design maximum wastewater load (generation rates) and organic load for the proposed development.	☑
	Description of existing system (if applicable).	☑
	Target effluent treatment quality.	☑
	Assess the capacity of the land to assimilate the treated wastewater based on the data collected and the total dissolved salts (TDS) in the potable water supply (see Section 2.3.4 and Appendix G of EPA Code of Practice (2013)) for both levels of effluent quality, primary and secondary.	☑
	Description and location of applicable DWM treatment system options (refer to the EPA website for list of currently approved systems).	☑
	List of effluent land application options and detailed description of preferred option and location.	☑
	Monthly water balance sizing the preferred effluent land application area. 70 th percentile climate data must be used for your location within the relevant Climate Zone, as detailed in Section 6.2.2 of Technical Document. A copy of the 70 th percentile climate data is attached in Appendix C of the Technical Document. All inputs, results and justification to be shown in the report.	☑
7. Mitigation Measures	<p>Detailed discussion of mitigation measures to overcome any site or soil constraints posed to the sustainable treatment and application of wastewater on-site. This may include the following:</p> <ul style="list-style-type: none"> • Storm water management • Soil amelioration; and • Vegetation establishment and management. 	☑
8. Site	Description of ways to improve wastewater and DWM system performance for residents' reference.	☑

Report Element	Detailed Requirements	Completed
Management Plan	Operation and Management Plan.	<input checked="" type="checkbox"/>
9. Conclusion	Conclusion summarising all the important design, sizing and mitigation requirements to ensure sustainable on-site DWM.	<input checked="" type="checkbox"/>
10. Site Plan Requirements	Site address, including property/parcel number and street number.	<input checked="" type="checkbox"/>
	All title boundaries.	<input checked="" type="checkbox"/>
	All relevant zones and overlays and/or restrictions (e.g. Council zoning and overlays, including Environmental Significant Overlays and DWSCs).	<input checked="" type="checkbox"/>
	Type of catchment (i.e. potable or other special water supply catchment).	<input checked="" type="checkbox"/>
	North arrow.	<input checked="" type="checkbox"/>
	Location of groundwater bores.	<input checked="" type="checkbox"/>
	Contour lines (at maximum of 2m intervals), direction of slope and grade.	<input checked="" type="checkbox"/>
	Location of soil test pits or auger holes.	<input checked="" type="checkbox"/>
	Location of any significant site features e.g. rock outcrops or waterlogged regions.	<input checked="" type="checkbox"/>
	Location of intermittent and permanent surface waterways (dams, creeks, reservoirs and springs).	<input checked="" type="checkbox"/>
	Location of 1% and 5% Annual Exceedance Probability flood level contours lines (if applicable).	<input checked="" type="checkbox"/>
	Location, depth and specified use of groundwater bores on the site and adjacent properties from the register of the relevant Rural Water Corporation. Depth to groundwater table in winter (if less than 2.1m deep).	<input checked="" type="checkbox"/>
	Vegetation cover (can use aerial image as base map).	<input checked="" type="checkbox"/>
	Relevant setback distances as per Table 5 EPA Code of Practice (2013).	<input checked="" type="checkbox"/>
	Location of existing and proposed buildings, sheds, driveways, paths and any other improvements.	<input checked="" type="checkbox"/>
	Available effluent management area(s).	<input checked="" type="checkbox"/>
	Location of proposed land application area (sized to scale).	<input checked="" type="checkbox"/>
	Location of proposed stormwater cut-off drains adjacent to the land application area.	<input checked="" type="checkbox"/>
	Location of proposed DWM system (nominal).	<input checked="" type="checkbox"/>
	Location of reserve land application area (sized to scale).	<input checked="" type="checkbox"/>
11. Appendices	Copy of the monthly water balance calculations.	<input checked="" type="checkbox"/>
	Figures.	<input checked="" type="checkbox"/>
	Site Plan.	<input checked="" type="checkbox"/>
	Soil bore logs for all test pits or auger holes.	<input checked="" type="checkbox"/>
	Certificate of Title (s) for property/parcel (plan).	<input checked="" type="checkbox"/>
	Proposed building plans.	<input checked="" type="checkbox"/>
	Planning Permit application (where applicable).	<input checked="" type="checkbox"/>
	Septic Tank Permit application.	<input checked="" type="checkbox"/>

LAND CAPABILITY ASSESSMENT ADDENDUM

TESTING PROGRAMME & REPORT

1. Report has been prepared by qualified persons and based on current available standards.
2. Recommendations are based on the assumption that limited test positions are representative of the sub-surface profile.
3. Whilst care has been taken to accurately report on the sub-surface conditions across the site it is not possible to anticipate unexpected sub-surface variations given the limited testing performed.
4. Changes in legislative policy may require report update or additional testing.

The purpose of this report is to determine the capability of the site to contain effluent with regard to the soil and land constraints. It is beyond the scope of this report to provide specific effluent system design. Where any variation or anomalies are encountered, we recommend additional investigation and reporting by us to resolve any potential issues.

EFFLUENT DISPOSAL CARE & MAINTENANCE

We recommend the following to assist in long term system serviceability and safe on site disposal:

1. Restrict germicides such as strong detergents, disinfectants, toilet clears with high acid content, nappy sanitisers, bleaches etc. that are likely to kill bacteria and affect the operation of the septic system.
2. Only use detergents with low alkaline salts and chlorine.
3. Sanitary napkins or disposable nappies must not be flushed into the system.
4. Limit the amount of fat and oils into the system.
5. Use sink strainer to limit the food that enters the system.
6. Do not use garbage disposal units.
7. Where odours occur, we recommend flushing approximately one cup of lime each day.
8. To reduce odours, we recommend filling the tank with water after installation or after desludging.
9. Grease trap should be checked for blockages and pumped every 6-12 months.
10. Inspect the system once a year by a qualified plumber or drainer.
11. Tank should be pumped concurrently every three years.

VEGETATION FOR TRANSPIRATION

Good vegetative cover is important to achieve effective transpiration of effluent disposal. It is therefore recommended to establish and maintain good grass cover over distribution areas and suitable shrubs or trees between distribution lines. Where trees are planted near drainage line, difficulties with root invasion can be anticipated. We do not recommend planting crops in disposal area.

The following list includes some suitable water tolerant plants:

Botanical Names	Common Names
Phragmites australis	
Canna x generakis	Canna Lily, Calla Lily, Ginger Lily
Acacia Howittii	Sticky Wattle
Callistemon citrinus	Crimson Bottlebrush
Callistemon macropunctatus	Scarlet Bottlebrush
Leptospermum lanigerum	Wooley Tea-Tree
Melaleuca decussate	Cross Honey Myrtle
Melaleuca ericifolia	Swamp Paperbark
Melaleuca halmaturorum	Salt paperbark
Tamarix juniperina	Flowering Tamarisk
Eleocharis acuta	Cannas
	Common Spike-Rush
	Buffalo / kikuyu
	Geranium
	Hydrangeas
	Tall wheat grass
	Strawberry Clover, White Clover
	Perennial Rye
	Bougainvillea

GENERAL COMMENTS

St Quentin Consulting does not accept responsibility for our report where it has been altered or not reproduced in full, including addendum.

Dimensions, slope, test locations are approximate only and must not be used for calculation of positioning.

Recommendations are based on information regarding the site and development type provided by the client or agent. If information supplied is not accurate or if significant changes are required our report may be inappropriate. We cannot accept responsibility for significant changes and anticipate additional fees should further tests or report update be required.

Offset distance to septic tanks or any subsurface excavations must not exceed the minimum angle of repose for the in-situ naturally occurring soil. We estimate the maximum angle of repose for sand is 30 and 45 for clay soils. We do not recommend steeper angles unless competent rock is encountered.

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GEOTECHNICAL ASSESSMENT OF LANDSLIDE RISK

9 Cara Court, Kennett River

November 2017

**Prepared for:
Nicholas Thompson**

**Report Date:
15055G-LRA**

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APPENDICES

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Site cross section Appendix B

Borelogs Appendix C

Site photographs..... Appendix D

Geotechnical Declaration: Form A Appendix E

AGS "Geoguides" Good and Poor Hillside Practice Appendix F

AGS Terminology in assessing risk..... Appendix G

Report Addendum Attachment



EXECUTIVE SUMMARY

Our geotechnical landslide risk assessment has found there are possible landslide events, common to many sites in the Otway region, which could conceivably present risks to life and property. However, subject to our recommendations and assessment of the risks, we conclude that there are no geotechnical reasons to prevent the issue of a permit to build the proposed residence on this site.

Following our landslide risk assessment for the proposed residence and at the nominated location on this site, we have judged the qualitative risk of property damage is "low to moderate" and the quantitative risk of injury is "tolerable" or less than 1×10^{-5} (existing slopes) by the AGS Guidelines in accordance with guidelines published by the Australian Geomechanics Society (AGS) journal Volume 42 No 1 of March 2007, entitled "Landslide Risk Management". AGS guidelines recommend that the "risk of loss of life" is calculated quantitatively to ensure that the value obtained does not exceed the value of "tolerable risk". Tolerable risk is defined as "the risk that society can live with" and has been denoted a value of 10^{-4} per annum (or a chance of 1 in 10,000) for an existing natural slope or 10^{-5} per annum (or a chance of 1 in 100,000) for an existing landslide. For the purposes of the assessment we have taken a conservative approach and defined the site as a landslide area.

We recommend footings penetrate into competent rock, with a minimum embedment depth about 0.5m, or 0.8-2.0m below the existing surface level. We also recommend retaining walls for effluent disposal be embedded at a sufficient depth (at least 1m below existing surface level) to reduce erosion/landslide risk. We recommend site excavations be kept to a minimum where possible and any unsupported cuts or fills supported with engineer designed retaining structures.

1.0 INTRODUCTION

Landslides, erosion and other forms of earth / rock movements are common throughout the Otway Ranges and are a continual natural process of geomorphological shaping of the land.

Developments of sites in geologically active areas are potentially at risk of damage from natural soil or rock movements. Under certain conditions serious building damage, personal injury or even death may result from landslides.

Whilst the risks due to soil movement can usually be identified and steps often be taken to mitigate or reduce the risks to tolerable levels, it is not feasible to eliminate the risks of damage or possible personal injury entirely through erosion or landslide risk.

2.0 SCOPE OF REPORT

St. Quentin Consulting was commissioned by the client to provide a Landslide Risk Assessment on the property to meet the requirements of the Colac Otway Shire EMO Schedule 1.

The principles used in assessing the landslide risk follow the guidelines published in the Australian Geomechanics Society (AGS) journal Volume 42 No 1 of March 2007, entitled "Landslide Risk Management".

The purpose of the assessment is to identify possible landslide hazards on the subject site near the proposed development location and to provide guidance and options for possible risk mitigation.

3.0 DEVELOPMENT DESCRIPTION

The proposed development is the construction of proposed residential development. Supplied site plan indicates that the development will be positioned midway down the slope of the site. We understand timber clad construction is proposed. Plans and elevations prepared by the client are considered to be an accurate representation of the proposed works (refer Geotechnical Declaration for drawing references). If the proposed development changes our recommendations may be invalid.



4.0 TESTING PROGRAM AND FINDINGS

4.1 Data gathering – desk top studies and previous investigations

There have been many of private and published landslide risk assessment reports conducted in the Otway Ranges (refer references). These reports suggest that landslide hazards are evident in particular areas and that inappropriate development can result in and contribute to slope failure. In preparation of our field investigation of the site, preliminary data was gathered from the following sources:

- Colac Otway Shire – landslide details and website information: inventory of known major landslides within the Shire developed by A.S. Miner Geotechnical and Dahlhaus Environmental Geology Pty Ltd.
- Corangamite Catchment Management Authority – 'CCMA' published landslide details, susceptibility mapping, field guide and information on its website.
- Department of Primary Industries – GeoVic website: details on geological features and mapping and the Victorian Resources Online website: information about soil properties.
- Federation University– UB Spatial: digital database of landslide, erosion features.
- Aerial photos and maps published by Nearmap.com & Googlemaps.com.
- Previous investigations and reports by us and other consultants, published and unpublished.
- Plans and elevations prepared by the client.

4.2 Field investigations

4.2.1 Site inspection and mapping

A thorough geomorphological appraisal of the site was conducted, identifying the main features of the site and the surrounding area to identify evidence of slope instability and past slope failures. Slope angles were measured with an inclinometer.

A plan showing the approximate borehole location and plan showing main geomorphic features is presented in Appendix A. A schematic cross section view of the site with a geological hazard model is presented in is presented in Appendix B.

4.2.2 Site description and geomorphology

The subject site is on the west side of Cara Court on a waxing divergent narrow ridgeline sloping to the south east. The overall natural slope of the land is relatively uniform and was measured to be approximately 7-16° (over the development area). We measured a rapid increase in slope toward the south west encroaching into the boundary at a distance of about 6m from the property boundary.

The attached photos (in Appendix D) also show various views of the site including some of the above-mentioned features.

4.2.3 Sub-surface conditions

Five boreholes were drilled to a maximum depth of about 1.5m. Disturbed soil samples were continuously collected logged and hand classified by an experienced geotechnical engineer. A description of the soil types observed in the boreholes is shown in Appendix C.

Our investigation has revealed that the soil profile comprises mainly silty sands and derived from weathering of Cretaceous age sandstone sediments known as the Eumeralla Formation. The composition of the soil layers in and near the proposed house area indicates the soil is "residual" having been formed in-situ. Refer also to the following section for a description of previous nearby movements.

4.2.4 Groundwater conditions

No permanent table was encountered during testing however a "perched water table" often develops after prolonged wet periods in the upper soil layers. Such a perched water table may prove problematic if construction is commenced after wet periods. Deep excavations may collapse without warning after wet periods. More details on drainage are given in Section 8.2.

Perched water table may prove problematic if construction is commenced after wet periods with potential collapse of deep excavations. For this reason, it is important upslope cut-off drains are provided to prevent/reduce transient water flows near the construction and effluent area. More details on drainage are provided in Section 8.2.

4.3 Previous landslide movements

There are several large landslide features in the Kennett River locality, some affecting a large expanse of the Kennett River township. Significant landslide features were identified on Colac-Otway Shire Landslide Inventory Mapping (collated by A.S. Miner Geotechnical and Dahlhaus Environmental Geology Pty Ltd). Moderate to large features were noted by Cooney, 1980, refer Figure 1.

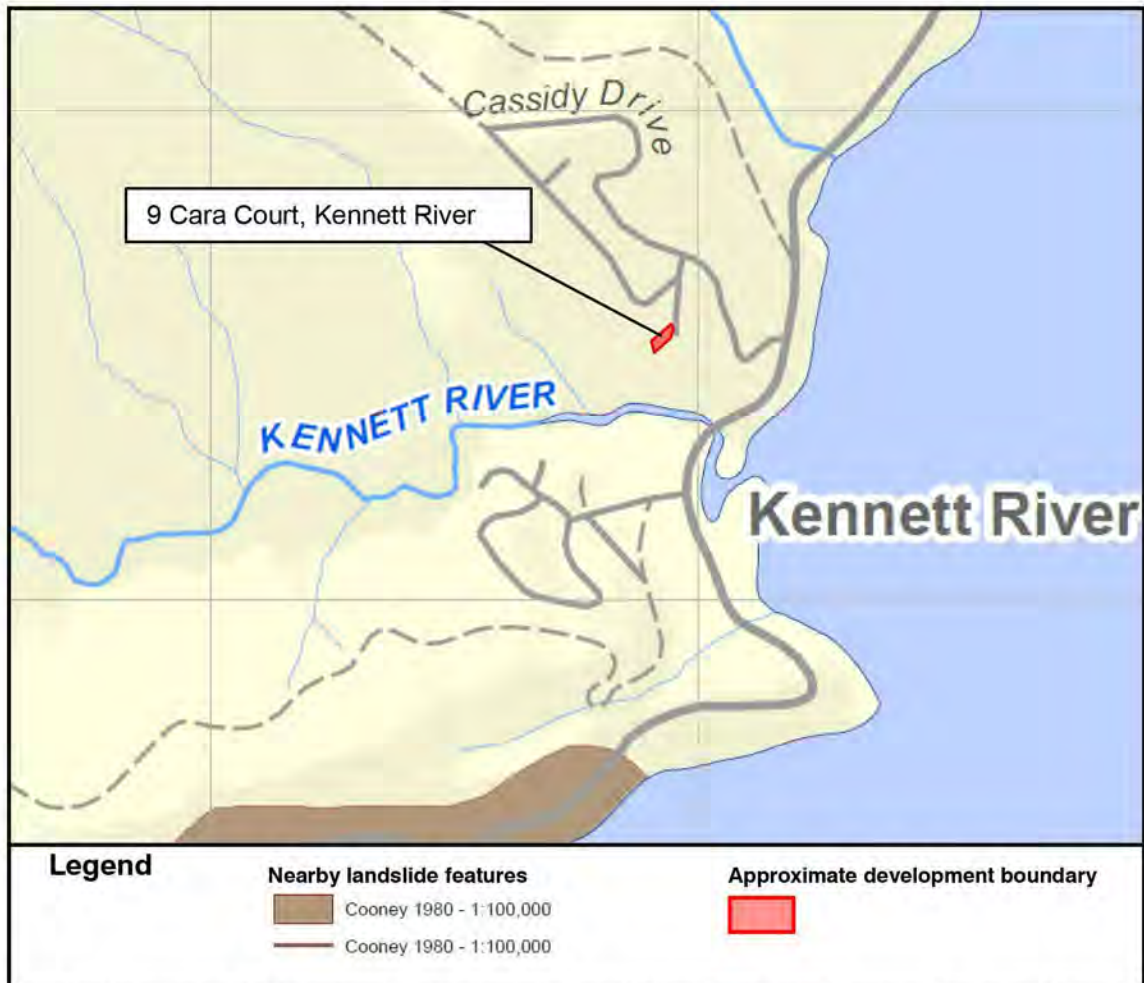


Figure 1: Department of Primary Industries Kennett River Colac-Otway Shire Landslide Inventory Mapping (A.S. Miner Geotechnical and Dahlhaus Environmental Geology Pty Ltd)

4.4 Recent fire activity and increase in landslide risk

Recent fire activity combined with subsequent vegetation removal and very high rainfall has compounded landslide risk close to this site (Wye River, Separation Creek and north east of Kennett River). However, the bushfire activity has not directly impacted this site and hence, there has been no additional landslide risk relating to these issues.

5.0 GEOTECHNICAL STATEMENT REQUIRED BY EMO SCHEDULE 1

In accordance with Colac Otway Shire Planning Scheme, Erosion Management Overlay (EMO) 44.01 we provide the following information.

5.1 Practitioner details

The author of this report is Cameron Farrar, a professional geotechnical engineer with a Bachelor of Engineering and is registered member of the Institute of Engineers and Australian Geomechanics Society. The author has 20 years of experience in geotechnical engineering and management of slope instability issues and landslip risk management.

5.2 Currency

This report is based on field measurements made less than 12 months ago.

5.3 Site description

Refer to section 4.2.2.

5.4 Site assessment plans

Appendix A & B show slope and contour details of the development site area.

5.5 Sub-surface conditions

Borelogs, presented in Appendix C and section 4.2.3 describe the site's subsurface features.

5.6 Natural slope failure

Past failures were identified on and near the site. Refer to section 4.3.

5.7 Site investigations

A site investigation was conducted to examine and sample the soil profile in order to assess the geotechnical/geological model. Details of the soil conditions revealed are included in this report (Appendix C) and are described in item 4.2.3 above.

5.8 Sub-surface investigation

Geological soil and rock samples were recovered from five test locations for examination by a professional geotechnical engineer.

5.9 Landslide risk

The risks for slope instability hazards identified are of a tolerable risk level and will remain so over the design life of the proposed development (as presented in development plans).

5.10 Development suitability

The subject lot is suitable for the proposed development and the proposed development can meet the tolerable risk criteria, as defined in the EMO schedule.

5.11 Special conditions and inspections

In our opinion and subject to our recommendations for engineer designed retaining walls, no other special geotechnical conditions are required for approval of the development and a program of periodic inspections is not required.

6.0 RISK ESTIMATION FOR PROPOSED DEVELOPMENT SITE

We have judged there are four significant and conceivable landslide events that may affect the proposed development site and individuals on the site.

Conceivable landslide events affected the existing dwelling are:

1. **Gradual, down-slope creep of the upper shallow soil layers.** This is a common form of "landslide" throughout the Otway region which involves slow speed creep of the soil layers down the slope. Signs creep incidence are usually noted well before any serious damage or personal injury results and therefore the consequence to life is 'barely credible'. Creep can be visually apparent at surface level as sets of closely spaced terraces, distorted or bent trunks.

Longer term creep develops into convex landforms on a broader scale. Presence of colluvium can also suggest evidence of soil creep as the soils mitigate downslope.

2. **Small size rotational failure in proposed effluent area.** In adverse conditions (such as after prolonged wet periods or effluent system failure) rotational failures may occur on the hillside, particularly in steeper areas at the rear of the site where site fill platforms are proposed. In adverse conditions (such as after prolonged wet periods or earthquakes) small size (20-200m³) rotational or translational slope failures may occur on the hillside, particularly where site cuts / fills have occurred. We have judged that small failures would not be likely in building envelope given the low slope angle, however consider that small failures could conceivably occur at the front of the site (east) and impact the proposed effluent disposal area. Note there are a number of foreseeable locations where small failures at the front of the site however we have judged each will have identical qualitative risk due to the element at risk (effluent disposal field).
3. **Medium size rotational or translational failures.** Similarly, medium size (200-2,000m³) rotational or translational slope failures in adverse conditions (such as after prolonged wet periods or earthquakes) rotational or translational slope failures may occur on the hillside, particularly where site cuts / fills have occurred. Again, we would consider that medium failures would not be likely in building envelope given the low slope angle, however consider that medium size failures could conceivably occur at the rear of the site (west) and impact the rear of the building however we would consider the set-back distance from the steeper slopes at the rear sufficient to spatially expose the property to medium size failures.
4. **Large translational failures.** Large size (2,000-20,000m³) slope failures have occurred in steeply sloping areas in nearby areas however are generally rare. Such failures probably occur along deep fault lines or weaknesses in the underlying rock layers or poorly drained regions and can be triggered predominately by exceptional rainfall periods. Given the site slope, the upper slope and the absence of reported large ancient landslide activity near the site we have judged similar large failures will be 'rare' however have been included in our analysis.

6.1 Estimation of qualitative risk of damage to property

Based on our measurements and observations and using the procedure and terminology from the AGS Guidelines (2007), we have assessed the "level of risk to property" for the proposed development site as "moderate".

For each of the events described, the risk to property can be summarised as follows:

Possible landslide event	Likelihood of event occurring	Consequence of event occurring	Risk to property
1. Creep of the natural soil slope (hazard posed to building)	Likely	Insignificant	Low
2. Failure of lower slope in proposed effluent area bank (hazard posed to effluent field)	Possible	Minor	Low
3. Medium rotational failure at rear of building (hazard posed to building)	Possible	Minor	Moderate
4. Large translational failure at rear of building (hazard posed to building)	Rare	Medium	Low

For an explanation of these qualitative terms and an example of a risk analysis matrix, refer to Appendix H (reproduced from the AGS 2007 Guidelines "Terminology in assessing risk").

6.2 Estimation of quantitative risk of loss of life

AGS guidelines recommend that the "risk of loss of life" is calculated quantitatively to ensure that the value obtained does not exceed the value of "tolerable risk". Tolerable risk is defined as "the risk that society can live with" and has been denoted a value of 10⁻⁴ per annum (or a chance of 1 in 10,000) for an existing natural slope or 10⁻⁵ per annum (or a chance of 1 in 100,000) for an existing landslide.

The qualitative risk of loss of life is calculated using the following formula:

$$R = P_{(H)} \times P_{(S:H)} \times P_{(T:S)} \times V_{(D:T)}$$

Where

- R is the risk (the annual probability of loss of life)
- $P_{(H)}$ is the annual probability of the hazardous event (the landslide)
- $P_{(S:H)}$ is the probability of spatial impact by the hazard, given the event
- $P_{(T:S)}$ is the temporal probability, given the spatial impact
- $V_{(D:T)}$ is the vulnerability of the individual

For each of the conceivable events that may occur on this site as described above, the risk to life is calculated using the above-mentioned formula as follows:

Possible event	$P_{(H)}$	$P_{(S:H)}$	$P_{(T:S)}$	$V_{(D:T)}$	R
1. Creep of the natural soil slope (hazard to resident in dwelling)	10^{-2}	1	1.7×10^{-1}	0	0
2. Small size failure in residual soil layer in effluent area (hazard to pedestrian)	10^{-3}	0.05	1.7×10^{-2}	1.0	8.5×10^{-7}
3. Medium rotational failure above the building envelope (hazard posed to residents in dwelling)	10^{-3}	0.5	8.5×10^{-2}	0.05	2.1×10^{-6}
4. Large translational failure along weathered rock/clay interface at rear of site (hazard posed to building)	10^{-6}	0.5	$\frac{0.17}{1.7 \times 10^{-1}}$	1.0	8.7×10^{-7}

6.3 Explanation of qualitative risk to life calculations

The values presented in the above table are multiplied to achieve the estimated risk to life shown "R" in the table. Note that these calculations refer to an individual inside the building; the risks to a person outside have not been considered.

$P_{(H)}$ and $P_{(S:H)}$ are derived from direct reading or estimation from Appendix C of the AGS 2007 Guidelines, a copy of this attached in Appendix H.

$P_{(T:S)}$ is calculated as follows:

annual occupancy of the residence: 10/12 months
 daily occupancy of the residence: 20/24 hours
 part of the residence affected by the event: 1 (or 0.5 for half the house)
 location of individual in the part of the residence: $\frac{1}{4}$

Where a pedestrian is affected by the event, the calculation for $P_{(T:S)}$ is:

$$P_{(T:S)} = 10/12 \times 0.5/24 \times 1 \times 1 = 0.017 \text{ or } 1.7 \times 10^{-2}$$

Where the whole building is affected by the event, the calculation for $P_{(T:S)}$ is:

$$P_{(T:S)} = 10/12 \times 20/24 \times 1 \times 1/4 = 0.17 \text{ or } 1.7 \times 10^{-1}$$

Where half of the building is affected by the event, the calculation for $P_{(T:S)}$ is:

$$P_{(T:S)} = 10/12 \times 20/24 \times 1/2 \times 1/4 = 0.085 \text{ or } 8.5 \times 10^{-2}$$

$V_{(D:T)}$ (the vulnerability of the individual) is derived from data collected from studies of landslide events in Hong Kong, for a person in a building. The relevant part of the study is reproduced below:

Case	Range in Data	Recommended Value	Comments
If building collapses	0.9 - 1.0	1.0	Death is almost certain
If building is filled with debris and person buried	0.8 – 1.0	1.0	Death is highly likely
If debris strikes building only	0 – 0.1	0.05 (5×10^{-2})	Very high chance of survival

- A value of 0 has been adopted for soil creep events.
- A value of 0.05 has been adopted for small failure events
- A value of 0.5 has been adopted for medium scale failure event affecting residents in residence
- A value of 1.0 has been adopted for the large-scale event (likely complete re-construction and re-siting would be required in the event of building damage associated with large landslide events).

7.0 SUMMARY OF RISKS AND CONCLUSION

Our assessment has identified possible risks of loss of life and damage to property on the site, due to conceivable landslide events. We have determined the risks associated with building on the proposed site are "low" in quantitative terms. However, subject to our recommendations and mitigation measures, including engineer designed and importantly appropriately constructed footings, retaining structures and drainage systems, the risk to life is below the recommended "tolerable risk" limit defined as 1×10^{-4} (natural slopes) and 1×10^{-5} (landslide areas) by the AGS Guidelines. We have judged, subject to appropriate design and careful management strategies, it is possible to reduce or maintain the likelihood and consequences of major risk events.

Based on our assessments of the risks, we conclude that there are no geotechnical reasons to prevent the issue of a permit to build the proposed residence on this site, dependent on our recommendations and management plan.

8.0 RECOMMENDATIONS and RISK MANAGEMENT PLAN

It is not feasible to remove all of the risks of building on the site but the risks can be reduced by appropriate engineering design, good hillside construction practices and by regular and frequent site maintenance.

Additional advice on risk reduction is included in "General Recommendations" Section of our report and in the attached Appendices and Report Addendum. We recommend particular attention be paid to the attached AGS "Geoguides" that are presented in Appendix F.

8.1 Site recommendations

We have no geotechnical objections to the construction of an appropriately designed development. The proposed development is considered appropriate for the site.

Note that an increase in landslide risk can be expected if an inappropriate development is undertaken or if site maintenance is neglected. Maintaining the site drainage and monitoring the site and buildings for any evidence of soil or slope movement are very important aspects of the ongoing site maintenance requirements.

8.2 Drainage management

Careful attention to drainage is essential to reduce the landslide risk and surface water must therefore be prevented from ponding anywhere on or near the site.

Past research has identified rainfall and/or poor site drainage as a common trigger of landslide events (et al. Wood 1982, Cooney 1980). Whilst rainfall intensity cannot be controlled, careful site drainage management and design can reduce saturation of the soil layers associated with soil movement.

Care must also be taken to ensure that all levelled areas (vehicle parking bays, recreation areas etc.) have a slight fall ($\geq 2^\circ$) to prevent surface water from ponding or seeping into the ground and diverted away from the buildings.

Drains must be positioned and constructed with sufficient fall to discharge completely to prevent water from accumulating in the soil anywhere near the buildings and connected to the legal point of discharge. Any blockages must be cleared and repaired promptly.

8.3 Household effluent disposal

Household effluent must be widely dispersed by irrigation laterally and well away from the house area to minimise the likelihood of wastewater being concentrated in the soil profile. Refer to separate land capability assessment report (ref: **15055G-LCA**).

8.4 Site vegetation

We expect the removal of trees may be necessary to accommodate the proposed development. Where large tree removal is required, they should be cut off at ground level with the root structures left intact.

Suitable vegetation significantly improves the stability of a site by reducing the soil moisture content, minimising soil erosion and binding the soil structure together. Large trees should be retained wherever possible.

8.5 Site excavations and fill batters

All site excavations and unsupported filled zones deeper than 1.0m must be retained by engineer-designed retaining walls, founded into naturally occurring rock with appropriate drainage features or be constructed with a flat batter angle $\sim 30^\circ$.

Cut areas must have a slight fall ($\geq 2^\circ$) away from cut interface to prevent surface water from ponding or seeping into the near the base of any site cut.

The construction of appropriately designed walls or battered slopes will reduce the risk of soil movement and the collapse of any proposed site excavations.

8.6 Site classification

Australian Standard AS2870-2011 provides the following system of site classification for residential footing designs:

Site Classification	Foundation Type
A	Most sand and rock sites with negligible ground movement from moisture change
S	Slightly reactive clay sites subject to slight ground movement from moisture change
M	Moderately reactive clay sites subject to moderate ground movement from moisture change
H1/H2	Highly reactive
E	Extremely reactive
P	Sites with environmental factors that may affect the performance of the building including trees, deep fill, recently removed building, abnormal moisture conditions, soft soils, landslide risk or erosion.

NOTE 1: AS2870-2011 recommends a site inspection during excavation to confirm the soil profile.

NOTE 2: The above classification is made assuming that the site will not change significantly before construction of the proposed building. Site cuts greater than 500mm or the placement of addition uncontrolled fill is considered a significant change and the site may need to be re-classified.

We have classified the soil profile as "P" in accordance with Section 2 of AS2870-2011 (Australian Standard on Residential Slabs and Footings), due to the potential landslide risk and existing trees.

8.7 Pad footings

We recommend engineer-designed footings designed according to the principles of AS 2870-2011 Section 4 and constructed in accordance with Sections 5 & 6.

Our testing indicates that "weathered rock" generally starts about 0.3-1.5m below surface and in our experience "competent rock" can be expected about 0.5m below this level, that is we expect that a suitable founding depth for footings will be approximately 0.8-2.0m below current surface level in the vicinity of the development area. An allowable bearing capacity of 350kPa may be assumed for competent rock.

The above quoted depth to competent rock is estimated from the test results and our previous experience however the depth to rock quality can vary significantly over short distances. The depth is measured from surface level at the time of testing and will vary if the site is cut and/or filled.

Having all footings appropriately designed and founded will reduce the risk of damage due to soil movement or slope failures.

8.8 General recommendations

The satisfactory performance of buildings on this site depends on good engineering and building practice. This includes:

- a) Design of an appropriate development for the site;
- b) Use of flexible construction materials whenever possible which are "movement tolerant" (eg. clad frame is preferable to brick and articulated brick or stone walls are preferable to non-articulated);
- c) Minimisation of site excavations wherever possible and the provision of adequate retaining structures and drainage for cut faces (or batter at an appropriate angle);
- d) A re-vegetation program including planting suitable trees and shrubs (preferably indigenous) at an appropriate distance from the buildings to help support the soil and minimise erosion;
- e) Appropriate site drainage to ensure surface water, excess roof water and household effluent does not pond or seep into the ground near building envelope;
- f) Diversion on uncontained water around the building envelope area and be widely dispersed laterally well below the house site;
- g) regular maintenance by the owner, including clearing of surface drains, sub-surface drains, repair of leaking plumbing, monitoring the site and buildings for any evidence of soil or slope movement and seeking immediate advice should any building distress become apparent.

Refer also to the attached Appendices for more general advice.

ST QUENTIN CONSULTING



Cameron Farrar
Geotechnical Engineer, MIE Aust (Reg No 4367740)

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Appendix A

Site geomorphological plan and borehole location

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Borehole Locations



Legend:

- Borehole locations
- Development site
- Site slope
- Proposed disposal area
- Proposed dev. area
- Site cut-top
- Site cut-bottom

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 Surveyors • Town Planners • Engineers
 51 LITTLE FYANS STREET,
 P.O. BOX 919, GEELONG 3220
 TELEPHONE (03) 5201 1811 FAX (03) 5229 2909

Geomorphological plan

Location: 9 Cara Court,
 Kennett River

Source: Google

Project No: 15055G

Inv. date: 4.07.17

Drawing No: 1

Scale: NOT TO SCALE

Drawn by: C.F.

Date: 20.11.17

Approved by: C.F.

Date: 20.11.17



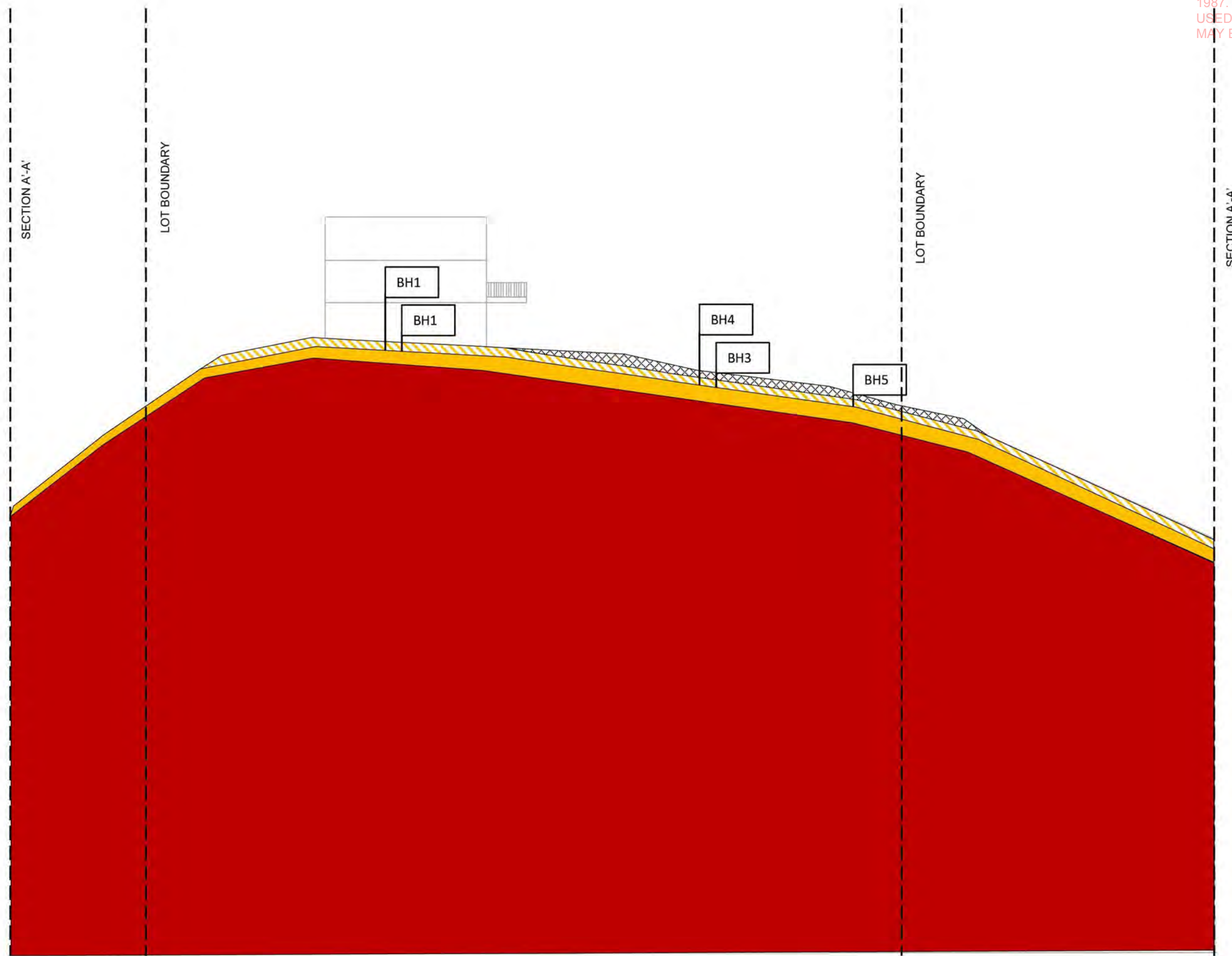
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Appendix B

Site cross section (geological)

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PROJECT NO: 15056G
DATE: 24/11/17

9 CARA COURT
KENNETT RIVER

ST. QUENTIN
Surveyors - Town Planners - Engineers
31 LITTLE FRANK STREET,
P.O. BOX 919, OCELONG B220
TELEPHONE (04) 9201 1971 FAX (04) 9239 2909

COLLUVIUM
FILL
RESIDUAL SOIL

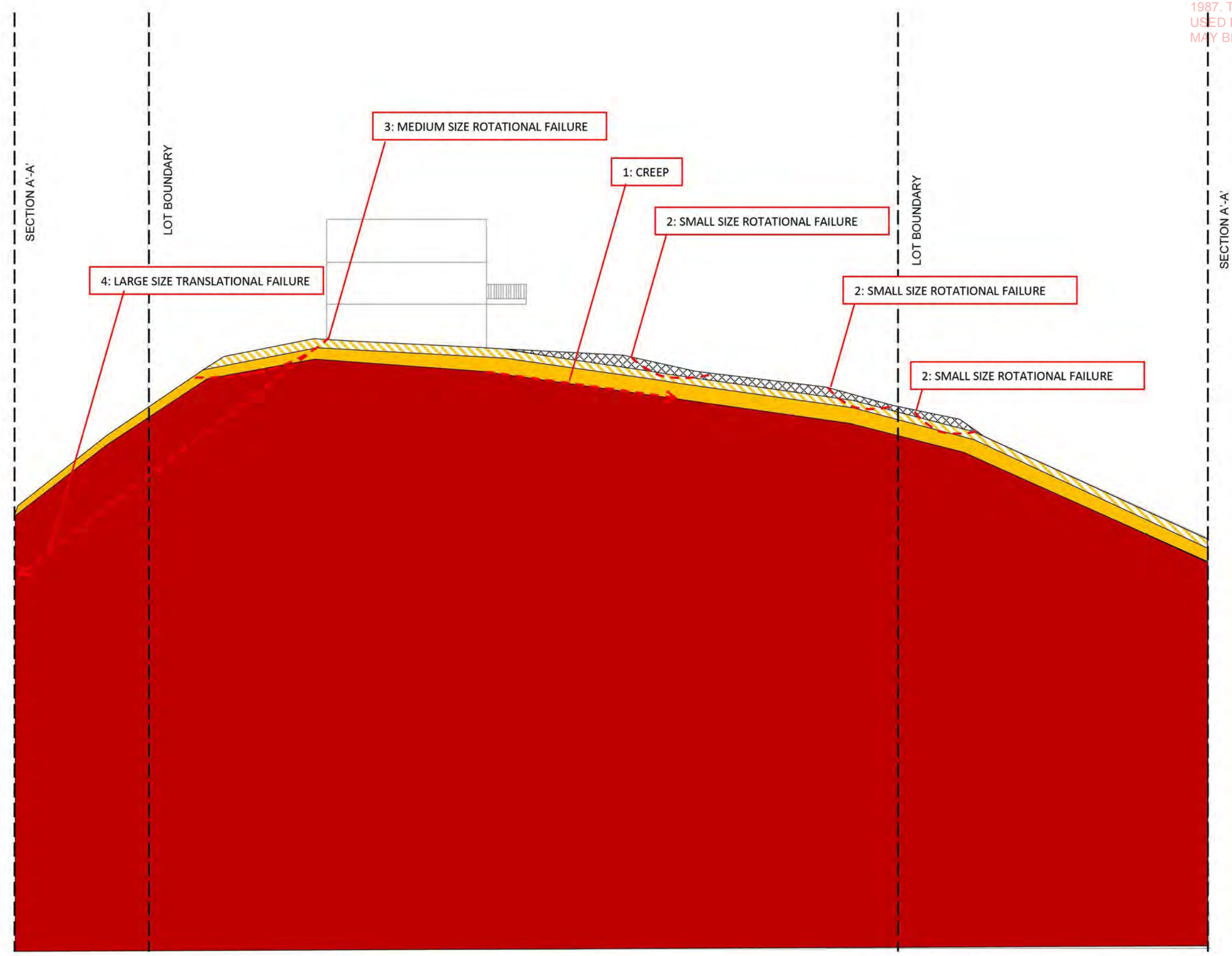
HIGHLY WEATHERED ROCK
OXIDE-RICH ROCK
LOCAL BEDDING ANGLE



DRAWN BY: A.V.
APPROVED BY: C.F.

CROSS SECTION A-A'
GEOMORPHOLOGICAL MODEL

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PROJECT NO: 15056G
 DATE: 24/11/17
 DRAWN BY: A.V
 APPROVED BY: C.F

9 CARA COURT
 KENNETT RIVER
 CROSS SECTION A-A'
 FAILURE MODES

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- COLLUVIUM
- FILL
- RESIDUAL SOIL
- HIGHLY WEATHERED ROCK
- COMPETENT ROCK
- LOCAL BEDDING ANGLE



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Appendix C

Borelogs

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BOREHOLE LOG

Client: Nicholas Thompson
Location: 9 Cara Court,
 Kennett River


Project No.: 15055G
Borehole No: BH 1
Inv. Date: 4.07.17

Sheet: 1 of 1
Logged by: C.F.
Checked by: C.F.

Depth (metres)	Graphic Log	Material Description Type, Plasticity, Colour, Particle characteristics	Soil Texture	Structure	Moisture	Consistency / Density	Sample / Test	Test Results	Geology and additional observations
0.2		Silty CLAY (Medium Clay) Mottled brown and red Massive structure Firm, dry	MC	Ma	D	F			
0.30		Borehole 1 terminated at 0.3m Refusal on extremely weathered sandstone							
0.4									
0.6									
0.8									
1.0									
1.2									
1.4									
1.6									
1.8									
2.0									
2.2									

moisture: D Dry SM Slightly Moist M Moist W Wet Sat Saturated	Sample / Test PP Pocket Penetrometer (kPa) V Picon Shear Vane (kPa) DCP Dynamic Cone Penetrometer Test N Standard Penetration Test DS Disturbed Sample	Consistency/density: VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense	Structure Ma Massive SG Single grained We Weak Mo Moderate Str Strong	Method:  Hand Auger  Auger Drilling  Roller/Tricone  Washbore  Non Destructive Digging
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<h1>BOREHOLE LOG</h1>	 ST. QUENTIN Surveyors Town Planners Engineers
-----------------------	---

Client: Nicholas Thompson	Project No.: 15055G
Location: 9 Cara Court, Kennett River	Borehole No: BH 2
	Inv. Date: 4.07.17
	Sheet: 1 of 1
	Logged by: C.F.
	Checked by: C.F.

Depth (metres)	Graphic Log	Material Description <small>Type, Plasticity, Colour, Particle characteristics</small>	Soil Texture	Structure	Moisture	Consistency / Density	Sample / Test	Test Results	Geology and additional observations
0.2		Sandy Clayey Silt (Sandy Loam) Mottled brown and red Massive structure Firm, dry Grass cover	SL	We	M	D			
0.30									
0.4		Silty CLAY (Light Clay) Mottled brown and red Massive structure Firm to stiff, low to medium plasticity, moist	MC	Ma	D	F			
0.6									
0.8									
0.80		Borehole 2 terminated at 0.8m Refusal on extremely weathered sandstone							
1.0									
1.2									
1.4									
1.6									
1.8									
2.0									
2.2									

moisture:	Sample / Test	Consistency/density:	Structure	Method:
D Dry	PP Pocket Penetrometer (kPa)	VS very soft	Ma Massive	<input checked="" type="checkbox"/> Hand Auger
SM Slightly Moist	V Picon Shear Vane (kPa)	S soft	SG Single grained	<input type="checkbox"/> Auger Drilling
M Moist	DCP Dynamic Cone Penetrometer Test	F firm	We Weak	<input type="checkbox"/> Roller/Tricone
W Wet	N Standard Penetration Test	St stiff	Mo Moderate	<input type="checkbox"/> Washbore
Sat Saturated	DS Disturbed Sample	VSt very stiff	Str Strong	<input type="checkbox"/> Non Destructive Digging
		H hard		
		VD very dense		

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<h1>BOREHOLE LOG</h1>	 ST. QUENTIN Surveyors Town Planners Engineers
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Client: Nicholas Thompson Location: 9 Cara Court, Kennett River	Project No.: 15055G Borehole No: BH 3 Inv. Date: 4.07.17	Sheet: 1 of 1 Logged by: C.F. Checked by: C.F.
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Depth (metres)	Graphic Log	Material Description <small>Type, Plasticity, Colour, Particle characteristics</small>	Soil Texture	Structure	Moisture	Consistency / Density	Sample / Test	Test Results	Geology and additional observations
0.2		Sandy Clayey Silt (Sandy Loam) Mottled brown and red Massive structure Firm, dry Grass cover	SL	We	M	D			
0.30									
0.4		Silty CLAY (Light Clay) Mottled brown and red Massive structure Firm to stiff, low to medium plasticity, moist	MC	Ma	D	F			
0.6									
0.8									
1.0									
1.00									
1.2		Borehole 3 terminated at 1m Refusal on extremely weathered sandstone							
1.4									
1.6									
1.8									
2.0									
2.2									

moisture: D Dry SM Slightly Moist M Moist W Wet Sat Saturated	Sample / Test PP Pocket Penetrometer (kPa) V Picon Shear Vane (kPa) DCP Dynamic Cone Penetrometer Test N Standard Penetration Test DS Disturbed Sample	Consistency/density: VS very soft Fb friable S soft VL very loose F firm L loose St stiff MD medium dense VSt very stiff D dense H hard VD very dense	Structure Ma Massive SG Single grained We Weak Mo Moderate Str Strong	Method: <input checked="" type="checkbox"/> Hand Auger <input type="checkbox"/> Auger Drilling <input type="checkbox"/> Roller/Tricone <input type="checkbox"/> Washbore <input type="checkbox"/> Non Destructive Digging
---	--	--	---	---

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BOREHOLE LOG



Client: Nicholas Thompson
Location: 9 Cara Court,
 Kennett River

Project No.: 15055G
Borehole No: BH 4
Inv. Date: 4.07.17

Sheet: 1 of 1
Logged by: C.F.
Checked by: C.F.

Depth (metres)	Graphic Log	Material Description <small>Type, Plasticity, Colour, Particle characteristics</small>	Soil Texture	Structure	Moisture	Consistency / Density	Sample / Test	Test Results	Geology and additional observations
0.2		FILL:Sandy Clayey Silt (Sandy Loam) Mottled brown and red Massive structure Poorly compacted Grass cover	SL	We	M	D			
0.50		Sandy Clayey Silt (Sandy Loam) Mottled brown and red Massive structure Firm, dry	SL	We	M	D			
1.00		Silty CLAY (Light Clay) Mottled brown and red Massive structure Firm to stiff, moist	MC	Ma	D	F			
1.50	Borehole 4 terminated at 1.5m Refusal on extremely weathered sandstone								
1.6									
1.8									
2.0									
2.2									
moisture:		Sample / Test		Consistency/density:		Structure		Method:	
D	Dry	PP	Pocket Penetrometer (kPa)	VS	very soft	Fb	friable	Ma	Massive
SM	Slightly Moist	V	Pilcon Shear Vane (kPa)	S	soft	VL	very loose	SG	Single grained
M	Moist	DCP	Dynamic Cone Penetrometer Test	F	firm	L	loose	We	Weak
W	Wet	N	Standard Penetration Test	St	stiff	MD	medium dense	Mo	Moderate
Sat	Saturated	DS	Disturbed Sample	VSt	very stiff	D	dense	Str	Strong
				H	hard	VD	very dense		
								<input checked="" type="checkbox"/>	Hand Auger
								<input type="checkbox"/>	Auger Drilling
								<input type="checkbox"/>	Roller/Tricone
								<input type="checkbox"/>	Washbore
								<input type="checkbox"/>	Non Destructive Digging

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BOREHOLE LOG



Client: Nicholas Thompson
Location: 9 Cara Court,
 Kennett River

Project No.: 15055G
Borehole No: BH 5
Inv. Date: 4.07.17

Sheet: 1 of 1
Logged by: C.F.
Checked by: C.F.

Depth (metres)	Graphic Log	Material Description <small>Type, Plasticity, Colour, Particle characteristics</small>	Soil Texture	Structure	Moisture	Consistency / Density	Sample / Test	Test Results	Geology and additional observations
0.2		FILL:Sandy Clayey Silt (Sandy Loam) Mottled brown and red Massive structure Poorly compacted	SL	We	M	D			
0.4		Sandy Clayey Silt (Sandy Loam) Mottled brown and red Massive structure Firm, dry	SL	We	M	D			
1.0		Silty CLAY (Light Clay) Mottled brown and red Massive structure Firm to stiff, moist	MC	Ma	D	F			
1.30	Borehole 5 terminated at 1.3m Refusal on extremely weathered sandstone								

moisture: D Dry SM Slightly Moist M Moist W Wet Sat Saturated	Sample / Test PP Pocket Penetrometer (kPa) V Pilcon Shear Vane (kPa) DCP Dynamic Cone Penetrometer Test N Standard Penetration Test DS Disturbed Sample	Consistency/density: VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense	Structure Ma Massive SG Single grained We Weak Mo Moderate Str Strong	Method: <input checked="" type="checkbox"/> Hand Auger <input type="checkbox"/> Auger Drilling <input type="checkbox"/> Roller/Tricone <input type="checkbox"/> Washbore <input type="checkbox"/> Non Destructive Digging
---	---	--	---	---

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Appendix D
Site photographs



North view: proposed development site, photo from front of site



South view: proposed development site, photo from rear of site



Adjacent site (west)




Adjacent site (east)

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Appendix E
Geotechnical Declaration: Form A

FORM	A	Geotechnical Declaration and Verification Development Application	
Office Use Only			
To be submitted with planning application. It must accompany the Geotechnical Assessment and/or Landslip Risk Assessment. This form is essential to verify that the Geotechnical Assessment and/or Landslip Risk Assessment has been prepared in accordance with CI 44.01 of the Colac Otway Planning Scheme and that the author of the Assessment/s is a geotechnical engineer or engineering geologist as defined by this clause.			
Section 1 Related Application			
Planning Application Number (if known)			
DA Site Address		9 Cara Court, Kennett River	
DA Applicant		Nicholas Thompson	
Section 2 Geotechnical Assessment and /or Landslip Risk Assessment			
Details	Title: Geotechnical Assessment of Landslide Risk at 9 Cara Court, Kennett River		
	Author's Company/Organisation Name: St Quentin Consulting		Report Reference No: 15055G-LRA
	Author: Cameron Farrar		Dated: November 2017
Section 3 Checklist			
Geotechnical Requirements (Tick as appropriate)		<p>Assessment and/or Landslip Risk Assessment. The report must also cover any additional matters required by Clause 44.01. This checklist must accompany each report. Each item is to be cross-referenced to the section or page of the Geotechnical Assessment and/or Landslip Risk Assessment which addresses that item.</p>	
Yes	No		
<input checked="" type="checkbox"/>	<input type="checkbox"/>	A review of readily available history of slope instability in the site or related land as per: Section 4.1 and 4.3	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	An assessment of the risk posed by all reasonably identifiable geotechnical hazards as per: Section 6	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Plans and sections of the site and related land as per: Section 4.2.2 and Appendix A & B	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Presentation of a geological model as per: Section 4.2.3 and Appendix A & B	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Photographs and/or drawings of the site as per: Appendix A, B & D	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	A conclusion as to whether the site is suitable for the development proposed to be carried out as per: Section 7	
<input type="checkbox"/>	<input type="checkbox"/>	If any items above are ticked No, an explanation is to be included in the report to justify why.	
		Subject to recommendations and conditions relevant to:	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Selection and construction of footing systems	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Earthworks	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Surface and sub surface drainage	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Recommendations for the selection of structural systems consistent with the geotechnical assessment of the risk	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Any conditions that may be required for the ongoing mitigation and maintenance of the site	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Highlighting and detailing the inspection regime to provide adequate notification for all necessary inspections	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	State Design life adopted: 50 years	
<p>NOTE: THIS FORM IS ADAPTED FROM: PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT 2007 Australian Geomechanics Vol 42 No 1 March 2007</p>			

FORM	A	Geotechnical Declaration and Verification Development Application	
Section 4 List of pertinent drawings and documents referenced in Geotechnical Report			
Document	Description	Reference	Date
Site Survey	Site Survey by Rodney Martin	17059	10/6/2017
Site Plan	Matt Goodman Architecture Office: Existing Site Plan	A0.38-TP_003	30/10/2017
Proposed Plan	Matt Goodman Architecture Office: Proposed Site Plan & Roof Plan	A0.38-TP_004	30/10/2017
Ground Floor Plan	Matt Goodman Architecture Office: Proposed Ground Floor Plan	A0.38-TP_005	30/10/2017
Level 1 Floor Plan	Matt Goodman Architecture Office: Proposed Level 1 Floor Plan	A0.38-TP_006	30/10/2017
Level 2 Floor Plan	Matt Goodman Architecture Office: Proposed Level 2 Floor Plan	A0.38-TP_007	30/10/2017
East Elevation	Matt Goodman Architecture Office: East Elevation	A0.38-TP_008	30/10/2017
South Elevation	Matt Goodman Architecture Office: South Elevation	A0.38-TP_009	30/10/2017
West Elevation	Matt Goodman Architecture Office: West Elevation	A0.38-TP_010	30/10/2017
North Elevation	Matt Goodman Architecture Office: North Elevation	A0.38-TP_011	30/10/2017
Section 5 Declaration			
Declaration (Tick all that apply)		I am a geotechnical practitioner as defined by the Schedule 1 to the Erosion Management Overlay and on behalf of the company below:	
Yes	<input checked="" type="checkbox"/>	No	I am a geotechnical engineer or engineering geologist as defined by the Colac Otway Planning Scheme and on behalf of the company below
Yes	<input checked="" type="checkbox"/>	N/A	I am aware that the Geotechnical Assessment and/or Landslip Risk Assessment I have either prepared or am technically verifying (referenced above) is to be submitted in support of a planning application for the proposed development site (referenced above) and its findings will be relied upon by the Colac Otway Shire Council in determining the planning application
Yes	<input checked="" type="checkbox"/>	N/A	I prepared the Geotechnical Assessment and/or Landslip Risk Assessment referenced above in accordance with the Colac Otway Planning Scheme and the AGS Guidelines 2007 as defined in the planning scheme.
Yes	<input checked="" type="checkbox"/>	No	I technically verify that the Geotechnical Assessment and/or Landslip Risk Assessment referenced above has been prepared in accordance with the Colac Otway Planning Scheme and the AGS Guidelines 2007 as appropriate.
Yes	<input checked="" type="checkbox"/>	No	I technically verify that the Geotechnical Assessment prepared for the planning application for the site confirms the land can meet the acceptable risk criteria specified in the schedule to Clause 44.01 of the Colac Otway Planning Scheme taking into account the total development and site disturbance proposed.
Yes	<input checked="" type="checkbox"/>	No	I technically verify that the Landslip Risk Assessment prepared for the planning application for the site confirms the land can meet the tolerable risk criteria specified in the schedule to Clause 44.01 of the Colac Otway Planning Scheme taking into account the total development and site disturbance proposed.
Section 6 Geotechnical Engineer or Engineering Geologist Details			
Company/ Organisation Name	St Quentin Consulting		
Name (Company Representative)	Surname: Farrar	Mr /Mrs /Other: Mr	
	Given Names: Cameron		
	Chartered Professional Status: Member Institute of Engineers	Registration No: 4367740	
Signature			Dated: 29/11/2017

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Appendix F

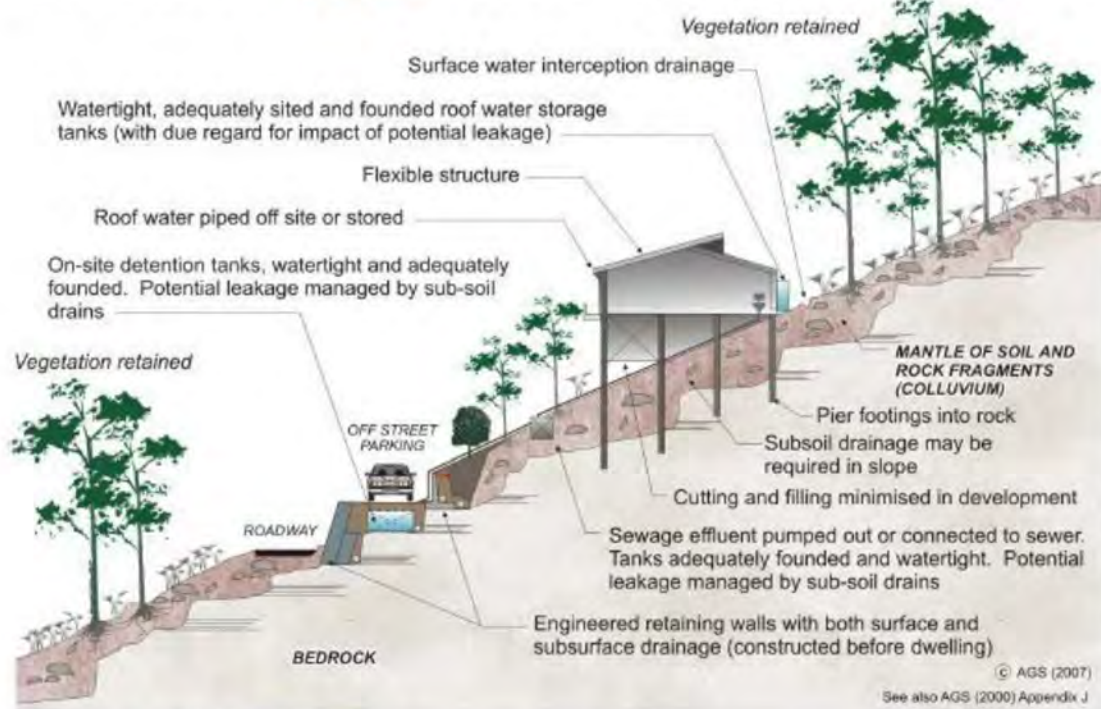
AGS "Geoguides" Good and Poor Hillside Practice

AUSTRALIAN GEOGUIDE LR8 (CONSTRUCTION PRACTICE)

HILLSIDE CONSTRUCTION PRACTICE

Sensible development practices are required when building on hillsides, particularly if the hillside has more than a low risk of instability (GeoGuide LR7). Only building techniques intended to maintain, or reduce, the overall level of landslide risk should be considered. Examples of good hillside construction practice are illustrated below.

EXAMPLES OF GOOD HILLSIDE CONSTRUCTION PRACTICE



WHY ARE THESE PRACTICES GOOD?

Roadways and parking areas - are paved and incorporate kerbs which prevent water discharging straight into the hillside (GeoGuide LR5).

Cuttings - are supported by retaining walls (GeoGuide LR6).

Retaining walls - are engineer designed to withstand the lateral earth pressures and surcharges expected, and include drains to prevent water pressures developing in the backfill. Where the ground slopes steeply down towards the high side of a retaining wall, the disturbing force (see GeoGuide LR6) can be two or more times that in level ground. Retaining walls must be designed taking these forces into account.

Sewage - whether treated or not is either taken away in pipes or contained in properly founded tanks so it cannot soak into the ground.

Surface water - from roofs and other hard surfaces is piped away to a suitable discharge point rather than being allowed to infiltrate into the ground. Preferably, the discharge point will be in a natural creek where ground water exits, rather than enters, the ground. Shallow, lined, drains on the surface can fulfil the same purpose (GeoGuide LR5).

Surface loads - are minimised. No fill embankments have been built. The house is a lightweight structure. Foundation loads have been taken down below the level at which a landslide is likely to occur and, preferably, to rock. This sort of construction is probably not applicable to soil slopes (GeoGuide LR3). If you are uncertain whether your site has rock near the surface, or is essentially a soil slope, you should engage a geotechnical practitioner to find out.

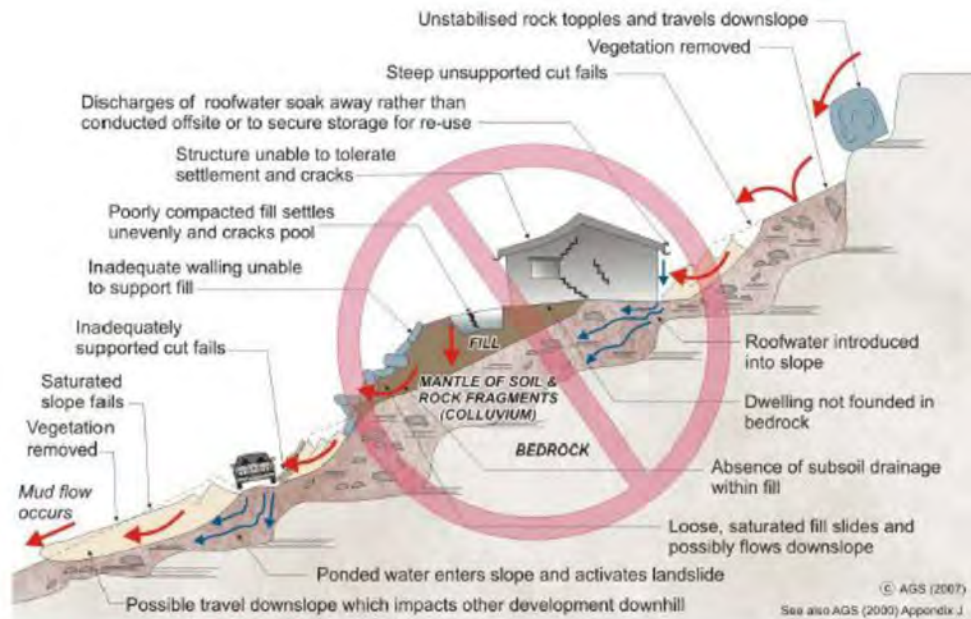
Flexible structures - have been used because they can tolerate a certain amount of movement with minimal signs of distress and maintain their functionality.

Vegetation clearance - on soil slopes has been kept to a reasonable minimum. Trees, and to a lesser extent smaller vegetation, take large quantities of water out of the ground every day. This lowers the ground water table, which in turn helps to maintain the stability of the slope. Large scale clearing can result in a rise in water table with a consequent increase in the likelihood of a landslide (GeoGuide LR5). An exception may have to be made to this rule on steep rock slopes where trees have little effect on the water table, but their roots pose a landslide hazard by dislodging boulders.

Possible effects of ignoring good construction practices are illustrated on page 2. Unfortunately, these poor construction practices are not as unusual as you might think and are often chosen because, on the face of it, they will save the developer, or owner, money. You should not lose sight of the fact that the cost and anguish associated with any one of the disasters illustrated, is likely to more than wipe out any apparent savings at the outset.

ADOPT GOOD PRACTICE ON HILLSIDE SITES

AUSTRALIAN GEOGUIDE LR8 (CONSTRUCTION PRACTICE) EXAMPLES OF **POOR** HILLSIDE CONSTRUCTION PRACTICE



WHY ARE THESE PRACTICES POOR?

Roadways and parking areas - are unsurfaced and lack proper table drains (gutters) causing surface water to pond and soak into the ground.

Cut and fill - has been used to balance earthworks quantities and level the site leaving unstable cut faces and added large surface loads to the ground. Failure to compact the fill properly has led to settlement, which will probably continue for several years after completion. The house and pool have been built on the fill and have settled with it and cracked. Leakage from the cracked pool and the applied surface loads from the fill have combined to cause landslides.

Retaining walls - have been avoided, to minimise cost, and hand placed rock walls used instead. Without applying engineering design principles, the walls have failed to provide the required support to the ground and have failed, creating a very dangerous situation.

A heavy, rigid, house - has been built on shallow, conventional, footings. Not only has the brickwork cracked because of the resulting ground movements, but it has also become involved in a man-made landslide.

Soak-away drainage - has been used for sewage and surface water run-off from roofs and pavements. This water soaks into the ground and raises the water table (GeoGuide LR5). Subsoil drains that run along the contours should be avoided for the same reason. If felt necessary, subsoil drains should run steeply downhill in a chevron, or herring bone, pattern. This may conflict with the requirements for effluent and surface water disposal (GeoGuide LR9) and if so, you will need to seek professional advice.

Rock debris - from landslides higher up on the slope seems likely to pass through the site. Such locations are often referred to by geotechnical practitioners as "debris flow paths". Rock is normally even denser than ordinary fill, so even quite modest boulders are likely to weigh many tonnes and do a lot of damage once they start to roll. Boulders have been known to travel hundreds of metres downhill leaving behind a trail of destruction.

Vegetation - has been completely cleared, leading to a possible rise in the water table and increased landslide risk (GeoGuide LR5).

DON'T CUT CORNERS ON HILLSIDE SITES - OBTAIN ADVICE FROM A GEOTECHNICAL PRACTITIONER

More information relevant to your particular situation may be found in other Australian GeoGuides:

- GeoGuide LR1 - Introduction
- GeoGuide LR2 - Landslides
- GeoGuide LR3 - Landslides in Soil
- GeoGuide LR4 - Landslides in Rock
- GeoGuide LR5 - Water & Drainage
- GeoGuide LR6 - Retaining Walls
- GeoGuide LR7 - Landslide Risk
- GeoGuide LR9 - Effluent & Surface Water Disposal
- GeoGuide LR10 - Coastal Landslides
- GeoGuide LR11 - Record Keeping

The Australian GeoGuides (LR series) are a set of publications intended for property owners; local councils; planning authorities; developers; insurers; lawyers and, in fact, anyone who lives with, or has an interest in, a natural or engineered slope, a cutting, or an excavation. They are intended to help you understand why slopes and retaining structures can be a hazard and what can be done with appropriate professional advice and local council approval (if required) to remove, reduce, or minimise the risk they represent. The GeoGuides have been prepared by the [Australian Geomechanics Society](#), a specialist technical society within Engineers Australia, the national peak body for all engineering disciplines in Australia, whose members are professional geotechnical engineers and engineering geologists with a particular interest in ground engineering. The GeoGuides have been funded under the Australian governments' National Disaster Mitigation Program.

APPENDIX G - SOME GUIDELINES FOR HILLSIDE CONSTRUCTION

GOOD ENGINEERING PRACTICE

POOR ENGINEERING PRACTICE

ADVICE

GEOTECHNICAL ASSESSMENT	Obtain advice from a qualified, experienced geotechnical practitioner at early stage of planning and before site works.	Prepare detailed plan and start site works before geotechnical advice.
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PLANNING

SITE PLANNING	Having obtained geotechnical advice, plan the development with the risk arising from the identified hazards and consequences in mind.	Plan development without regard for the Risk.
---------------	---	---

DESIGN AND CONSTRUCTION

HOUSE DESIGN	Use flexible structures which incorporate properly designed brickwork, timber or steel frames, timber or panel cladding. Consider use of split levels. Use decks for recreational areas where appropriate.	Floor plans which require extensive cutting and filling. Movement intolerant structures.
SITE CLEARING	Retain natural vegetation wherever practicable.	Indiscriminately clear the site.
ACCESS & DRIVEWAYS	Satisfy requirements below for cuts, fills, retaining walls and drainage. Council specifications for grades may need to be modified. Driveways and parking areas may need to be fully supported on piers.	Excavate and fill for site access before geotechnical advice.
EARTHWORKS	Retain natural contours wherever possible.	Indiscriminatory bulk earthworks.
CUTS	Minimise depth. Support with engineered retaining walls or batter to appropriate slope. Provide drainage measures and erosion control.	Large scale cuts and benching. Unsupported cuts. Ignore drainage requirements
FILLS	Minimise height Strip vegetation and topsoil and key into natural slopes prior to filling. Use clean fill materials and compact to engineering standards. Batter to appropriate slope or support with engineered retaining wall. Provide surface drainage and appropriate subsurface drainage.	Loose or poorly compacted fill, which if it fails, may flow a considerable distance including onto property below. Block natural drainage lines. Fill over existing vegetation and topsoil. Include stumps, trees, vegetation, topsoil, boulders, building rubble etc in fill.
ROCK OUTCROPS & BOULDERS	Remove or stabilise boulders which may have unacceptable risk. Support rock faces where necessary.	Disturb or undercut detached blocks or boulders.
RETAINING WALLS	Engineer design to resist applied soil and water forces. Found on rock where practicable. Provide subsurface drainage within wall backfill and surface drainage on slope above. Construct wall as soon as possible after cut/fill operation.	Construct a structurally inadequate wall such as sandstone flagging, brick or unreinforced blockwork. Lack of subsurface drains and weepholes.
FOOTINGS	Found within rock where practicable. Use rows of piers or strip footings oriented up and down slope. Design for lateral creep pressures if necessary. Backfill footing excavations to exclude ingress of surface water.	Found on topsoil, loose fill, detached boulders or undercut cliffs.
SWIMMING POOLS	Engineer designed. Support on piers to rock where practicable. Provide with under-drainage and gravity drain outlet where practicable. Design for high soil pressures which may develop on uphill side whilst there may be little or no lateral support on downhill side.	
DRAINAGE		
SURFACE	Provide at tops of cut and fill slopes. Discharge to street drainage or natural water courses. Provide general falls to prevent blockage by siltation and incorporate silt traps. Line to minimise infiltration and make flexible where possible. Special structures to dissipate energy at changes of slope and/or direction.	Discharge at top of fills and cuts. Allow water to pond on bench areas.
SUBSURFACE	Provide filter around subsurface drain. Provide drain behind retaining walls. Use flexible pipelines with access for maintenance. Prevent inflow of surface water.	Discharge roof runoff into absorption trenches.
SEPTIC & SULLAGE	Usually requires pump-out or mains sewer systems; absorption trenches may be possible in some areas if risk is acceptable. Storage tanks should be water-tight and adequately founded.	Discharge sullage directly onto and into slopes. Use absorption trenches without consideration of landslide risk.
EROSION CONTROL & LANDSCAPING	Control erosion as this may lead to instability. Revegetate cleared area.	Failure to observe earthworks and drainage recommendations when landscaping.

DRAWINGS AND SITE VISITS DURING CONSTRUCTION

DRAWINGS	Building Application drawings should be viewed by geotechnical consultant	
SITE VISITS	Site Visits by consultant may be appropriate during construction/	

INSPECTION AND MAINTENANCE BY OWNER

OWNER'S RESPONSIBILITY	Clean drainage systems; repair broken joints in drains and leaks in supply pipes. Where structural distress is evident see advice. If seepage observed, determine causes or seek advice on consequences.	
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Appendix G
AGS Terminology in assessing risk

PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT 2007

APPENDIX C: LANDSLIDE RISK ASSESSMENT

QUALITATIVE TERMINOLOGY FOR USE IN ASSESSING RISK TO PROPERTY

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QUALITATIVE MEASURES OF LIKELIHOOD

Approximate Annual Probability		Implied Indicative Landslide Recurrence Interval		Description	Descriptor	Level
Indicative Value	Notional Boundary					
10^{-1}	5×10^{-2}	10 years	20 years	The event is expected to occur over the design life.	ALMOST CERTAIN	A
10^{-2}		100 years		The event will probably occur under adverse conditions over the design life.	LIKELY	B
10^{-3}	5×10^{-3}	1000 years	200 years	The event could occur under adverse conditions over the design life.	POSSIBLE	C
10^{-4}		10,000 years	2000 years	The event might occur under very adverse circumstances over the design life.	UNLIKELY	D
10^{-5}	5×10^{-5}	100,000 years	20,000 years	The event is conceivable but only under exceptional circumstances over the design life.	RARE	E
10^{-6}		1,000,000 years	200,000 years	The event is inconceivable or fanciful over the design life.	BARELY CREDIBLE	F

Note: (1) The table should be used from left to right; use Approximate Annual Probability or Description to assign Descriptor, not *vice versa*.

QUALITATIVE MEASURES OF CONSEQUENCES TO PROPERTY

Approximate Cost of Damage		Description	Descriptor	Level
Indicative Value	Notional Boundary			
200%	100%	Structure(s) completely destroyed and/or large scale damage requiring major engineering works for stabilisation. Could cause at least one adjacent property major consequence damage.	CATASTROPHIC	1
60%		Extensive damage to most of structure, and/or extending beyond site boundaries requiring significant stabilisation works. Could cause at least one adjacent property medium consequence damage.	MAJOR	2
20%	40%	Moderate damage to some of structure, and/or significant part of site requiring large stabilisation works. Could cause at least one adjacent property minor consequence damage.	MEDIUM	3
5%		10%	Limited damage to part of structure, and/or part of site requiring some reinstatement stabilisation works.	MINOR
0.5%	1%	Little damage. (Note for high probability event (Almost Certain), this category may be subdivided at a notional boundary of 0.1%. See Risk Matrix.)	INSIGNIFICANT	5

- Notes: (2) The Approximate Cost of Damage is expressed as a percentage of market value, being the cost of the improved value of the unaffected property which includes the land plus the unaffected structures.
- (3) The Approximate Cost is to be an estimate of the direct cost of the damage, such as the cost of reinstatement of the damaged portion of the property (land plus structures), stabilisation works required to render the site to tolerable risk level for the landslide which has occurred and professional design fees, and consequential costs such as legal fees, temporary accommodation. It does not include additional stabilisation works to address other landslides which may affect the property.
- (4) The table should be used from left to right; use Approximate Cost of Damage or Description to assign Descriptor, not *vice versa*

PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT 2007

APPENDIX C: – QUALITATIVE TERMINOLOGY FOR USE IN ASSESSING RISK TO PROPERTY (CONTINUED)

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QUALITATIVE RISK ANALYSIS MATRIX – LEVEL OF RISK TO PROPERTY

LIKELIHOOD		CONSEQUENCES TO PROPERTY (With Indicative Approximate Cost of Damage)				
	Indicative Value of Approximate Annual Probability	1: CATASTROPHIC 200%	2: MAJOR 60%	3: MEDIUM 20%	4: MINOR 5%	5: INSIGNIFICANT 0.5%
A – ALMOST CERTAIN	10^{-1}	VH	VH	VH	H	M or L (5)
B – LIKELY	10^{-2}	VH	VH	H	M	L
C – POSSIBLE	10^{-3}	VH	H	M	M	VL
D – UNLIKELY	10^{-4}	H	M	L	L	VL
E – RARE	10^{-5}	M	L	L	VL	VL
F – BARELY CREDIBLE	10^{-6}	L	VL	VL	VL	VL

Notes: (5) For Cell A5, may be subdivided such that a consequence of less than 0.1% is Low Risk.

(6) When considering a risk assessment it must be clearly stated whether it is for existing conditions or with risk control measures which may not be implemented at the current time.

RISK LEVEL IMPLICATIONS

Risk Level	Example Implications (7)
VH VERY HIGH RISK	Unacceptable without treatment. Extensive detailed investigation and research, planning and implementation of treatment options essential to reduce risk to Low; may be too expensive and not practical. Work likely to cost more than value of the property.
H HIGH RISK	Unacceptable without treatment. Detailed investigation, planning and implementation of treatment options required to reduce risk to Low. Work would cost a substantial sum in relation to the value of the property.
M MODERATE RISK	May be tolerated in certain circumstances (subject to regulator's approval) but requires investigation, planning and implementation of treatment options to reduce the risk to Low. Treatment options to reduce to Low risk should be implemented as soon as practicable.
L LOW RISK	Usually acceptable to regulators. Where treatment has been required to reduce the risk to this level, ongoing maintenance is required.
VL VERY LOW RISK	Acceptable. Manage by normal slope maintenance procedures.

Note: (7) The implications for a particular situation are to be determined by all parties to the risk assessment and may depend on the nature of the property at risk; these are only given as a general guide.

GEOTECHNICAL INVESTIGATION ADDENDUM

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TESTING PROGRAMME & REPORT

1. Report has been prepared by qualified persons and based on current available standards.
2. Recommendations are based on the assumption that limited test positions are representative of the sub-surface profile.
3. Whilst care has been taken to accurately report on the sub-surface conditions across the site it is not possible to anticipate unexpected sub-surface variations given the limited testing performed.
4. Changes in legislative policy may require report update or additional testing.

The purpose of this report is to conduct a limited and preliminary geotechnical investigation. Where any variation or anomalies are encountered, we recommend additional investigation and reporting by us to resolve any potential issues.

GENERAL COMMENTS

St Quentin Consulting does not accept responsibility for our report where it has been altered or not reproduced in full, including addendum.

Dimensions, slope, test locations are approximate only and must not be used for calculation of positioning.

Recommendations are based on information regarding the site and development type provided by the client or agent. If information supplied is not accurate or if significant changes are required, our report may be inappropriate. We cannot accept responsibility for significant changes and anticipate additional fees should further tests or report update be required.

Offset distance to any subsurface excavations must not exceed the minimum angle of repose for the in-situ naturally occurring soil. We estimate the maximum angle of repose for sand is 30 and 45 for clay soils. We do not recommend steeper angles unless competent rock is encountered.

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Fire Safety Referrals

Fire & Emergency Management

Email: firesafetyreferrals@cfa.vic.gov.au

Telephone: 03 9262 8578

Our Ref: 6000-61973-84143

Council Ref: PP302/2017-1

17 October 2018

Helen Evans
Colac Otway Shire
PO Box 283
COLAC VIC 3250

Dear Helen

OBJECTION TO THE GRANT OF A PERMIT

Application No: PP302/2017-1
Subject land: 9 Cara Court, Kennet River
Proposal: Construction of a dwelling in the BMO.

I refer to correspondence dated 10 September 2018 seeking comments on the above application.

CFA acting as a recommending Referral Authority pursuant to section 55 of the *Planning and Environment Act 1987* has considered the above proposal and objects to a permit being issued on the following grounds:

The slope under the forested vegetation to the west of the property is greater than 20 degrees. Table 1 to clause 53.02-5 therefore cannot be used and AM1.2 cannot be met. As such, the application must respond to the requirements of clause 53.02-4 (Pathway 2).

The current application responds to the approved measures AM1.1, AM1.2 & AM1.3 of clause 53.02-3 (Pathway 1). The Application requirements at clause 53.02-1 are such that all approved measures contained in clause 53.02-3 must be met, otherwise Pathway 2 applies.

The site is in an extremely high risk landscape, on the top of a ridgeline, with minimal setback from forest vegetation which is on a slope of greater than 30 degrees. Given the level of risk present at both the landscape and site levels, any development on this site needs to fully respond to the bushfire objectives within the planning scheme. Amongst other requirements this includes:

Landscape, siting and design:

- Development is appropriate having regard to the nature of the bushfire risk arising from the surrounding landscape.
- Development is sited to minimise the risk from bushfire.
- Building design minimises vulnerability to bushfire attack

Defendable space and construction:

- Defendable space and building construction mitigate the effect of flame contact, radiant heat and embers on buildings

The current application has not demonstrated it meets these requirements and is unlikely to achieve these objectives. In particular, the design and construction of the building should be reconsidered in order to more effectively '*minimise the vulnerability to bushfire attack*' and '*mitigate the effect of flame contact*'.

Further comments

Any future application should respond to the following Pathway 2 provisions:

- 53.02-4.1 *Landscape, siting & design objectives*
 - AM 2.1
 - AM 2.2
 - AM 2.3
- 53.02-4.2 *Defendable space and construction objectives*
 - AM 3.1 cannot be achieved therefore the application should respond to AltM 3.4 & AltM 3.5
- 53.02-4.3 *Water supply & Access objectives*
 - AM 4.1

and better incorporate the advice in CFA's guideline [Applying the Bushfire Hazard Landscape Assessment for development in the BMO](#).

If you wish to discuss this matter in more detail, please do not hesitate to contact the Fire Safety Team on 9262 8578.

Yours sincerely



Mark Holland
Fire Safety Team Leader
FIRE & EMERGENCY MANAGEMENT

cc: Matt Goodman
matt@mgao.com.au

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1. SITE SURVEY
2. SITE PHOTOS
3. EXISTING SITE PLAN
4. PROPOSED SITE & ROOF PLAN
5. CONTEXT PLAN
6. GROUND PLAN
7. LEVEL 1 PLAN
8. EAST ELEVATION
9. SOUTH ELEVATION
10. WEST ELEVATION
11. NORTH ELEVATION
12. 3D PERSPECTIVE
13. SHADOW DIAGRAMS
14. MATERIAL SCHEDULE

(REVISED DRAWINGS NOTED IN RED)

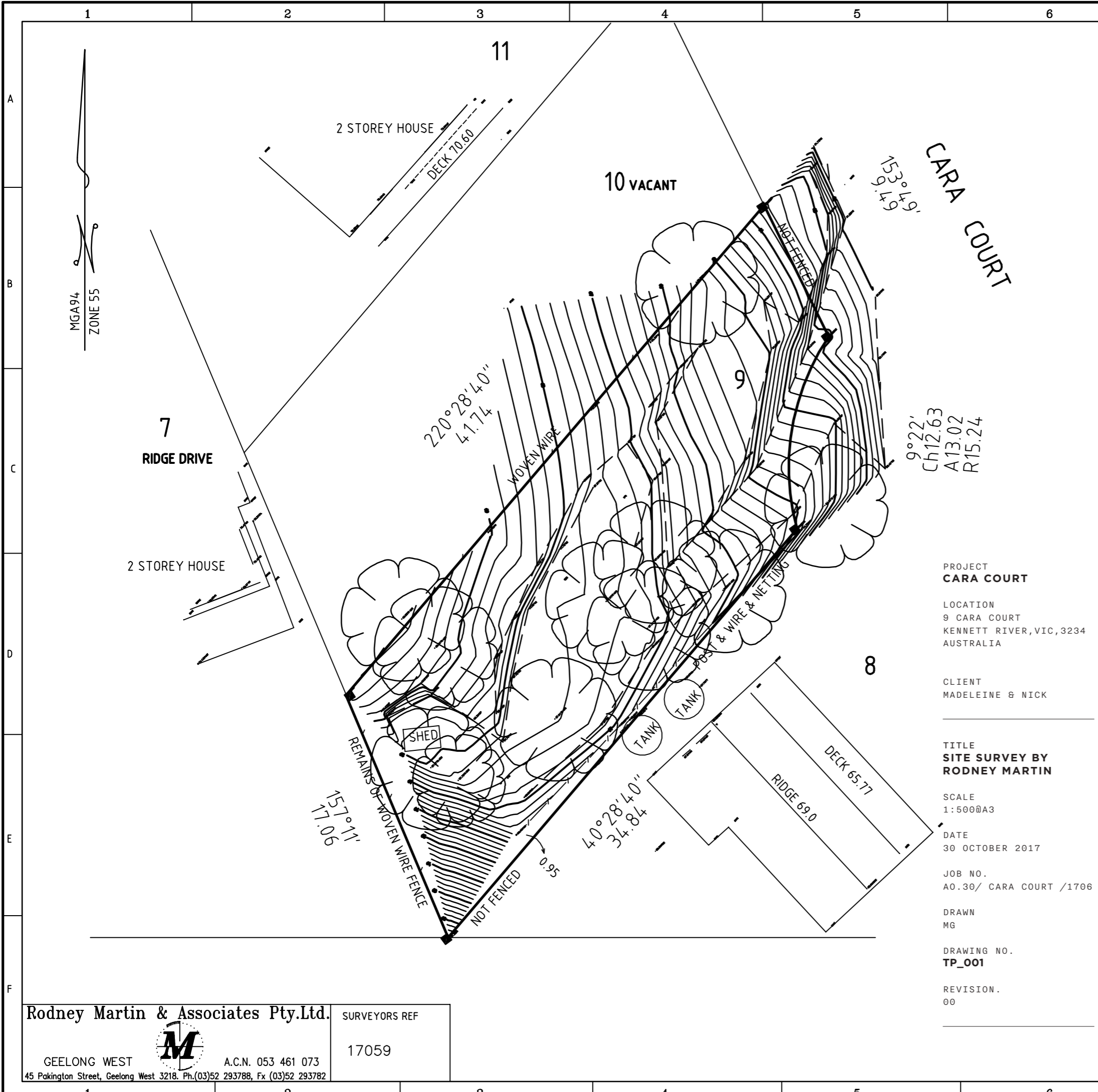
PROJECT
9 CARA COURT

TITLE
**PLANNING DRAWINGS
REVISED**

DATE
19 AUGUST 2019

JOB NO.
AO.30/ CARA COURT /1706

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ARCHITECTURE OFFICE**



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NOTATIONS

LAND SUBJECT TO EASEMENT
NIL

Property Address: 9 CARA COURT
KENNETT RIVER 3234
Date of Survey 20/6/2017
PRINCIPAL: MATT GOODMAN ARCHITECTURE

OTHER NOTATIONS
HEIGHTS ARE TO AUSTRALIAN HEIGHT DATUM
CONTOUR INTERVAL IS 0.20m
TR 4G12 DENOTES TREE,CANOPY RADIUS 4, GUM, HEIGHT 12m.

CERTIFICATION BY SURVEYOR

I, RODNEY IAN MARTIN
OF, 45 PAKINGTON STREET, GEELONG WEST
certify that this plan correctly represents the results of the survey effected under my direction and supervision and marked on the ground in accordance with the **Surveying Act 2004**, that the survey accuracy accords with that required for undulating land as defined in regulation 7 (2) of the Surveying (Cadastral Surveys) Regulations 2005 and that this plan correctly represents the adopted boundaries and the related features existing on 19-6-2017

**Licensed Surveyor,
Surveying Act 2004**

Date: _____

THIS SURVEY HAS BEEN CONNECTED TO PERMANENT MARK NOS. 24
IN PROCLAIMED SURVEY AREA NO. —

THE LAND IN THE SURVEY IS SHOWN ENCLOSED BY CONTINUOUS THICK LINES

TITLE REF :
LAST PLAN REF : 20/LP56866

PLAN OF SURVEY

COUNTY POLWARTH
PARISH WONGARRA
CROWN ALLOTMENT 10A (PART)

NUMBER OF SHEETS 1
SHEET NOS 1

SCALE
2.5 0 2.5 5 10
LENGTHS ARE IN METRES

ORIGINAL
SCALE 1:250
SHEET SIZE A3

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PROJECT
CARA COURT

LOCATION
9 CARA COURT
KENNETT RIVER, VIC, 3234
AUSTRALIA

CLIENT
MADELEINE & NICK

TITLE
**SITE SURVEY BY
RODNEY MARTIN**

SCALE
1:500@A3

DATE
30 OCTOBER 2017

JOB NO.
AO.30/ CARA COURT /1706

DRAWN
MG

DRAWING NO.
TP_001

REVISION.
00

Rodney Martin & Associates Pty.Ltd. SURVEYORS REF
17059

GEELONG WEST A.C.N. 053 461 073
45 Pakington Street, Geelong West 3218. Ph.(03)52 293788, Fx (03)52 293782

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SITE - VIEWED FROM CARA COURT



SITE - LOOKING SOUTH / NEIGHBOURING DWELLING



SITE - LOOKING WEST



SITE - LOOKING EAST

PROJECT
CARA COURT

LOCATION
9 CARA COURT
KENNETT RIVER, VIC, 3234
AUSTRALIA

CLIENT
MADELEINE & NICK

TITLE
SITE PHOTOS

SCALE
NTS

DATE
30 OCTOBER 2017

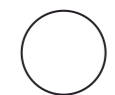
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PROJECT
CARA COURT

LOCATION
9 CARA COURT
KENNETT RIVER, VIC, 3234
AUSTRALIA

CLIENT
MADELEINE & NICK

TITLE
EXISTING SITE PLAN

SCALE
1:200@A3

DATE
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AO.30/ CARA COURT /1706

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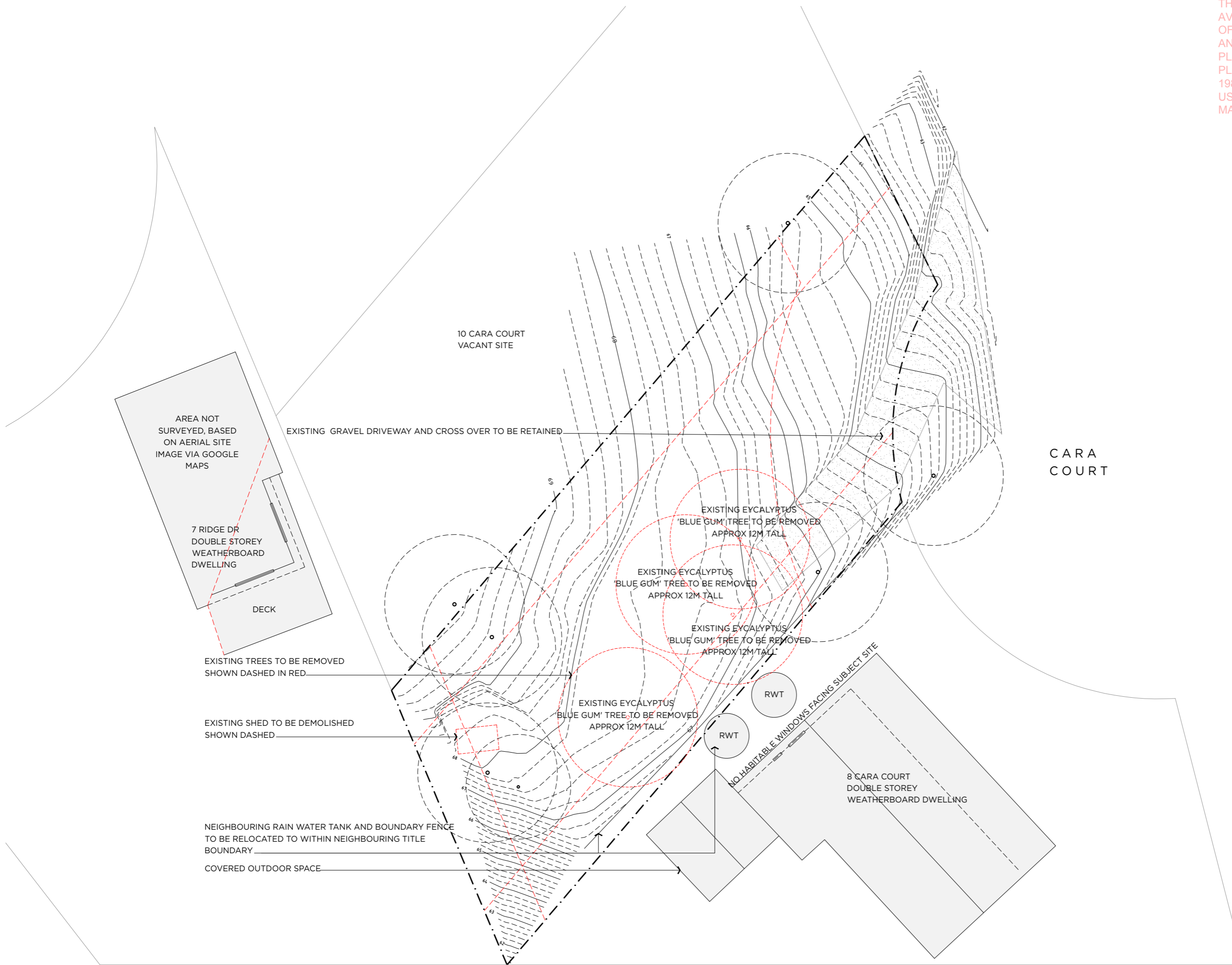
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CARA COURT

LOCATION
9 CARA COURT
KENNETT RIVER, VIC, 3234
AUSTRALIA

CLIENT
MADELEINE & NICK

TITLE
**PROPOSED SITE
PLAN & ROOF PLAN
RELOCATED FOR CFA**

SCALE
1:200@A3

DATE
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JOB NO.
AO.30/ CARA COURT /1706

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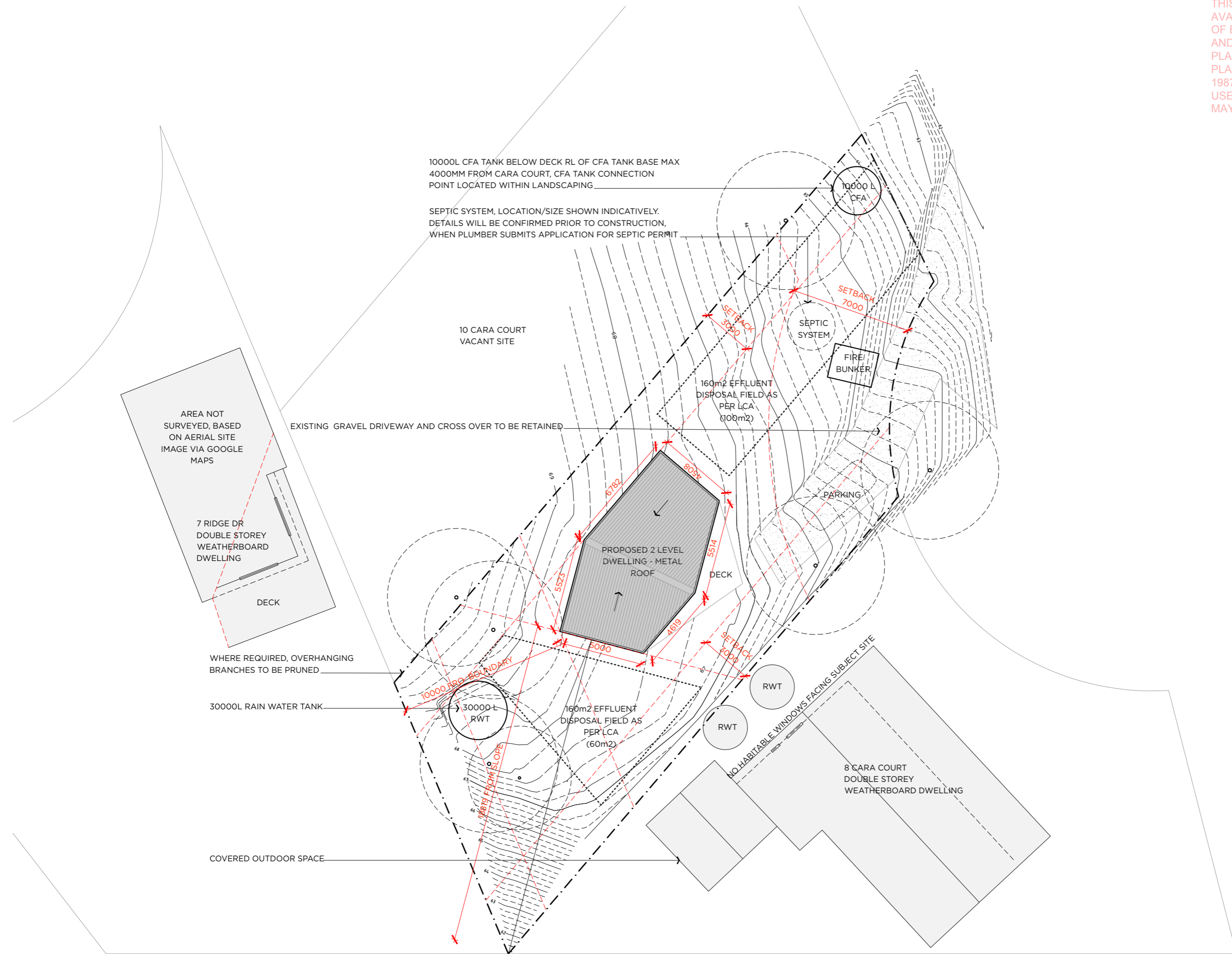
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10000L CFA TANK BELOW DECK RL OF CFA TANK BASE MAX 4000MM FROM CARA COURT, CFA TANK CONNECTION POINT LOCATED WITHIN LANDSCAPING

SEPTIC SYSTEM, LOCATION/SIZE SHOWN INDICATIVELY. DETAILS WILL BE CONFIRMED PRIOR TO CONSTRUCTION, WHEN PLUMBER SUBMITS APPLICATION FOR SEPTIC PERMIT

10 CARA COURT VACANT SITE

EXISTING GRAVEL DRIVEWAY AND CROSS OVER TO BE RETAINED

AREA NOT SURVEYED, BASED ON AERIAL SITE IMAGE VIA GOOGLE MAPS

7 RIDGE DR DOUBLE STOREY WEATHERBOARD DWELLING

DECK

WHERE REQUIRED, OVERHANGING BRANCHES TO BE PRUNED

30000L RAIN WATER TANK

COVERED OUTDOOR SPACE

PROPOSED 2 LEVEL DWELLING - METAL ROOF

DECK

PARKING

SEPTIC SYSTEM

FIRE BUNKER

160m2 EFFLUENT DISPOSAL FIELD AS PER LCA (100m2)

160m2 EFFLUENT DISPOSAL FIELD AS PER LCA (60m2)

RWT

RWT

8 CARA COURT DOUBLE STOREY WEATHERBOARD DWELLING

NO HABITABLE WINDOWS FACING SUBJECT SITE

10000 RWT BOUNDARY

10000 RWT FROM SLOPE

SETBACK 7000

SETBACK 3000

SETBACK 3000

5000

5514

5523

6182

8034

6182

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PROJECT
CARA COURT

LOCATION
9 CARA COURT
KENNETT RIVER, VIC, 3234
AUSTRALIA

CLIENT
MADELEINE & NICK

TITLE
**PROPOSED SITE PLAN
& ROOF PLAN
RELOCATED FOR CFA**

SCALE
1:200@A3

DATE
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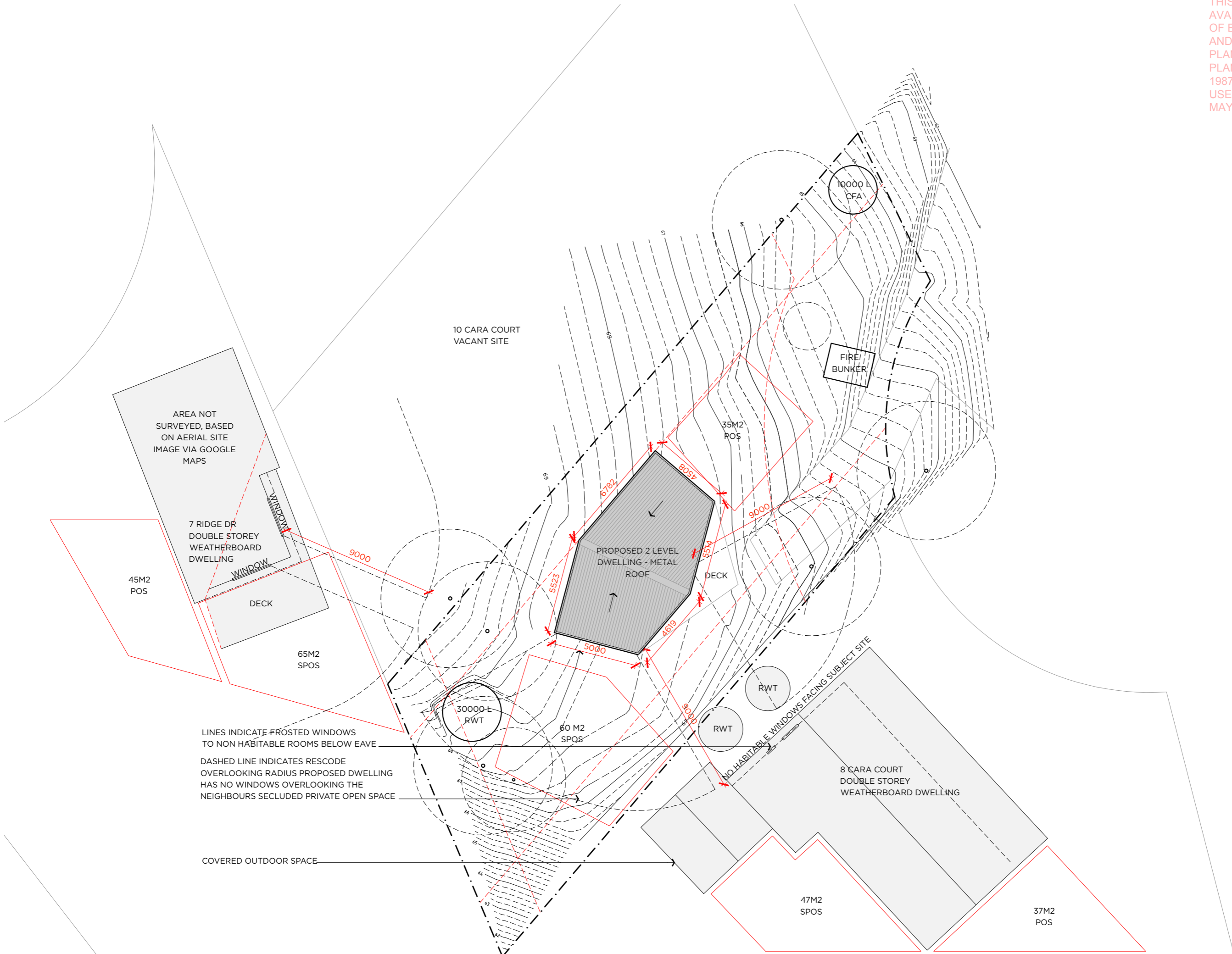
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LINES INDICATE FROSTED WINDOWS
TO NON HABITABLE ROOMS BELOW EAVE

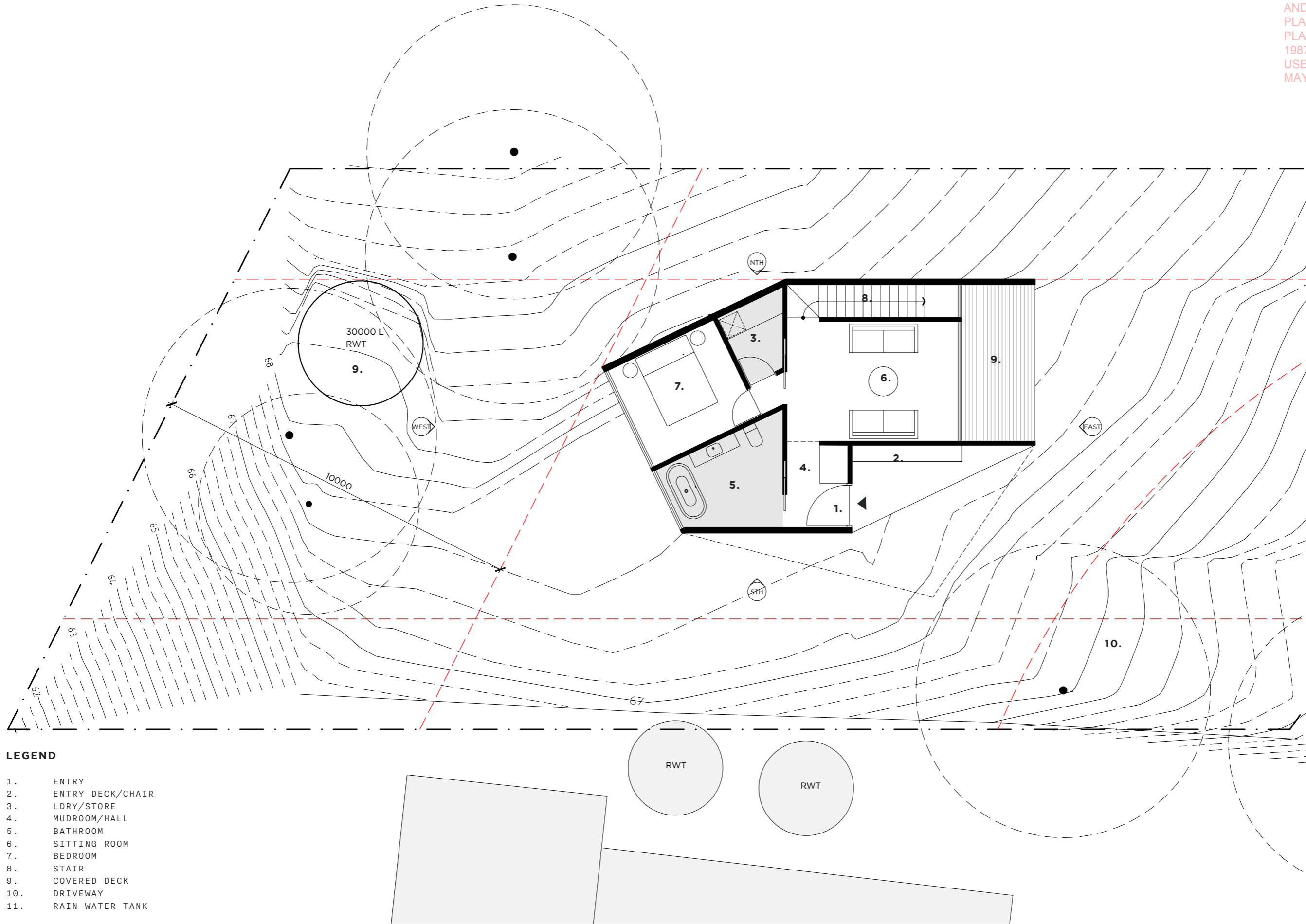
DASHED LINE INDICATES RESCODE
OVERLOOKING RADIUS PROPOSED DWELLING
HAS NO WINDOWS OVERLOOKING THE
NEIGHBOURS SECLUDED PRIVATE OPEN SPACE

COVERED OUTDOOR SPACE

NO HABITABLE WINDOWS FACING SUBJECT SITE

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LOCATION
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TITLE
GROUND FLOOR PLAN

SCALE
1:100@A3

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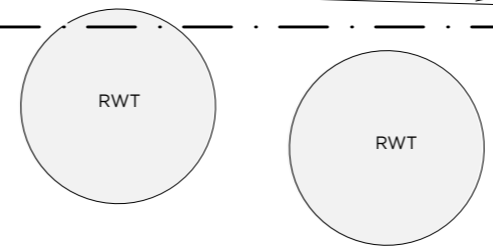
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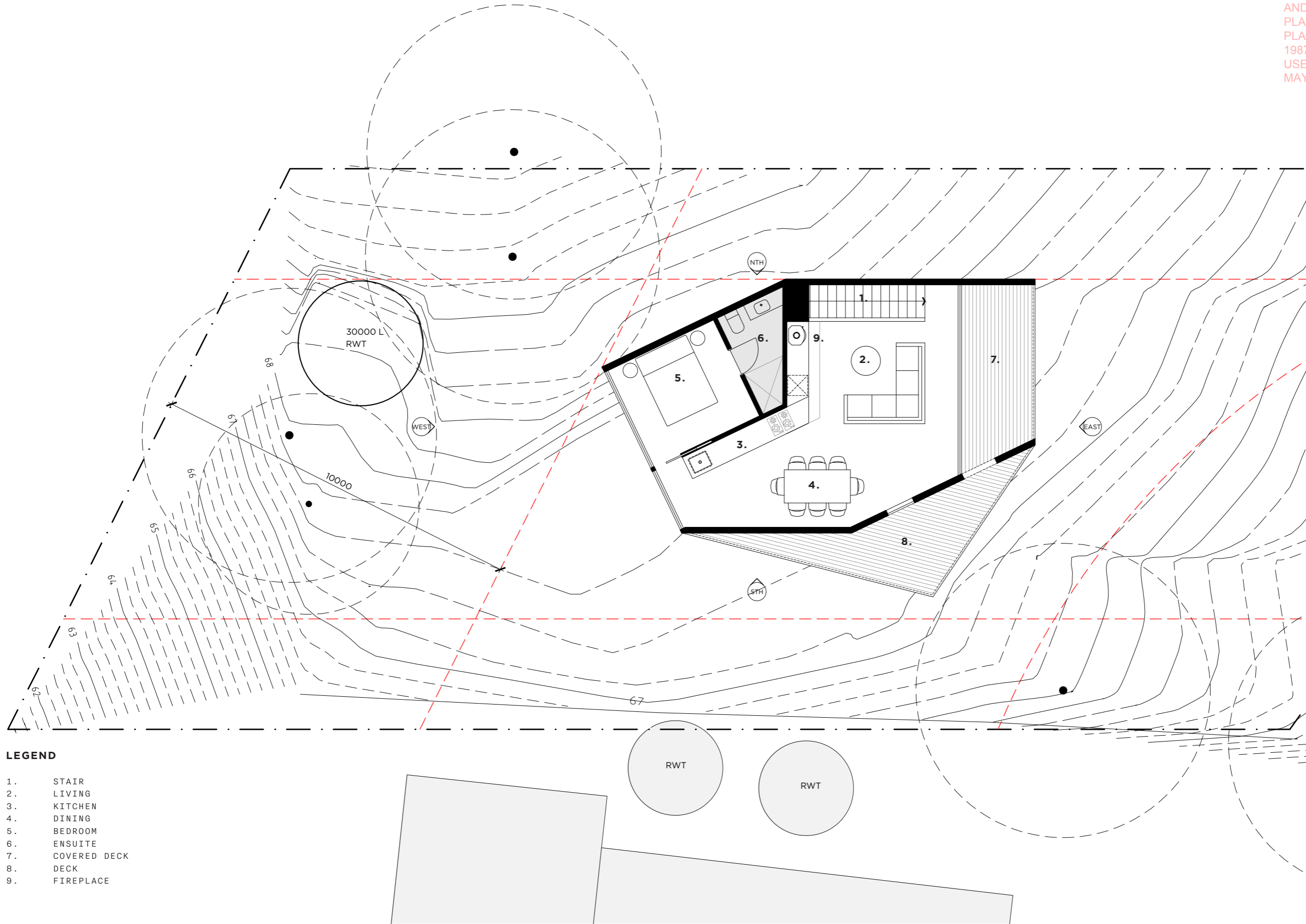
- LEGEND**
- 1. ENTRY
 - 2. ENTRY DECK/CHAIR
 - 3. LDRY/STORE
 - 4. MUDROOM/HALL
 - 5. BATHROOM
 - 6. SITTING ROOM
 - 7. BEDROOM
 - 8. STAIR
 - 9. COVERED DECK
 - 10. DRIVEWAY
 - 11. RAIN WATER TANK



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CARA COURT

LOCATION
9 CARA COURT
KENNETT RIVER, VIC, 3234
AUSTRALIA

CLIENT
MADELEINE & NICK

TITLE
LEVEL 1 FLOOR PLAN

SCALE
1:100@A3

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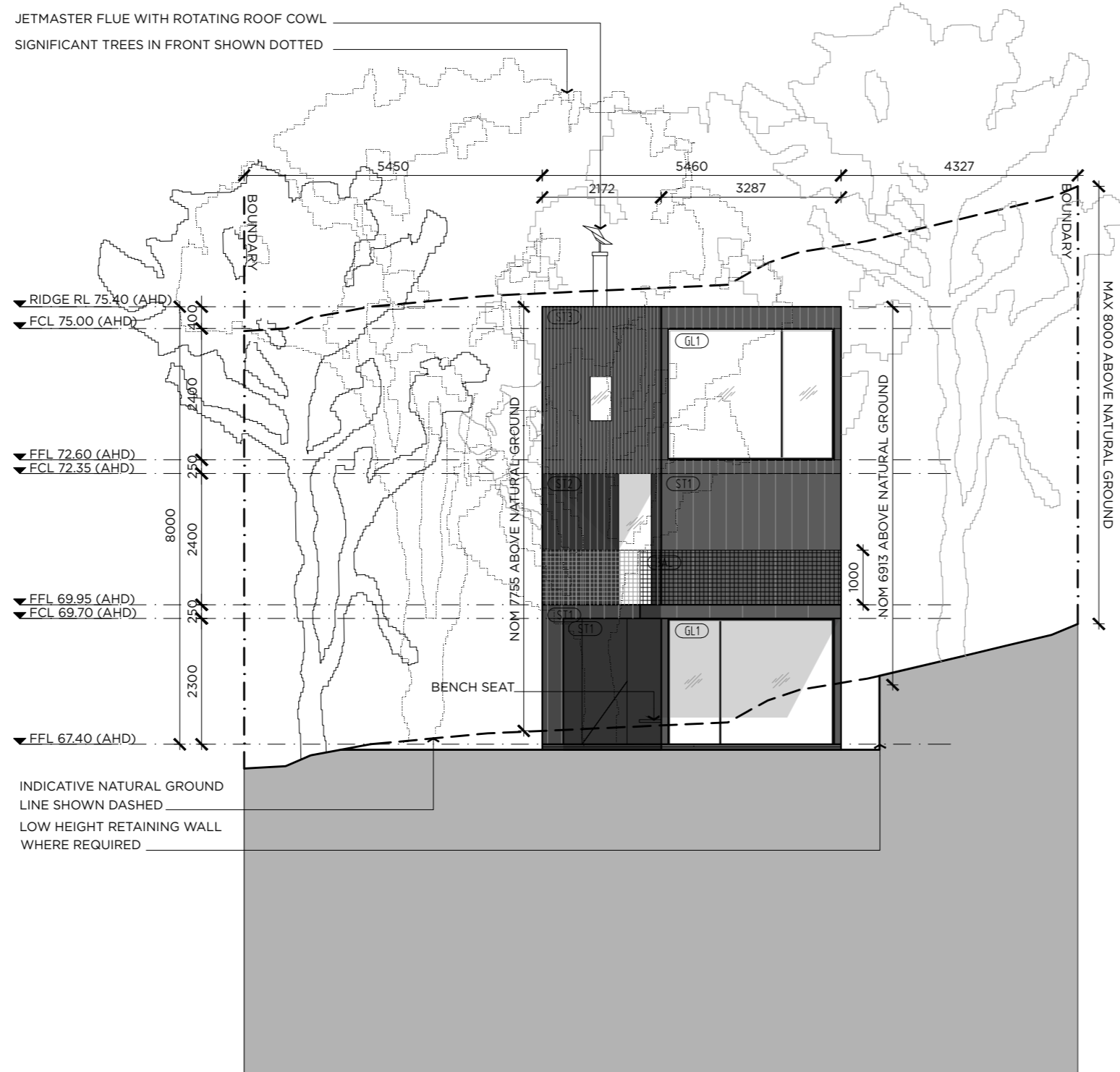
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- LEGEND**
- 1. STAIR
 - 2. LIVING
 - 3. KITCHEN
 - 4. DINING
 - 5. BEDROOM
 - 6. ENSUITE
 - 7. COVERED DECK
 - 8. DECK
 - 9. FIREPLACE

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PROJECT
CARA COURT

LOCATION
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KENNETT RIVER, VIC, 3234
AUSTRALIA

CLIENT
MADELEINE & NICK

TITLE
**EAST ELEVATION
PREVIOUS**

SCALE
1:100@A3

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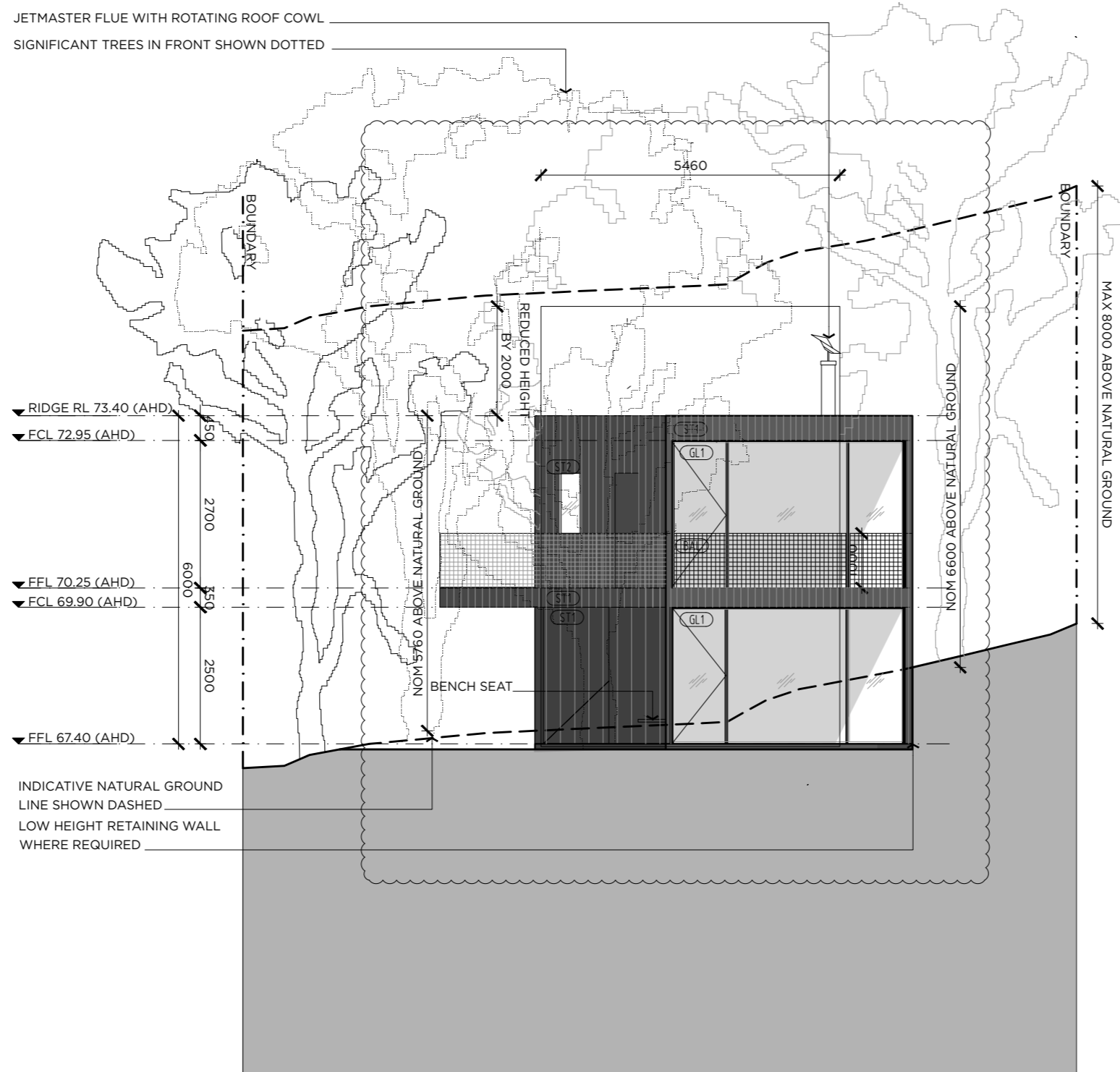
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PROJECT
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LOCATION
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KENNETT RIVER, VIC, 3234
AUSTRALIA

CLIENT
MADELEINE & NICK

TITLE
**EAST ELEVATION
REVISED**

SCALE
1:100@A3

DATE
19 AUGUST 2019

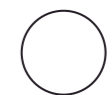
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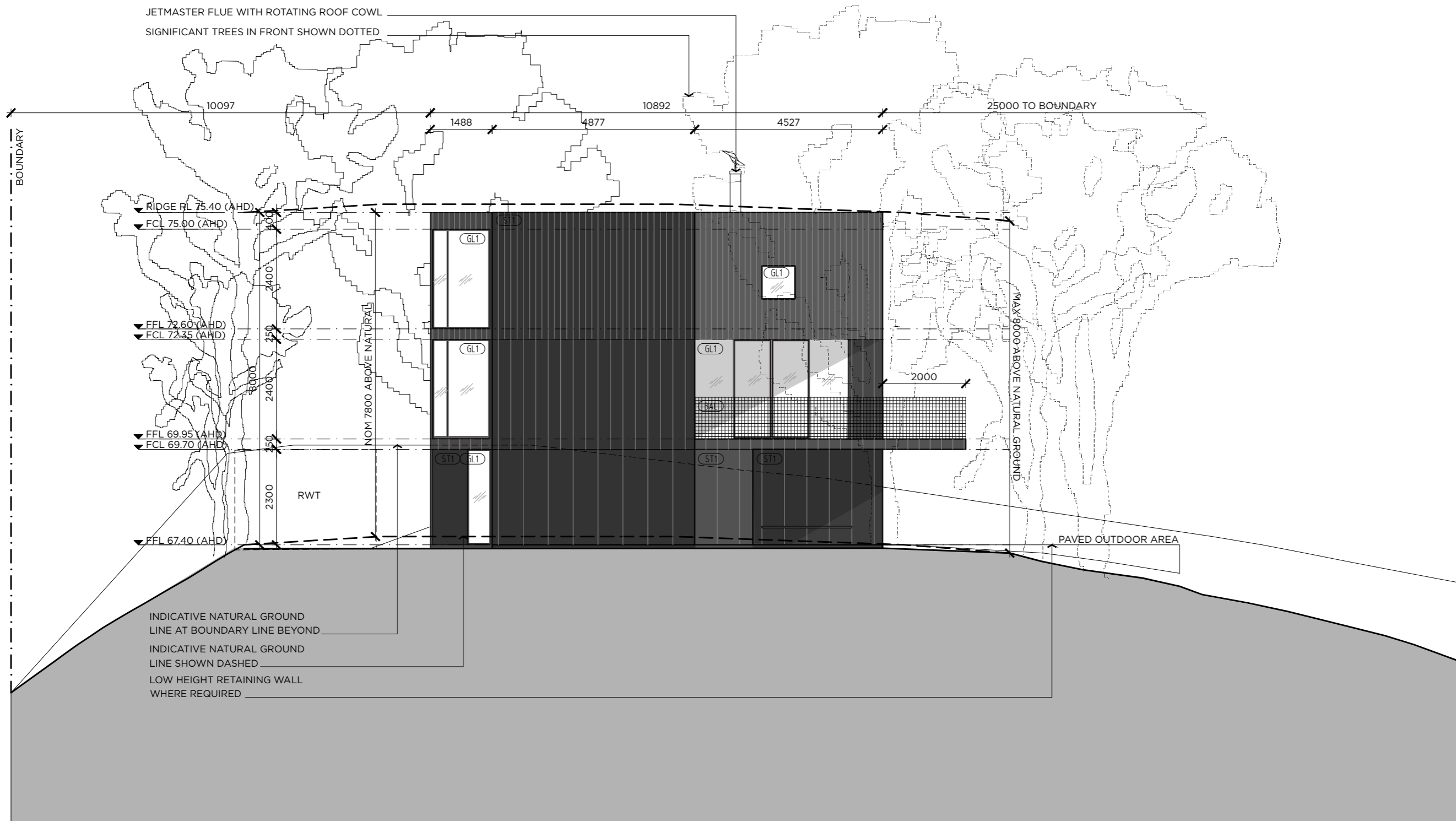
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PROJECT
CARA COURT

LOCATION
9 CARA COURT
KENNETT RIVER, VIC, 3234
AUSTRALIA

CLIENT
MADELEINE & NICK

TITLE
**SOUTH ELEVATION
PREVIOUS**

SCALE
1:100@A3

DATE
19 AUGUST 2019

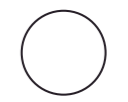
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AO.30/ CARA COURT /1706

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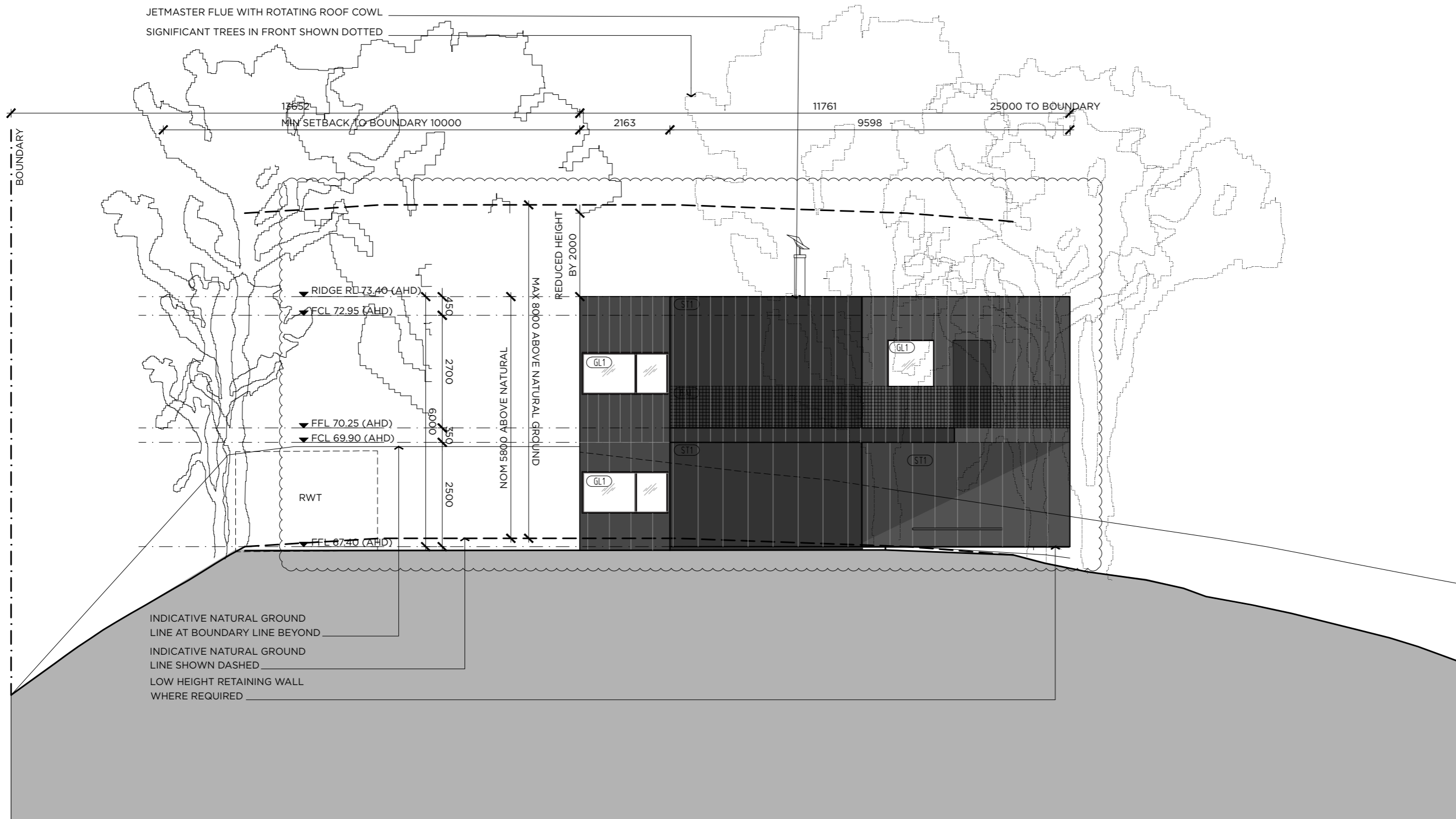
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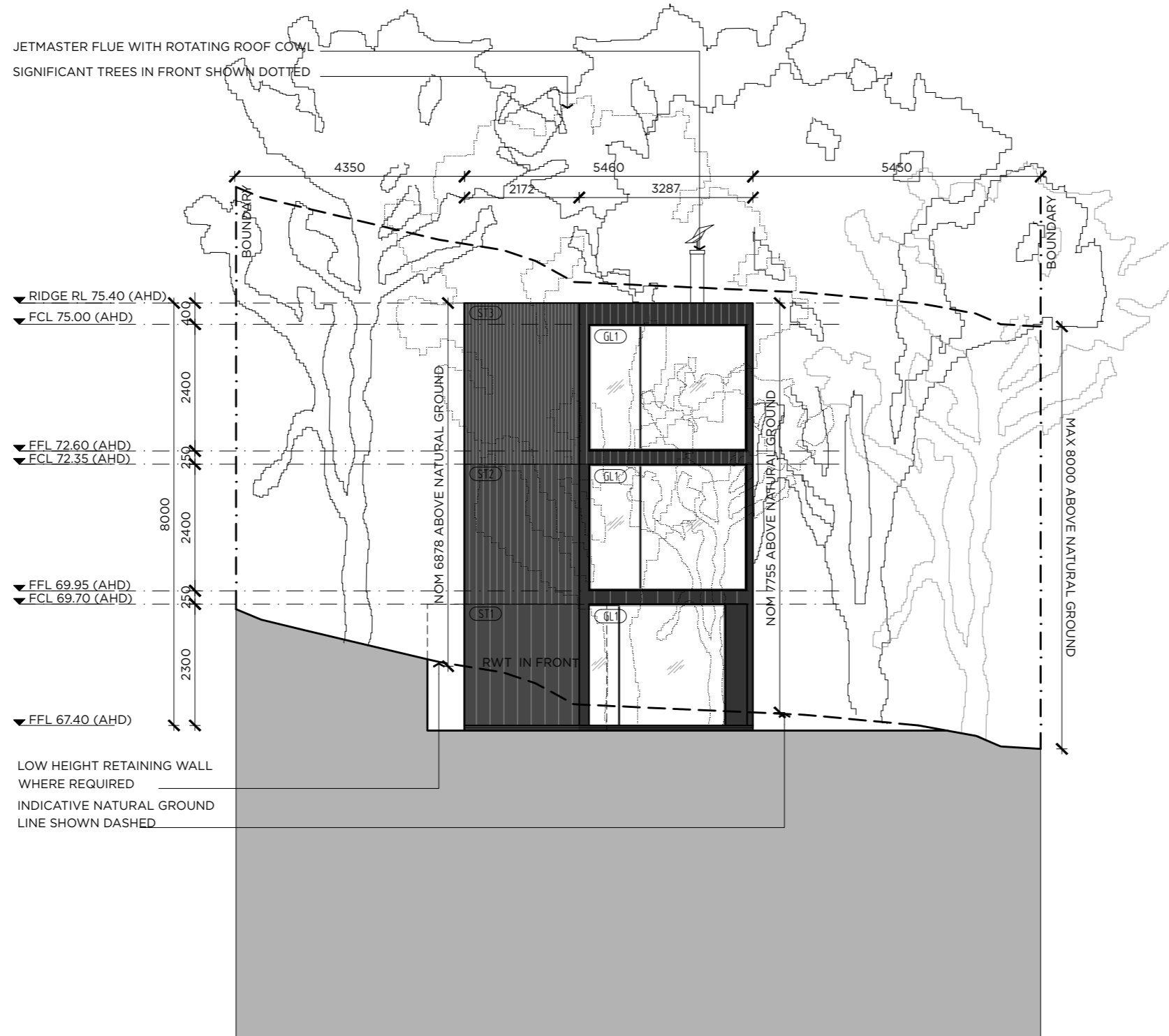
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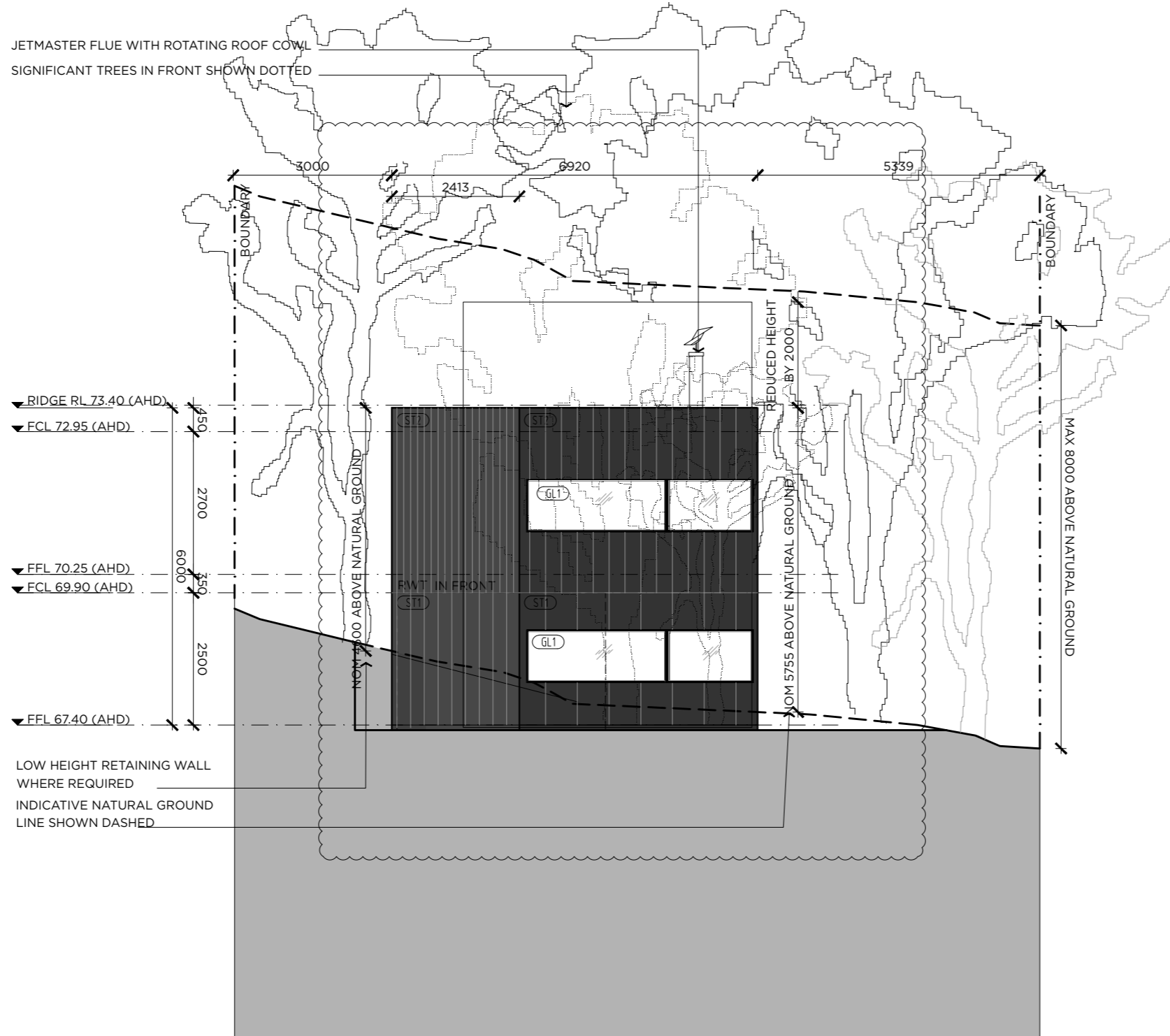
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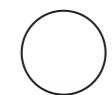
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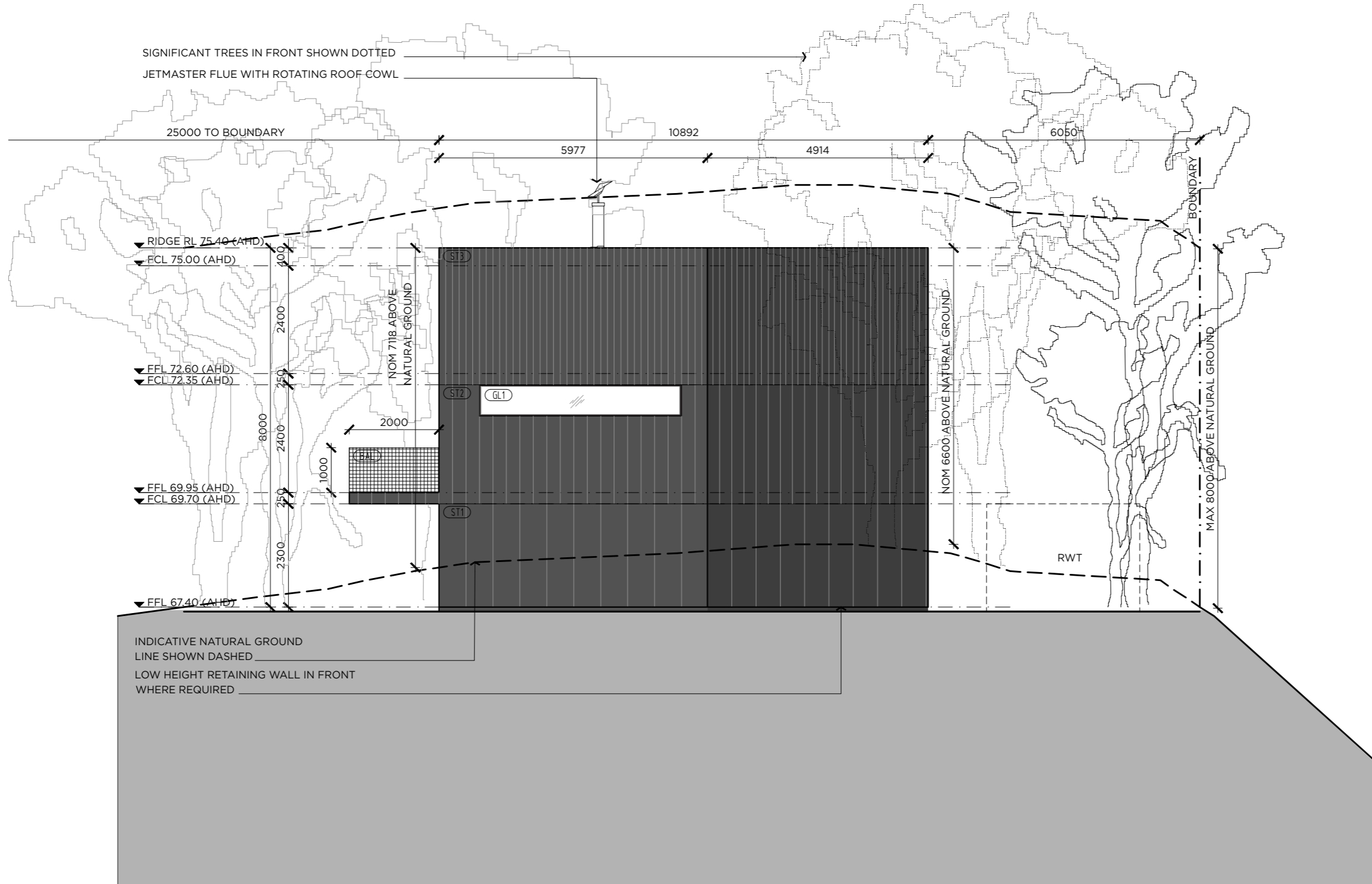
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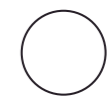
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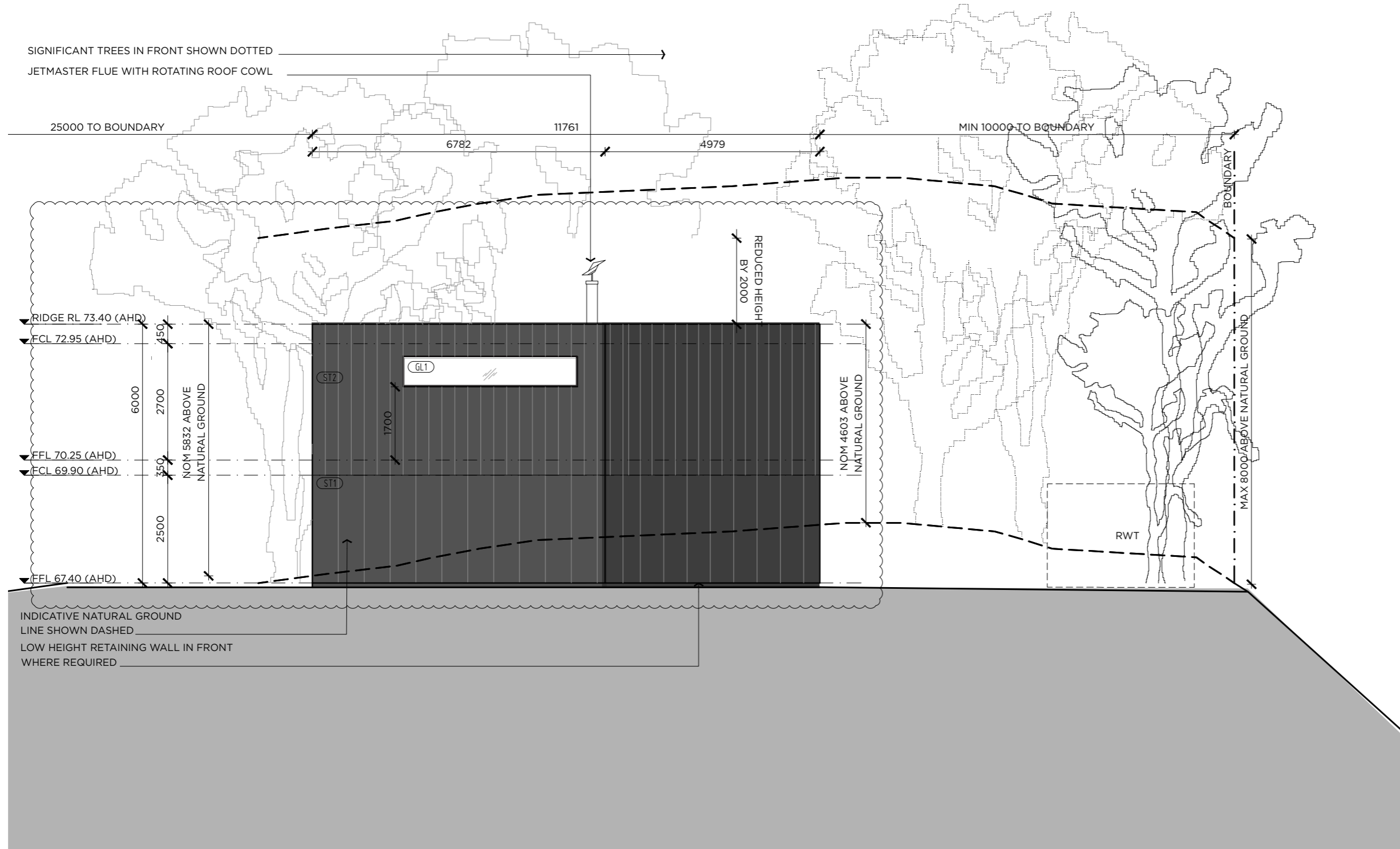
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PROJECT
CARA COURT

LOCATION
9 CARA COURT
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AUSTRALIA

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TITLE
**3D PERSPECTIVE
EXTERNAL VIEW 1
PREVIOUS**

SCALE
NTS

DATE
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PROJECT
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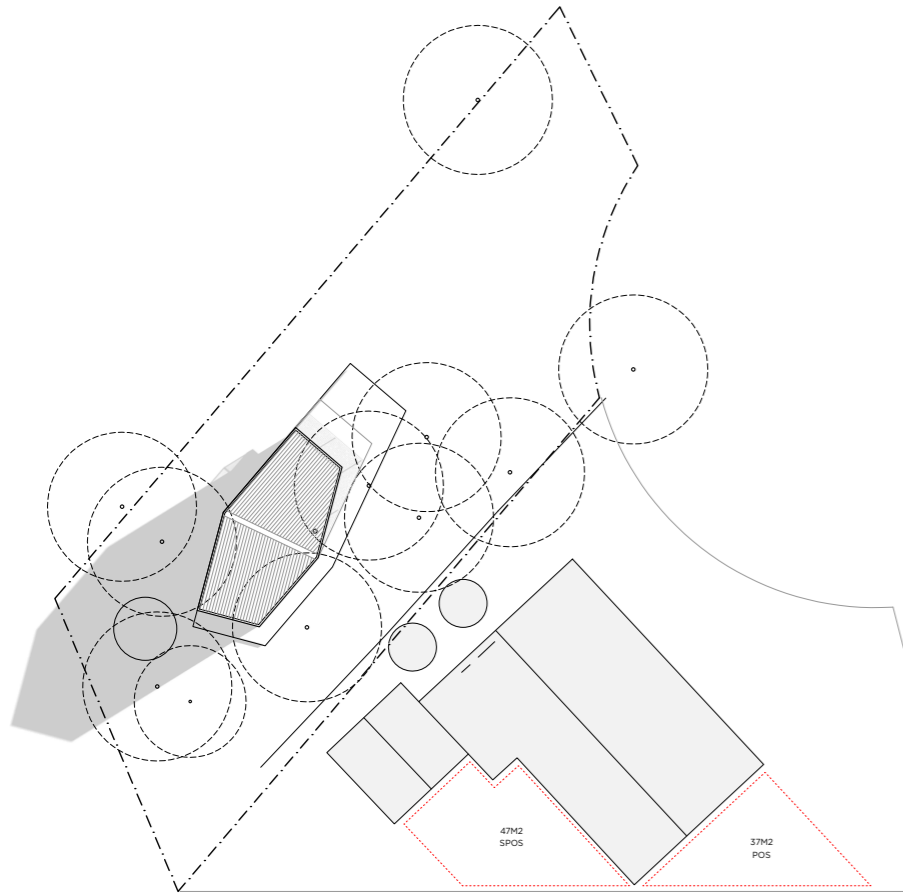
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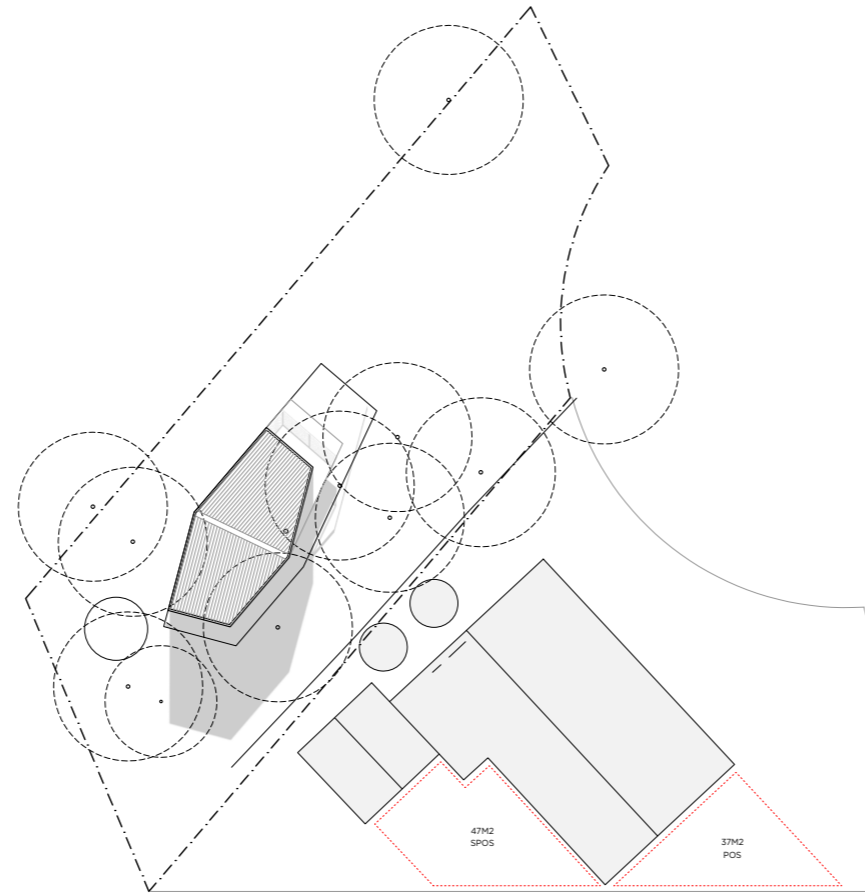
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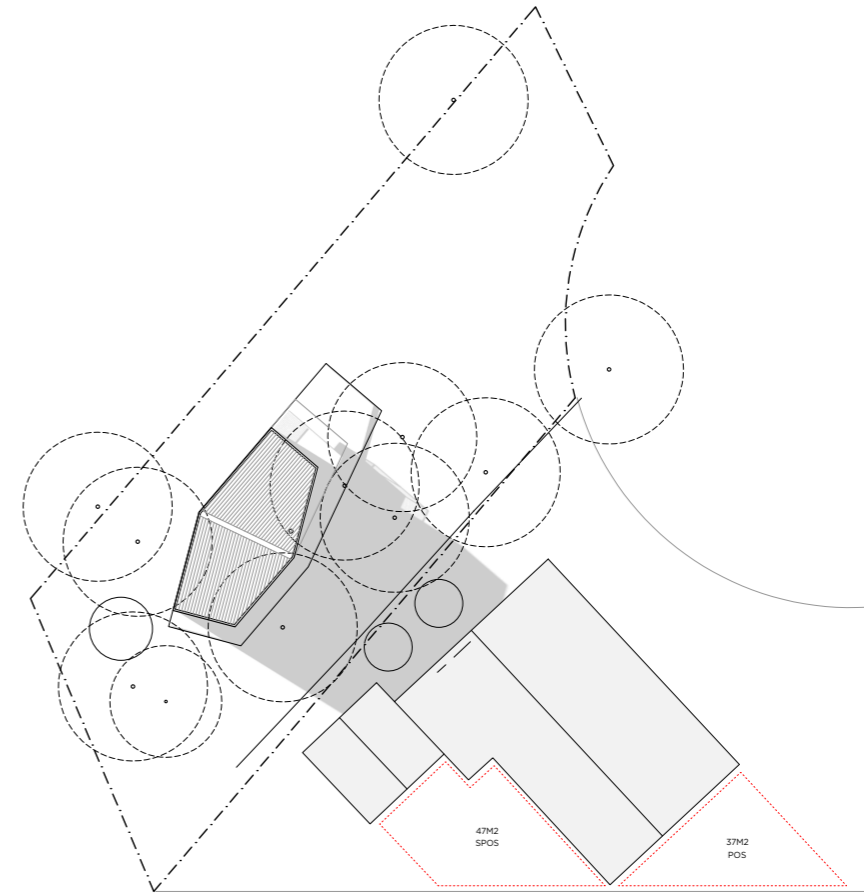
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9AM SEPTEMBER 22ND



12PM SEPTEMBER 22ND



3PM SEPTEMBER 22ND

PROJECT
CARA COURT

LOCATION
9 CARA COURT
KENNETT RIVER, VIC, 3234
AUSTRALIA

CLIENT
MADELEINE & NICK

TITLE
SHADOW DIAGRAMS

SCALE
NTS

DATE
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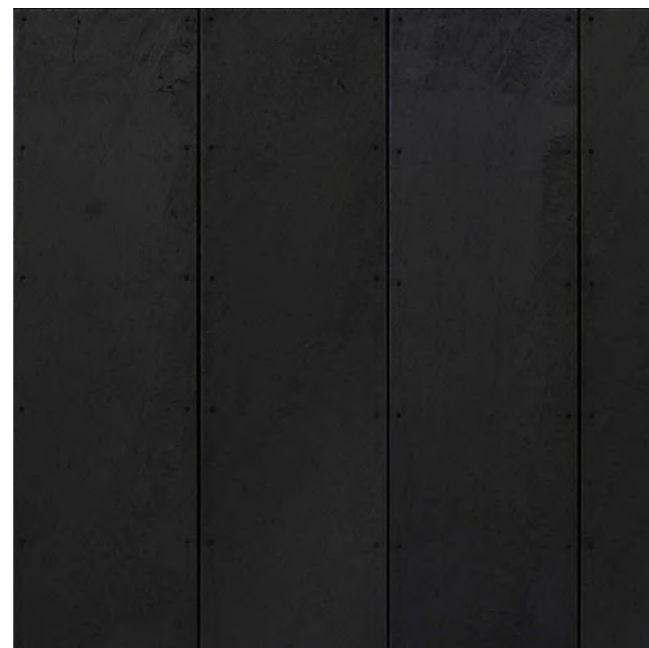
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(RF) METAL DECK ROOF SHEET



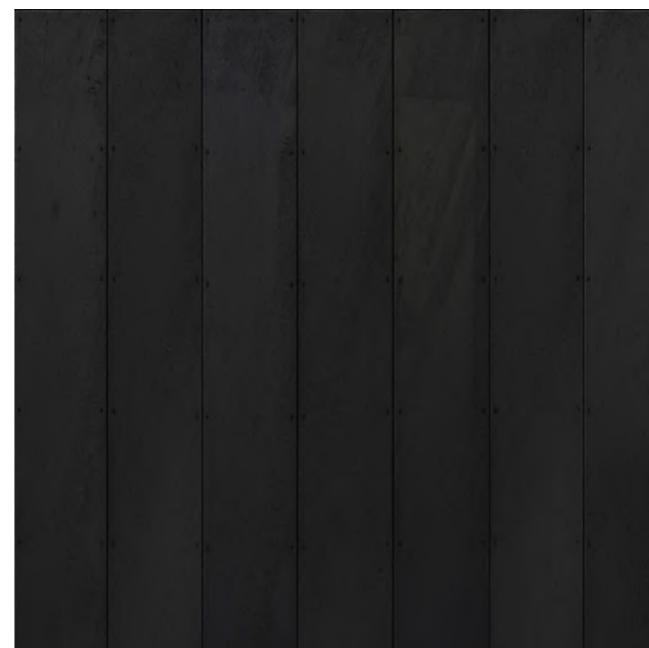
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(ST1) EXTERNAL CLADDING - OPTION



COLORBOND INTERLOCKING CLADDING PANEL COLORBOND NIGHTSKY OR SIMILAR- PROPOSED MATERIAL TO MEET BAL FIRE REQUIREMENTS, PROFILE 1 (WIDE)

(ST2) EXTERNAL CLADDING - OPTION



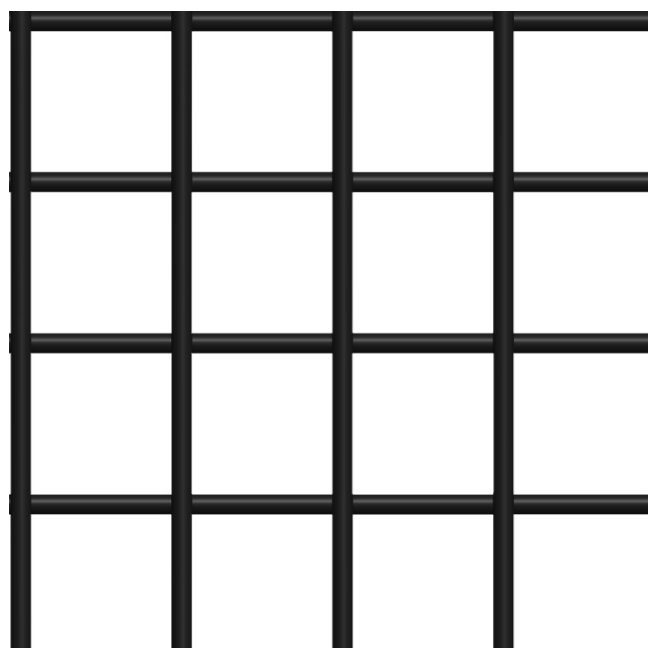
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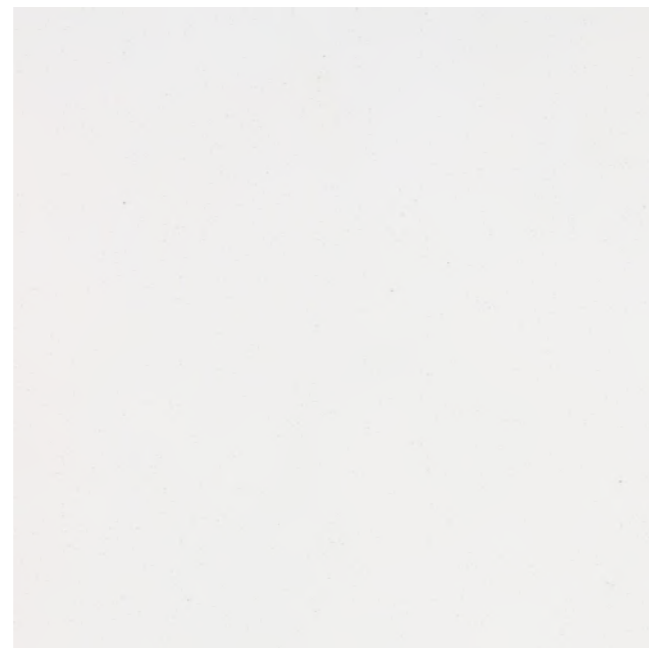
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(BAL) BALUSTRADE



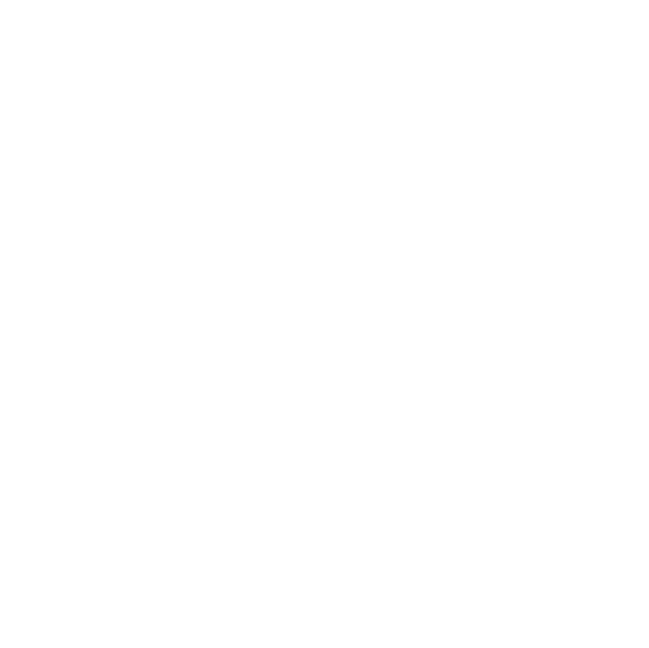
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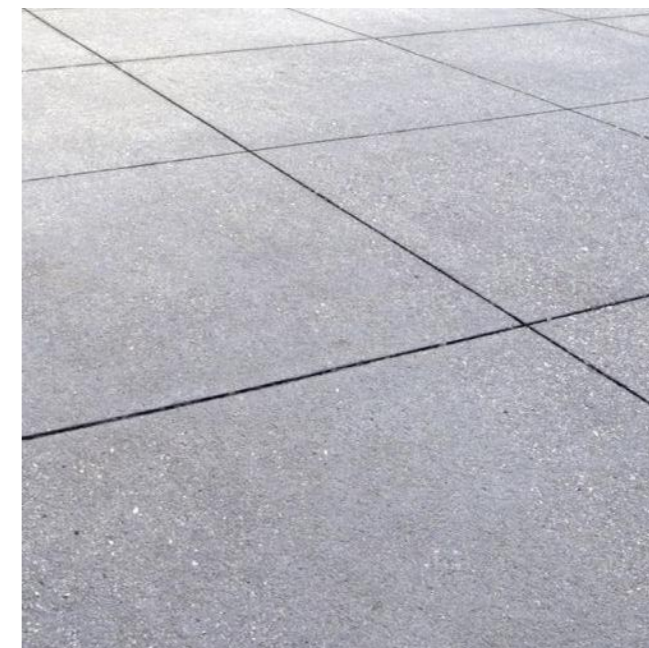


WHITE PAINT FINISH TO FC SHEET SOFFITS

(TM1) EXTERNAL DECK - GROUND/BALCONY



(PA) EXTERNAL DECK - GROUND



CONCRETE PAVERS TO EXTERNAL DECKS

PROJECT
CARA COURT

LOCATION
9 CARA COURT
KENNETT RIVER, VIC, 3234
AUSTRALIA

CLIENT
MADELEINE & NICK

TITLE
MATERIAL SCHEDULE

SCALE
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PROJECT
9 CARA COURT

TITLE
**PLANNING REPORT
TPO2**

LOCATION
9 CARA COURT,
KENNETT RIVER VIC
AUSTRALIA, 3234

DATE
20 AUGUST 2018

JOB NO.
A0.30/ CARA COURT /1706

**MATT GOODMAN
ARCHITECTURE OFFICE**

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2. NEIGHBOURHOOD CHARACTER OVERLAY - SCHEDULE 1 (NC01)
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4. SIGNIFICANT LANDSCAPE OVERLAY - SCHEDULE 2 (SL02)
5. EROSION MANAGEMENT OVERLAY - (EM01)
6. BAL RESPONSE (BMO)
7. SURROUNDING EXISTING CONDITIONS
8. VISUAL IMPACT STUDY

APPENDIX 1 - ARCHITECTURAL PLANS

1. INTRODUCTION

This application seeks approval for a planning permit to build a multi-storey dwelling including rainwater storage, wastewater system and effluent field on a vacant lot at 9 Cara Court, Kennett River. The property contains a moderate cover of native vegetation, including 12 significant trees. The permit will require the removal of 4 trees and a number of shrubs currently located on the site.

1a. ZONE

The subject site is located within the TOWNSHIP ZONE (TZ)

1b. OVERLAYS

- BMO - BUSHFIRE MANAGEMENT OVERLAY
- DD04 - DESIGN AND DEVELOPMENT OVERLAY (SCHEDULE 4)
- EM01 - EROSION MANAGEMENT OVERLAY (SCHEDULE 1)
- NC01 - NEIGHBOURHOOD CHARACTER OVERLAY (SCHEDULE 1)
- SL02 - SIGNIFICANT LANDSCAPE OVERLAY (SCHEDULE 2)



2. NEIGHBOURHOOD CHARACTER OVERLAY

54.01 NEIGHBOURHOOD AND SITE DESCRIPTION

Cara Court is a narrow street that runs in a North - South direction 60+m above the ocean parallel to the Great Ocean Road, terminating in a quiet caldersac. Neighbouring dwellings are nestled within the sloping topography and dense native vegetation, with momentary vista views of the ocean between some of the dwellings.

The neighbouring dwellings range from classic 1960 and 1970's original beach houses that utilised very simple and small built forms, through to large, multi storey modern designs that had been recently built or renovated in various styles, with no single Architectural style predominate in the area.

The vacant lot at 9 Cara Court, is accessed via a steep driveway, arriving at a flat plateau which once accomodated a caravan. The site contains nurnmoreous significant trees, 12m+ in height, which contribute greatly to the character of the densly vegetated area.

The location of the site, perched partially on a rise, provides filtered views toward Bass Straight to the North/East and toward the Kennett River Township, carvan park and distant landscape beyond to the South/West. The site has a significant fall from the rear of the block toward the West, rapidly dropping down to Kennett River to south, over 50m below. This typography is typical of most properties abutting bushland on the southern side of Kennett River Precinct 1.

Distant views of the site are concealed by the significant trees, which present as an unbroken canopy. Views of the site from Cara Court are also minimal due the dead end nature of the caldersac and the densely packed shrubs which border the sites street frontage. Both of these conditions provide the site with a seemingly tranquile and remote sensation.



2. NEIGHBOURHOOD CHARACTER OVERLAY

54.01-2 DESIGN RESPONSE

The proposed dwelling has been designed around the Clients desire to retain as many of the existing significant trees and understorey vegetation on the site as possible. To do so the proposed building footprint has been minimised significantly (46m²) when compared to footprints of many contemporary developments.

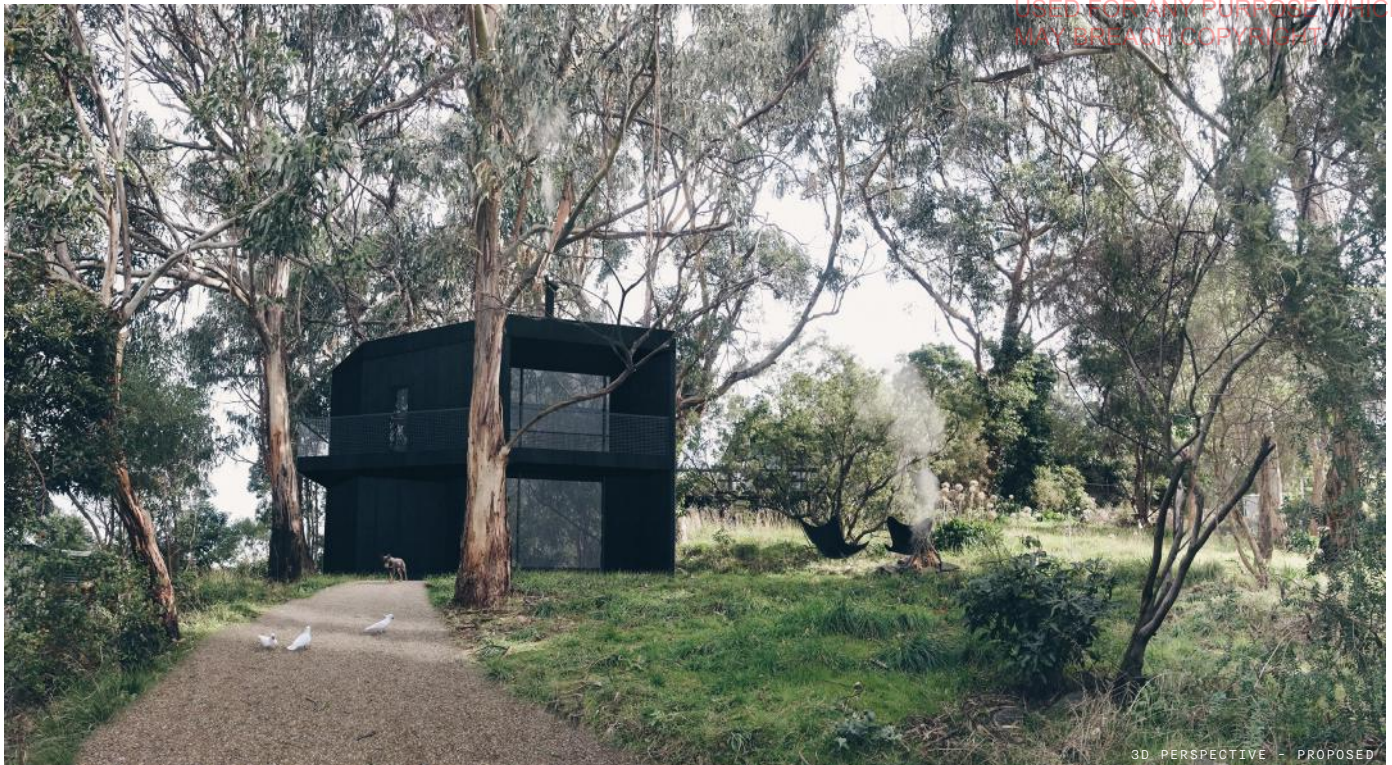
By making use of the existing plateau the 2 bedroom dwelling can be accommodated with the removal of only **three to four significant trees**. **The proposed dwelling has max height of 6m**, is sited away from Cara Court and away from the prominent ridgeline, concealed below the established mature tree canopy, all to ensure that the proposal remains recessive in the landscape.

(refer to Part 7: Visual Impact Study)

The main access to the proposed dwelling is on Ground level, which includes: A multipurpose indoor/outdoor/sitting room, a bathroom, utility spaces and one bedroom. The upper level contains one bedroom with ensuite, a Kitchen/Dining room, and an external balconies. Also sited on the ground level are water tanks, providing 10,000KL of water storage to the site (10KL of which is for CFA usage).

Despite its generous design, care has been taken to ensure the footprint doesn't exceed **65m²**. The form of the proposed dwelling ensures the impact on surrounding view lines, overshadowing and overlooking is minimized.

The proposed east-west layout maximises northern sunlight into the daytime livingrooms; takes advantage of views toward Kennett River and the ocean; and reduces to the building's footprint in order to minimise impact on the existing vegetation and the surrounding environment.



54.01-2 DESIGN RESPONSE (CONT)

When viewed from the Cara Court, the proposed dwelling is barely visible through the surrounding trees. (refer to Part 8: Visual Impact Study) This is due to the proposed dwelling utilising a dark, matt, lightweight, metal cladding which both compliments the native vegetation and addresses the strict BAL requirements imposed on the site, ensuring that the dwelling visually recedes into the landscape. Simple honest building details ensure that the building itself is also visually recessive, with no ostentatious elements detracting from the surrounding environment.

Each room has a feature window which frames and focuses distant views of Kennett River Township and Bass Straight beyond. These glazed elements, along with the proposed cantilevered deck, articulate the facades, lightening the building's form. The window break up on the front facade has been designed to portray a double storey dwelling in order to belie the multi storey nature of the proposal (proposed in order to minimize the impact on the existing vegetation)

The proposed design allows for a sufficient effluent field and onsite water collection / storage, please see Land Capability Assessment by St Quentin.

The proposed design, in its recessive nature, respects the existing neighbourhood character and contributes to the preferred neighbourhood character by addressing the guidelines set out in the Neighbourhood Character Study - Kennett River 1 (By limiting the footprint size, building height, tree/vegetation removal and respecting view lines and neighbouring amenity.)

Due to creative siting, the proposal has no impact on the Great Ocean Road region's landscape. By minimising the disturbance to native trees on site and ensuring the proposed dwelling is unseen from all distant views, the Great Ocean Road remains the key visual feature of the area. (refer to Part 8: Visual Impact Study)



54.01-2 DESIGN RESPONSE (CONT)

The proposed max building height is 6m ensuring that the entire building volume sits below the 8m maximum height limit. Ensuring that vegetation remains the main feature of this area when viewed for close and distant view points. Understorey vegetation has also been retained, particularly along site boundaries; therefore no fencing is required.

The form, materiality and siting of the proposed dwelling is in keeping with the neighbourhood character outlined in NCO1. ensuring that there is sufficient openspace around the proposed dwelling to accomodate future vegetation growth.

The generous building setbacks reasonably reflect the neighbourhood character outlined in NCO1. The size & scale of the proposal has been minimized inline with the guidelines stated in the Neighbourhood character study - Kennett River precinct 1. The design response and the desire to retain the is certainly appropriate to the neighbourhood

- Standard A1 has been satisfied.

54.02-2 INTEGRATION WITH THE STREET OBJECTIVE

The proposed dwelling is orientated toward Cara Court, in order to capitalise on the ocean views North East. The existing understorey/bushes/shrubs are to be retained, No fences are proposed here.

- Standard A2 has been satisfied.

54.03-1 STREET SETBACK OBJECTIVE

The dwelling in this proposal meets the 7m setback from the street boundary fronting Cara Court. The front set backs of the surrounding buildings are extremely varied, with the proposed setback being decided upon based on the minimal impact on the existing vegetaion, making efficient use of the site.

This satisfies the NCO1's minimum 7m street setback policy.

- Standard A3 has been satisfied.

3. DESIGN & DEVELOPMENT OVERLAY

54.03-2 BUILDING HEIGHT OBJECTIVE

The building height objective is to ensure that the height of new buildings respects the existing or preferred neighbourhood character (please refer to Part 7 for surrounding existing conditions). Due to the desire to retain as many of the existing significant trees and as much understorey vegetation as possible, best efforts have been made to minimise the building footprint. In order to accommodate a functional 2 bedroom dwelling, a double storey dwelling has been proposed.

Numerous planning permits have been granted in Kennett River, Wye River and Separation Creek, for proposed dwellings, which due to difficult site conditions (eg. sloping sites) greatly exceed the 8m Max building height Objective. In instances where this height has been exceeded, permits have also been granted for multi storey dwellings. We hope that the Council will review our application on its merits and see that although the site is not located on a steep slope, that the thin proportions of the site, the minimal flat area available to accommodate a dwelling and the intention to retain numerous significant trees on the site, all combined to create extremely difficult site conditions.

The maximum height building height of 6m is well below the max 8m limit, therefore the building height objective has been met

- Standard A4 has been satisfied.

54.03-3 SITE COVERAGE OBJECTIVE

The site area is 660m²

The proposed footprint is 65m²

The proposed site coverage is 9.8%

NC01 requires maximum site coverage of 20%.

- Standard A5 has been satisfied.

54.03-4 PERMEABILITY OBJECTIVES

The proposed roof area and impervious portion of the access way is 110m².

The permeability area is 84%, which meets the clause 54.03-4 requirement of min 20%.

- Standard A6 has been satisfied.

54.03-5 ENERGY EFFICIENCY PROTECTION OBJECTIVES

The large north facing window ensures that south facing living room on level 1 will have solar access for Passive solar gain. All glazing in the proposed dwelling is double glazed and the high glazing to floor area ratio will ensure that excellent natural light and ventilation are achieved. Best practice bulk insulation will be used in all envelope elements: R2.1 To the subfloor, R3.2 For the Roof, and R2.5 For the walls. Energy efficiency opportunities for neighbouring properties will not be affected.

- Standard A7 has been satisfied.

54.03-6 SIGNIFICANT TREES OBJECTIVES

Only 3-4 significant trees are required to be removed in this proposal to meet the BMO requirements for BALFZ sites. 9 significant trees and numerous understorey bushes and shrubs will be retained.

- Standard A8 has been satisfied.

54.03-7 PARKING OBJECTIVE

The proposed driveway retains the existing driveway and cross over and provides stacked parking spaces for at least 3 cars.

- Standard A9 has been satisfied.

54.04 AMENITY IMPACTS

54.04-1 SIDE AND REAR SETBACKS OBJECTIVE

The proposed rear setback varies with a min of 6m.

NC01 requires a rear setback of 5m. A 10m setback is proposed

The proposed building is positioned at the highest / flatest point of the site to maximise opportunities for views toward Bass Strait, and the Kennett River Township, minimise site excavation/retention. The proposed dwelling is below the tree canopy. The proposed side setbacks to both side boundaries is min 3m, in accordance with NC01.

- Standard A10 has been satisfied.

54.04-2 WALLS ON BOUNDARIES OBJECTIVE

No walls on boundaries are proposed.

- Standard A11 has been satisfied.

54.04-3 DAYLIGHT TO EXISTING WINDOWS OBJECTIVE

No habitable or non habitable windows to neighbouring properties are effected by the proposed development. (refer to shadow diagrams)

- Standard a12 has been satisfied.

54.04-4 NORTH-FACING WINDOWS OBJECTIVE

There are no existing north-facing windows which are effected by the proposed development. (refer to shadow diagrams)

- Standard A13 has been satisfied.

54.04-5 OVERSHADOWING OPEN SPACE OBJECTIVE

The proposed development does not overshadow the private open space of the neighbouring properties. (refer to shadow diagrams)

- Standard A14 is satisfied.

54.04-6 OVERLOOKING OBJECTIVE

All neighbouring proposed windows do not overlook the neighbouring properties private open space / habitable windows. (refer to site plan)

- Standard A15 is satisfied.

54.05 ONSITE AMENITY AND FACILITIES

54.05-1 DAYLIGHT TO NEW WINDOWS OBJECTIVE

All proposed glazing provides adequate natural light to each habitable room. Minimum of 10% floor area is achieved in all habitable rooms with greater than 3m² clear to sky available.

- Standard A16 is satisfied.

54.05-2 PRIVATE OPEN SPACE OBJECTIVE

The proposal provides in excess of 650m² of private open space to the sides and rear of the dwelling. This is a sufficient area for recreation and any services the residents need, exceeding the requirement of at least 20% of the site.

- Standard A17 is satisfied.

54.05-3 SOLAR ACCESS TO OPEN SPACE OBJECTIVE

Private open space is located at the Northern, Eastern, Western and Southern sides of the dwelling. Due to its large expanse adequate solar access to this open space is provided.

- Standard A18 is satisfied.

54.06 DETAILED DESIGN

54.06-1 DESIGN DETAIL OBJECTIVE

The design of the proposed dwelling at 9 Cara Court respects the preferred neighbourhood character of the Township Zone of Wye River.

The proposed dwelling in its revised design is visually recessive and respectful of the vegetation that exists on the site, with all elements visually concealed behind & below the mature vegetation when viewed from key locations within the township. A reduced material palette, simple building details, use of glazing, and building colours that are subtle, combine to create a neutral and unobtrusive proposal which sits harmoniously in the quiet, coastal setting.

The design's sensitivity to the natural site ensures it does not exceed building footprint regulations, nor dominate the bushland setting. Importantly, the design ensures that the Kennett River's informal, open, spacious character created by the dominance of vegetation (which will regrow in future), low scale buildings and a lack of solid fencing is retained.

There is no undercover or enclosed parking on the site. The proposed landscaping works to the site will provide a denser bushland setting to the site, better complimenting the character of the town and further softening the unobtrusive appearance of the building from the street and adjoining properties.

- Standard A19 is satisfied.

54.06-2 FRONT FENCES OBJECTIVE

No front fence is proposed.

- Standard A20 is satisfied.

4. SIGNIFICANT LANDSCAPE OVERLAY

Only two significant trees are required to be removed in this proposal, with additional minor pruning for Fire Protection purposes.

5. EROSION MANAGEMENT OVERLAY SCHEDULE 1

Please see Landslip Risk Assessment and Land Capability Assessment reports by Assessing Geological Risk by St Quentin

6. BAL RESPONSE - BALFZ SITE

Please see BMO - Bush Fire Report by Hamish Allan Terramatrix.

- The understorey / grassland of this site will be managed to prevent fire risk to the property and to maintain the defensible space.
- Only native trees will be planted.
- 10,000kl static water supply will be provided to the property within 4m from the road (as per Site Plan).
- Routine maintenance of the property and vegetation will be conducted regularly to ensure the site is free from fire hazards.
- All building materials will comply with Australian Standard AS3959-2009.

5 Ridge Dr, viewed from Cara Court



5 Ridge Dr, viewed from Ridge Dr



11 Cara Cr, viewed from Cara Court



24 Cassidy Dr
Dominant form viewed from street in Precinct 1



6A Cassidy Dr
Dominant form viewed from street in Precinct 1



8 Ridge Dr, viewed from Ridge Dr
Dominant form viewed from street in Precinct 1

7. SURROUNDING EXISTING CONDITIONS & MULTI-STOREY PRECEDENT

The above images document local precedent where 3 Storey dwellings have been constructed within close proximity to the subject site, dwellings which exceed the 8m or 2 storeys, which ever is lesser, guideline stated in the building height objective.

The existing dwelling at 5 Ridge Drive (viewed from the entry to Cara Court), is clearly composed of three vertical storeys above natural ground level. The image of 11 Cara Court (the closest neighbouring dwelling to the north of the subject site) presents itself to Cara Court as a 3 storey structure. The extremely dominant form of this structure is intensified due to the extensive removal of significant trees and site excavation/terracing in order to accommodate the large dwelling

The bottom three images document multiple dwellings within Kennett River Precinct 1, which present themselves to the street as 2 and 3 storey structures.



7. VISUAL IMPACT STUDY - GREAT OCEAN ROAD

A Visual Impact Study was undertaken by MGAO on 23/10/2017 between 1-2pm, in order to review the Visual impact that the proposed development will have on the surrounding site, when viewed by travellers driving along the Great Ocean Rd.

8 Key locations along the Great Ocean Rd and within the Kennett River Township (noted above) were selected for the Visual Impact Study, The majority of these locations were selected due to their prominent aspect, providing vista views toward Kennett River, Others for the direct relationship between the Great Ocean Road and the subject site. Where visible, the 3D model has been overlaid on the image to give an impression of the Visual Impact of the proposed development.

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LOCATION 1 - KENNETT RIVER PRECINCT 2, BEACH CARPARK TOWARD PRECINCT 1 (NOT VISIBLE)

Subject site is concealed behind and below the existing significant trees and mature undergrowth. No impact when viewed from the Great Ocean Road. No Visual Impact from this location.



LOCATION 2 - KENNETT RIVER PRECINCT 2, CAMP GROUND / CAFE CORNER, TOWARD PRECINCT 1 (NOT VISIBLE)

Subject site is concealed behind and below the existing significant trees and mature undergrowth. No impact when viewed from the Great Ocean Road. No Visual Impact from this location.

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LOCATION 3 - KENNETT RIVER PRECINCT 2, TENNIS COURT TOWARD PRECINCT 1 (NOT VISIBLE)

Subject site is concealed behind and below the existing significant trees and mature undergrowth. Location is dominated by the presence of the flat open grassed area. No Visual Impact from this location.



LOCATION 4 - KENNETT RIVER PRECINCT 2, ROAD TO RIVER, TOWARD PRECINCT 1 (NOT VISIBLE)

Subject site is concealed behind and below the existing significant trees and mature undergrowth. Location is dominated by the presence of the flat open grassed area and River beyond. No Visual Impact from this location.

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NOT VISIBLE
NO IMPACT



LOCATION 5 - KENNETT RIVER PRECINCT 2, KENNETT RIVER BRIDGE, TOWARD PRECINCT 1 (NOT VISIBLE)

Subject site is concealed behind and below the existing significant trees and mature undergrowth. Location is dominated by the presence of the River. No impact on the Great Ocean Road. No Visual Impact from this location.

NOT VISIBLE
NO IMPACT

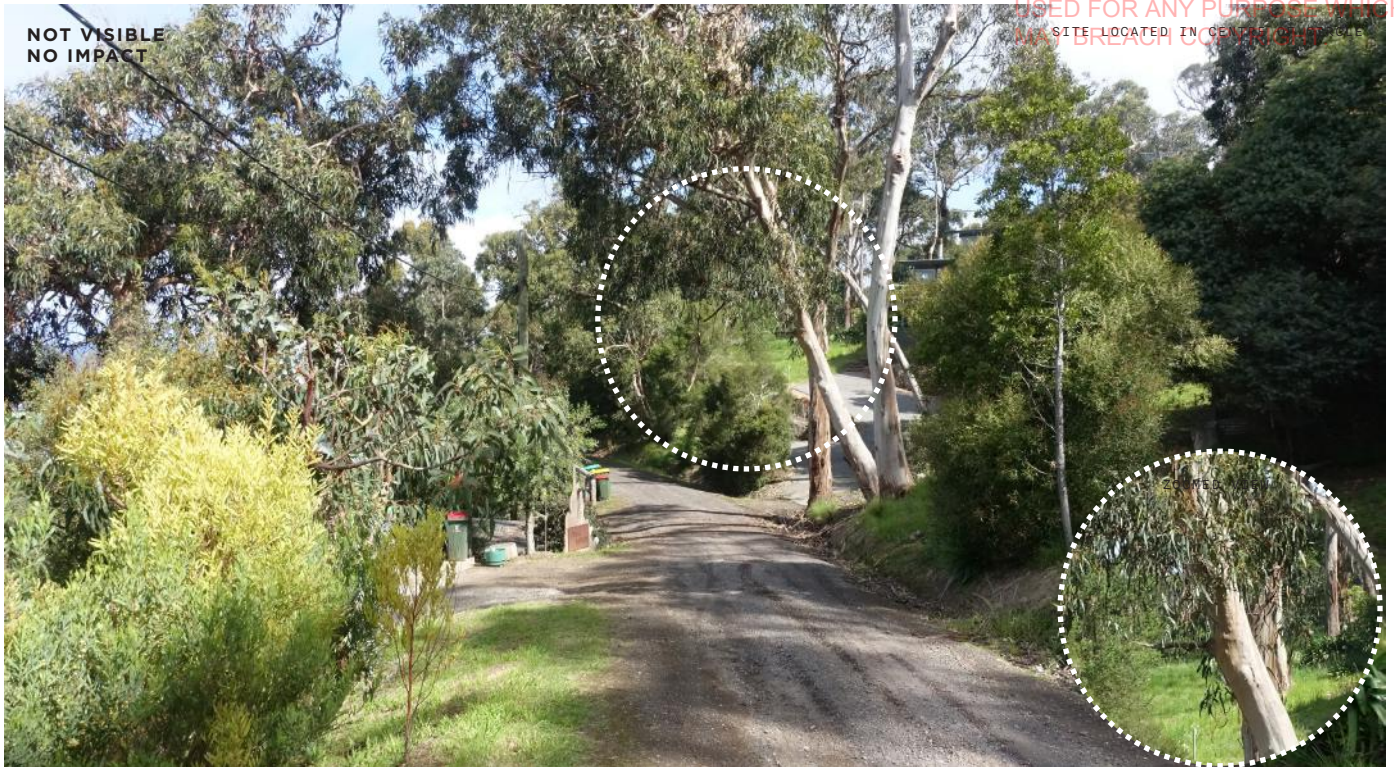
SITE LOCATED IN CENTRE OF CIRCLE



LOCATION 6 - KENNETT RIVER BEACH, TOWARD PRECINCT 1 (NOT VISIBLE)

Subject site is concealed behind and below the existing significant trees and mature undergrowth. Location is dominated by the presence of the River and Ocean. No impact on the Great Ocean Road. No Visual Impact from this location.

**MATT GOODMAN
ARCHITECTURE OFFICE**



LOCATION 7 - ENTRY TO CARA COURT (NOT VISIBLE)

Subject site is concealed behind and below the existing significant trees and mature undergrowth. Location is dominated by the presence of foreground vegetation and neighbouring 2 & 3 storey dwellings. No Visual Impact from this location.



LOCATION 8 - CARA COURT DIRECTLY IN FRONT OF SUBJECT SITE (PARTIALLY VISIBLE)

Subject site is partially concealed behind shrubs and surrounded by existing significant trees which are proposed to be retained. Location is dominated by the presence of foreground vegetation and neighbouring 2 & 3 storey dwellings. No Visual Impact from this location.

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APPENDIX A - REVISED ARCHITECTURAL PLANS

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Bushfire Management Statement

for the development of a
dwelling at 9 Cara Court
Kennett River VIC 3234

Prepared for
Nicholas Thompson

August 2019

WWW.TERRAMATRIX.COM.AU

Terramatrix project: Thompson-2019-01 BMO-Kennett River

Cover Image: Looking southwest into the site from Cara Court.

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Version Control

Version	Date	Comments	Name
0.1	27/08/2019	Analysis, mapping and report compilation	Hamish Allan Manager, Bushfire Planning and Design
0.1	27/08/2019	Peer review	Jon Boura Managing Director
1.0	28/08/2019	Bushfire Management Statement (BMS)	To client

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1 Introduction

This report has been prepared for Nicholas Thompson, to show how the proposed development of a dwelling and associated works at 9 Cara Court, Kennett River VIC 3234, responds to the Victorian planning and building controls that relate to bushfire, specifically the requirements of Clause 13.02 *Bushfire*, Clause 44.06 *Bushfire Management Overlay* (BMO) and associated Clause 53.02 *Bushfire Planning* in the Colac Otway Planning Scheme.

The site is currently an undeveloped lot in the Township Zone (TZ), within the settlement boundary. The development proposal is for a dwelling to be constructed on the site, with associated works including driveway and private bushfire shelter. Accordingly, this report includes a response to the applicable objectives and approved measures for the development of a single dwelling in a residential zone at Clause 53.02-3 (Colac Otway Planning Scheme, 2018a).

The property is within a declared Bushfire Prone Area (BPA) and is covered by the BMO. In accordance with the application requirements of Clause 44.06 (Colac Otway Planning Scheme, 2018b), this report includes:

- A Bushfire Hazard Site Assessment, including a plan that describes the bushfire hazard within 150m of the site in accordance with the site assessment methodology of AS 3959-2018¹ *Construction of buildings in bushfire-prone areas* and Clause 44.06; and
- A Bushfire Management Statement (BMS), detailing how the development responds to the bushfire risk and the requirements and objectives of Clauses 44.06 and 53.02.

This report also includes a Bushfire Management Plan (BMP) consistent with the CFA's standard permit conditions and BMP guidance (CFA, 2017).

Additionally, due to the need to demonstrate that the development appropriately prioritises the protection of human life as required by the Planning Policy Framework, this report also provides a response to Clause 13.02 including consideration of the broad, local and neighbourhood landscape risk, including a Bushfire Hazard Landscape Assessment and plan.

The report has been prepared consistent with guidance provided in the technical guide *Planning Permit Applications – Bushfire Management Overlay* (DELWP, 2017), additional CFA guidance for high risk landscapes (CFA 2018), and guidance for assessing and responding to bushfire risk at Clause 13.02 in Planning Advisory Note 68 *Bushfire State Planning Policy Amendment VC140* (DELWP, 2018a).

¹ AS 3959-2009 was superseded by AS 3959-2018 in November 2018 and was invoked in the new National Construction Code on 1st May 2019. Accordingly, all references in this report to AS-3959-2009 have been amended to refer to the 2018 version of the standard.

Address:	9 Cara Court, Kennett River VIC 3234
Property size:	640 m ²
Local Government Area:	Colac Otway Shire Council
Zone/s	Township Zone and Schedule (TZ)
Overlay/s	Bushfire Management Overlay (BMO) Design and Development Overlay - Schedule 4 (DDO4) Neighbourhood Character Overlay - Schedule 1 (NCO1) Significant Landscape Overlay - Schedule 2 (SLO2) Erosion Management Overlay - Schedule 1 (EMO1)
Directory reference:	VicRoads 101 F4
Site assessment date:	3/04/2019
Assessed by:	Hamish Allan

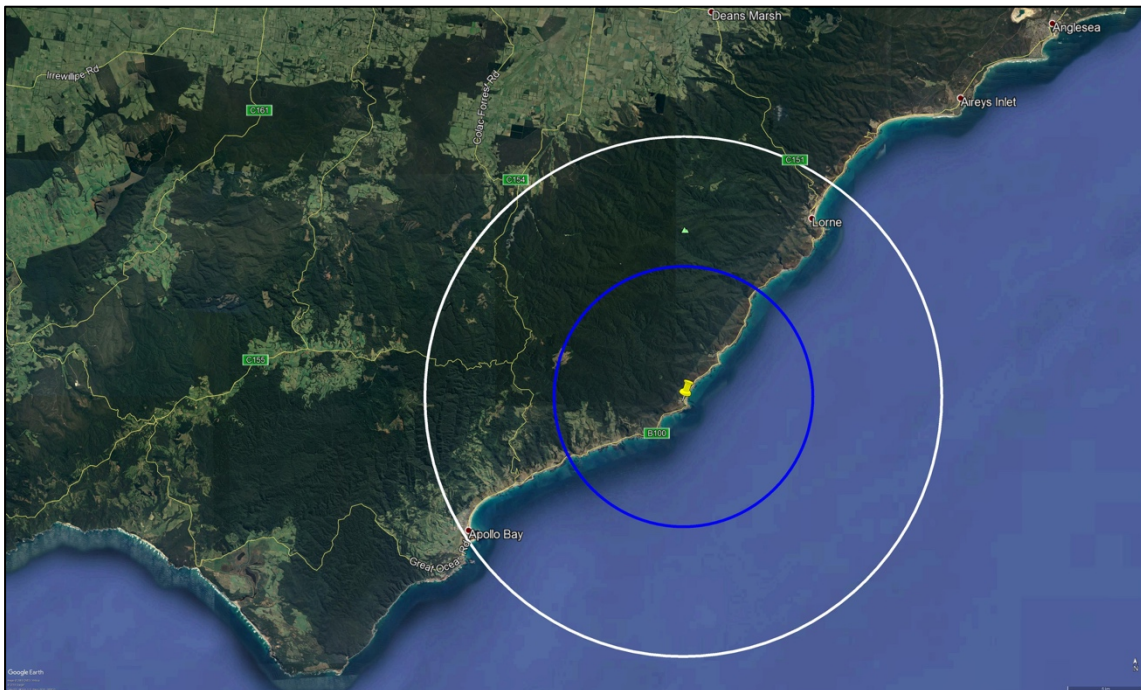


Figure 1 – Site location and landscape context (site shown with yellow pin, 10km buffer of site in blue outline and 20km buffer in white outline) (Image CNES/Airbus © 2018 Google).

2 Bushfire planning and building controls

This section summarises the applicable planning and building controls that relate to bushfire.

2.1 Clause 13.02 Bushfire

Clause 13.02 has the objective '*To strengthen the resilience of settlements and communities to bushfire through risk based planning that prioritises the protection of human life*' (Colac Otway Planning Scheme, 2018c). The policy must be applied to all planning and decision making under the Planning and Environment Act 1987, relating to land which is:

- Within a designated Bushfire Prone Area;
- Subject to a Bushfire Management Overlay; or
- Proposed to be used or developed in a way that may create a bushfire hazard.

Clause 13.02 requires priority to be given to the protection of human life by:

- '*Prioritising the protection of human life over all other policy considerations.*
- '*Directing population growth and development to low risk locations and ensuring the availability of, and safe access to, areas where human life can be better protected from the effects of bushfire.*
- '*Reducing the vulnerability of communities to bushfire through consideration of bushfire risk in decision-making at all stages of the planning process*' (Colac Otway Planning Scheme, 2018c).

Key strategies are stipulated in Clause 13.02, which require that strategic planning documents, planning scheme amendments and development plan approvals properly assess bushfire risk and include appropriate bushfire protection measures. This also applies to planning permit applications for:

- Subdivisions of more than 10 lots;
- Accommodation;
- Education centre;
- Emergency services facility;
- Hospital;
- Indoor recreation facility;
- Major sports and recreation facility;
- Place of assembly; and
- Any application for development that will result in people congregating in large numbers.

A response to the applicable strategies of Clause 13.02 is provided in Section 5.1 of this report.

Development should not be approved where '*...a landowner or proponent has not satisfactorily demonstrated that the relevant policies have been addressed, performance measures satisfied or*

bushfire protection measures can be adequately implemented' (Colac Otway Planning Scheme, 2018c).

As a planning permit application that will result in the development of land for accommodation, the use and development control strategy in Clause 13.02 requires the assessment of the proposal to:

- *'Consider the risk of bushfire to people, property and community infrastructure.*
- *Require the implementation of appropriate bushfire protection measures to address the identified bushfire risk.*
- *Ensure new development can implement bushfire protection measures without unacceptable biodiversity impacts'* (Colac Otway Planning Scheme, 2018c).

This report demonstrates that the risk has been appropriately considered at the broader, local, neighbourhood and site scale, as stipulated in Clause 13.02 and Clause 44.06. As identified in Section 4, the site is in a significant bushfire risk location and without appropriate mitigation measures the development could be exposed to significant levels of radiant heat, flame contact, ember attack, smoke and wind. However, mitigation measures that exceed the approved measures for BMO compliance have been proposed (and can be practically implemented) to reduce these potential impacts to a level deemed acceptable by the approved measures in Clause 53.02 (see Sections 5.2 and 5.3).

It is noted that in accordance with Planning Advisory Note 68, if a planning permit is required for the use or development under Clause 44.06 *Bushfire Management Overlay*, then the use and development control strategy at Clause 13.02 is addressed through the relevant application requirements and decision guidelines in Clause 53.02 (DELWP, 2018a). A response to the Clause 53.02 requirements is provided as the Bushfire Management Statement in Section 5.2.

2.2 Clause 21 Municipal Strategic Statement (MSS)²

The 'Environmental features' theme at Clause 21.02-2 'Land Use Vision' in the MSS, identifies that *'Development will respond to environmental risks such as bushfire, flooding, landslip, erosion and salinity'* (Colac Otway Planning Scheme, 2014).

Further, Clause 21.03-6 'Kennett River, Wye River and Separation Creek', identifies that *'Future development within the townships should respond appropriately to a range of acknowledged environmental constraints including land slip, wildfire threat, coastal inundation and erosion, storm water management, water supply and effluent disposal'* (Colac Otway Planning Scheme, 2013a).

² It is noted that the Local Planning Policy Framework (LPPF) will be translated into the PPF as the Municipal Planning Strategy, as proposed by VC148 (DELWP, 2018b). However, at the time of preparing this report, the LPPF and Municipal Strategic Statement (MSS) are components of the Colac Otway Planning Scheme.

Similarly, one of the strategies in Clause 21.03-8 'Smaller Townships', is to *'Otherwise generally restrict the expansion of communities in potable water supply areas and areas subject to or at risk of landslip, high fire risk and flooding'* (Colac Otway Planning Scheme, 2013b).

2.3 Clause 71.02-3 Integrated Decision Making

Clause 71.02-3 states that planning and responsible authorities should endeavour to integrate policies and balance conflicting objectives in favour of net community benefit and sustainable development. However, in bushfire affected areas, the protection of human life must be prioritised over all other policy considerations (Colac Otway Planning Scheme, 2018d).

2.4 Bushfire Management Overlay

The purposes of Clause 44.06 *Bushfire Management Overlay* (BMO) are:

- *'To implement the Municipal Planning Strategy and the Planning Policy Framework.*
- *To ensure that the development of land prioritises the protection of human life and strengthens community resilience to bushfire.*
- *To identify areas where the bushfire hazard warrants bushfire protection measures to be implemented.*
- *To ensure development is only permitted where the risk to life and property from bushfire can be reduced to an acceptable level'* (Colac Otway Planning Scheme, 2018b).

The BMO largely applies to patches of treed vegetation greater than 4ha in size, where head fire intensity has been modelled to be 30,000kW/m or more. It also extends over land 150m around those areas, based on research into house loss from bushfires which has found that 92% of house loss occurs within 150m of the bushfire hazard (DTPLI, 2013).

The BMO covers the site and surrounding landscape in all directions. This reflects BMO mapping introduced into the Colac Otway Planning Scheme by amendment GC13, which was gazetted on 3rd October 2017.

The BMO requires a planning permit for all subdivision of land, and buildings and works associated with the following uses (some exemptions apply):

- Accommodation (including a dependent person's unit);
- Education centre;
- Hospital;
- Industry;
- Leisure and Recreation;
- Office;
- Place of assembly;
- Retail premises;
- Service station;

- Timber production; and
- Warehouse.

A BMO application must be accompanied by:

- A 'Bushfire Hazard Site Assessment', including a plan that describes the bushfire hazard within 150m of the development in accordance with the site assessment methodology of *AS 3959-2018 Construction of buildings in bushfire-prone areas* and Clause 44.06;
- A 'Bushfire Hazard Landscape Assessment', including a plan that describes the bushfire hazard of the general locality more than 150m from the site³; and
- A Bushfire Management Statement, detailing how the development responds to the bushfire risk and the requirements of Clauses 44.06 and 53.02.

Section 3 of this report includes a bushfire hazard site assessment and plan and Section 4 includes a bushfire hazard landscape assessment and plan. Section 5.2 comprises a Bushfire Management Statement.

Clause 53.02 *Bushfire Planning* applies to BMO applications and contains:

- **Objectives:** An objective describes the outcome that must be achieved in a completed development.
- **Approved measures:** An approved measure meets the objective.
- **Alternative measures:** An alternative measure may be considered where the responsible authority is satisfied that the objective can be met. The responsible authority may consider other unspecified alternative measures.
- **Decision guidelines:** The decision guidelines set out the matters that the responsible authority must consider before deciding on an application, including whether any proposed alternative measure is appropriate.

Section 5.2 of this report details how the development responds to Clause 53.02.

2.5 Bushfire Prone Area (BPA)

The site is in a Bushfire Prone Area (BPA). BPAs are those areas subject to or likely to be subject to bushfire, as determined by the Minister for Planning.

In a BPA, the Building Act 1993 and associated Building Regulations 2018, through application of the National Construction Code (NCC), require bushfire protection standards for class 1, 2 and 3⁴

³ This requirement does not apply to a dwelling that includes all of the approved measures specified in Clause 53.02-3.

⁴ Class 1, 2 and 3 buildings are defined in the NCC and are generally those used for residential accommodation, including houses and other dwellings, apartments, hotels and other buildings with a similar function or use.

buildings, 'Specific Use Bushfire Protected Buildings'⁵ and associated class 10A buildings⁶ or decks. The performance requirement in the NCC for class 1 and associated class 10A buildings in a BPA, is that they must:

- '.. to the degree necessary, be designed and constructed to reduce the risk of ignition from a bushfire, appropriate to the —*
- (a) potential for ignition caused by burning embers, radiant heat or flame generated by a bushfire; and*
 - (b) intensity of the bushfire attack on the building'* (ABCB, 2019).

Compliance with AS 3959-2018 *Construction of buildings in bushfire prone areas* is 'deemed-to-satisfy' the performance requirement⁷ (ABCB, 2016).

The Victorian Building Regulations (2018) require that applicable buildings be constructed to a minimum Bushfire Attack Level (BAL)-12.5, or higher as determined by a site assessment or planning scheme requirement. A BAL is a means of measuring the severity of a building's potential exposure to ember attack, radiant heat and direct flame contact. There are six BALs defined in AS 3959-2018, which range from BAL-LOW, which has no bushfire construction requirements to BAL-FZ (Flame Zone) where flame contact with a building is expected.

In a BPA, larger developments and certain vulnerable uses including Accommodation (see Section 2.1) are also required by Clause 13.02 *Bushfire* to:

- *'Consider the risk of bushfire to people, property and community infrastructure.*
- *Require the implementation of appropriate bushfire protection measures to address the identified bushfire risk.*
- *Ensure new development can implement bushfire protection measures without unacceptable biodiversity impacts'* (Colac Otway Planning Scheme, 2018c).

2.6 Other controls

2.6.1 Zoning

The TZ designation does not of itself have any significant bushfire safety implications. However, as a residential zone it allows for simplified application requirements and approved measures for a single dwelling application (as is proposed) in accordance with Clause 53.02-3 (see Section 5.2).

⁵ Specific Use Bushfire Protected Buildings are defined in the Victorian *Building Regulations 2018*, they generally comprise 'vulnerable' uses and include schools, kindergartens, childcare facilities, aged care facilities and hospitals.

⁶ Class 10a buildings are defined in the NCC as non-habitable buildings including sheds, carports, and private garages.

⁷ The *NASH Standard – Steel Framed Construction in Bushfire Areas* is also deemed to satisfy the performance requirement.

2.6.2 Overlays

Apart from the BMO, the other overlays affecting the site do not have direct implications for bushfire safety. However, their objectives and decision guidelines may constrain and/or require consideration of the impact of any proposed vegetation removal.

3 Bushfire hazard site assessment

3.1 Classified vegetation

Vegetation within the 150m assessment zone around the site has been classified in accordance with the BMO/AS 3959 methodology. Classified vegetation is vegetation that is deemed hazardous from a bushfire perspective.

The classification system is not directly analogous to Ecological Vegetation Classes (EVCs) but uses a generalised description of vegetation based on the AUSLIG (Australian Natural Resources Atlas: No. 7 - Native Vegetation) classification system. The classification is based on the mature state of the vegetation and the likely fire behaviour that it will generate.

3.1.1 Forest

Two large areas of tree and shrub vegetation to the west and east of the township and the site (generally southwest of Ridge Drive and east of Cassidy Drive as shown in Map 1), are classified as the Open Forest or Tall Open Forest vegetation types, in the Forest group of AS 3959. This type of vegetation comprises trees to 30 m high or taller at maturity, with 30%–70% foliage cover and an understorey of sclerophyllous low trees, tree ferns or shrubs (Standards Australia, 2018).



Figure 2 - Forest on the steep downslope to the southwest of the site.



Figure 3 – Looking north up Cassidy Drive, with Forest in view to the north and east.

3.1.2 Modified vegetation

‘Modified vegetation is vegetation that doesn’t fit into the vegetation classifications in AS 3959-2018 (sic) Construction of buildings in bushfire prone areas (the standard) because it:

- *has been modified, altered or is managed due to urban development, or gardening,*
- *has different fuel loads from those assumed in the standard,*
- *has limited or no understorey vegetation, or*
- *is not low-threat or low-risk vegetation as defined in the standard’ (Colac Otway Planning Scheme, 2018a).*

Modified vegetation may occur where fuel loads are higher than typical residential gardens and therefore the vegetation cannot be excluded as low-threat. However, because of the amount of disturbance and modification that has occurred and/or the pattern and configuration of the vegetation (e.g. small, fragmented patches and/or reduced or no understorey/surface vegetation), the fuel load and anticipated fire behaviour is likely to be different from that presumed in the BMO/AS 3959 methodology.

This type of vegetation may not produce a 100m wide fire front moving at a quasi-steady state rate of forward spread, as presumed in the BMO/AS 3959 methodology, but may generate radiant heat and localised flame contact that needs to be fully considered (DELWP, 2017).

The township area and neighbouring properties, generally to the north and east of the site, contains modified vegetation, due to the extent of remnant tree and shrub cover. Overall, it comprises an intergrading mix of low threat 'cultivated garden' areas and less managed 'bush gardens' (see Map 1). Where the modified vegetation grades into more open areas of cultivated gardens with sparser shrub cover, lawns and non-vegetated areas, it becomes low threat.

3.2 Excluded vegetation and non-vegetated areas

Areas of low threat vegetation and non-vegetated areas can be excluded from classification in accordance with Section 2.2.3.2 of AS 3959-2018, if they meet one or more of the following criteria:

- i. *'Vegetation of any type that is more than 100m⁸ from the site.*
- ii. *Single areas of vegetation less than 1 ha in area and not within 100m of other areas of vegetation being classified vegetation.*
- iii. *Multiple areas of vegetation less than 0.25 ha in area and not within 20 m of the site, or each other, or of other areas of vegetation being classified vegetation.*
- iv. *Strips of vegetation less than 20 m in width (measured perpendicular to the elevation exposed to the strip of vegetation) regardless of length and not within 20 m of the site or each other, or other areas of vegetation being classified vegetation.*
- v. *Non-vegetated areas, that is, areas permanently cleared of vegetation, including waterways, exposed beaches, roads, footpaths, buildings and rocky outcrops.*
- vi. *Vegetation regarded as low threat due to factors such as flammability, moisture content or fuel load. This includes grassland managed in a minimal fuel condition⁹, mangroves and other saline wetlands, maintained lawns, golf courses (such as playing areas and fairways), maintained public reserves and parklands, sporting fields, vineyards, orchards, banana plantations, market gardens (and other non-curing crops), cultivated gardens, commercial nurseries, nature strips and windbreaks' (Standards Australia, 2018).*

All vegetation that is within the defendable space of the proposed dwelling, which extends to the property boundary in all directions (see Map 4), will need to be managed as low threat vegetation, in accordance with the vegetation management specifications for defendable space stipulated in Table 6 to Clause 53.02 (see Appendix B).

Non-vegetated areas include the roads, driveways and structures within the 150m site assessment zone (see Map 1).

⁸ This distance extends to 150m in BMO areas.

⁹ Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack, recognisable as short-cropped grass for example, to a nominal height of 100mm (Standards Australia, 2018).

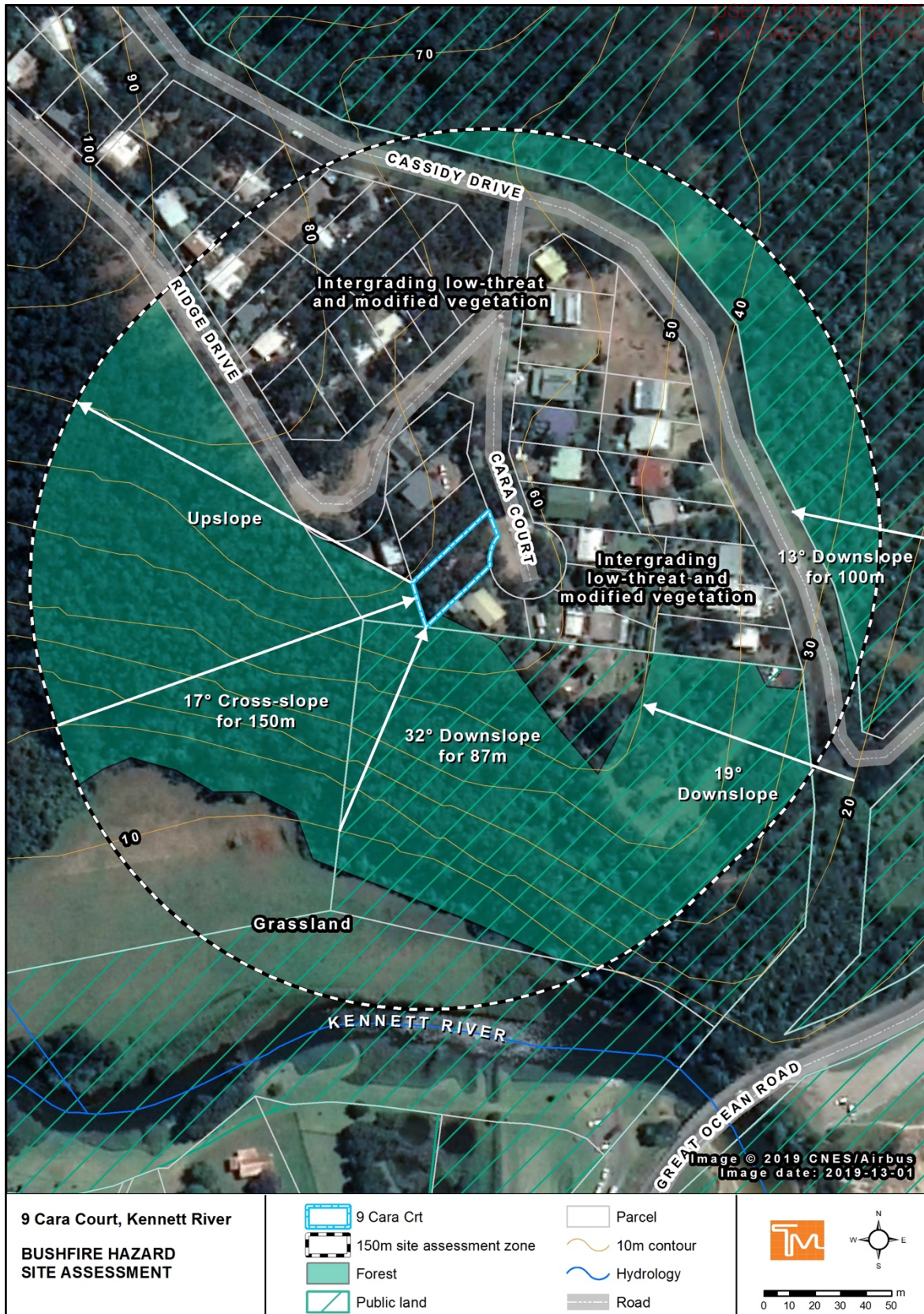
3.3 Topography

The 'effective slope' must be identified to determine the BAL and applicable defensible space distance. This is the slope of land under the classified vegetation that will most significantly influence the bushfire attack. Two broad types apply:

- Flat and/or Upslope - land that is flat or on which a bushfire will be burning downhill in relation to the development. Fires burning downhill (i.e. on an upslope) will generally be moving more slowly with a reduced intensity.
- Downslope - land on which a bushfire will be burning uphill in relation to the site. As the rate of spread of a bushfire burning on a downslope (i.e. burning uphill towards a development) is significantly influenced by increases in slope, downslopes are grouped into five classes in 5° increments from 0° up to 20°.

The site is towards the southeast (coastal) end of a ridge line that is oriented northwest to southeast and which slopes down to the coast. The northern residential area of the Kennett River settlement is located upon this ridge.

The topography within the 150m assessment zone and in the broader landscape (see Map 1) is steep and a contributor to intense fire behaviour. The very steep downslope to the southwest of the site has a gradient up to 32°, which significantly exceeds the maximum 20° downslope threshold for applying the 'default' defensible space distances in the tables to Clause 53.02-5 (see Section 5.2.2).



Map 1 – Bushfire Hazard Site Assessment Plan.

4 Bushfire Hazard Landscape Assessment

A bushfire hazard landscape assessment is not required for BMO applications to construct a single dwelling in a residential zone, that comply with all the requirements of Clause 53.02-3. However, the decision guidelines of Clause 53.02-3 include consideration of the Planning Policy Framework (PPF). Clause 13.02 in the PPF requires consideration of the bushfire hazard at the local and broader landscape scale; therefore, this section identifies landscape risk considerations for the development.

4.1 Location description

The Kennett River settlement is divided into northern and southern residential areas by the Kennett River. 9 Cara Court is located on the southern boundary of the northern residential area, which comprises a finger of residential development occupying a northwest-southeast ridgeline that slopes down to the coast.

To the south and west of the site, the land slopes steeply down to the Kennett River; beyond which is the flatter southern part of the Kennett River settlement (see Figure 1, Map 2 and Map 3). The river valley comprises a small floodplain at the coast, then quickly becomes a steep v-shaped valley with associated tributaries, that rises north and west into the Otway Ranges. The settlement is generally well vegetated, with dwellings nestled amongst remnant trees and patches of remnant understorey. Beyond the settlement in all directions, the land is heavily vegetated with coastal scrub and tall forests.

4.2 Landscape risk

Clause 13.02 stipulates that developments must properly assess bushfire risk, including consideration of the hazard (and the resultant risk) beyond the site level. The BMO also requires for applications that do not follow the Clause 53.02-1 pathway, that a Bushfire Hazard Landscape Assessment be prepared, which describes the bushfire hazard of the general locality more than 150m from the site (see Map 2).

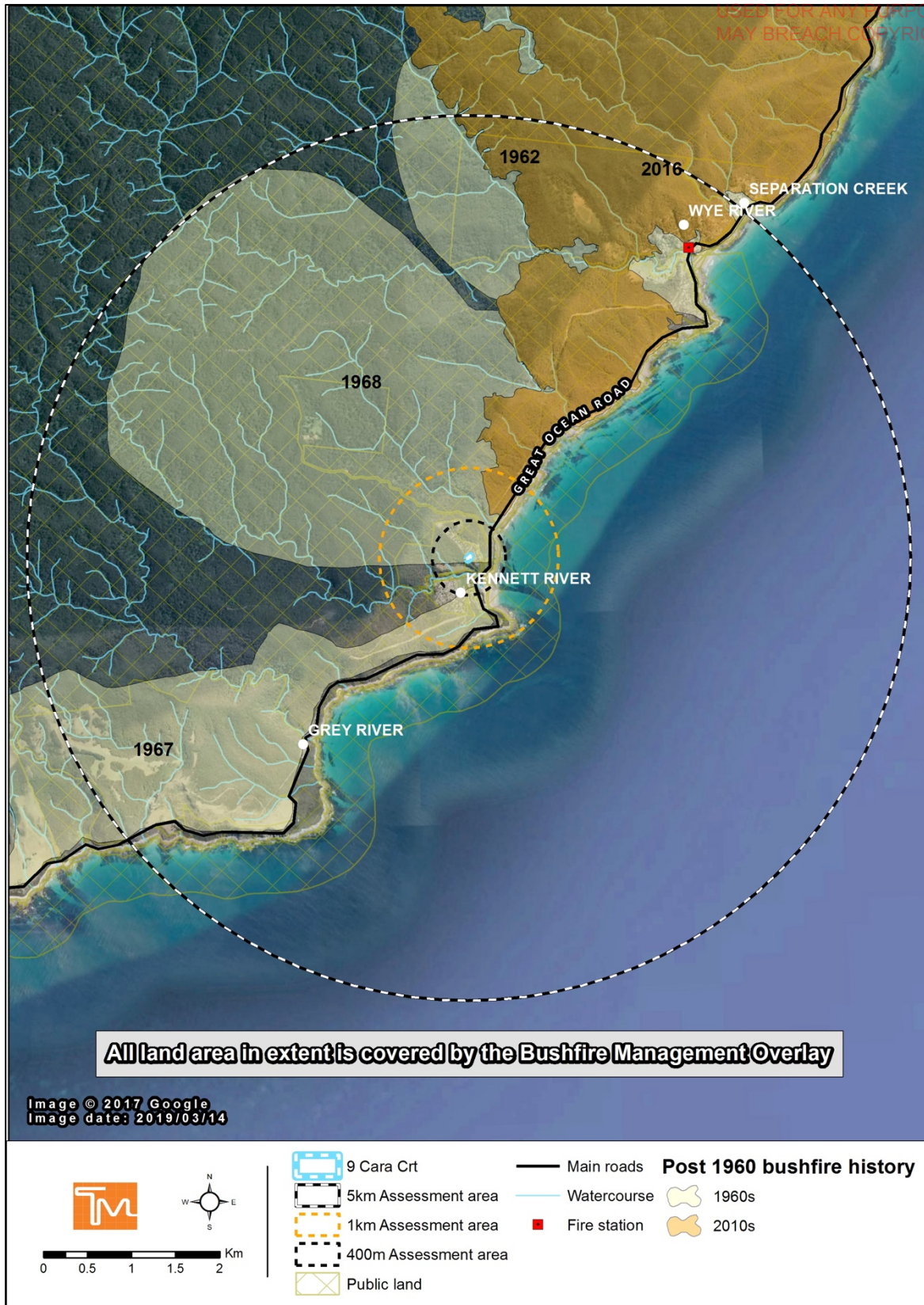
To assist in defining the risk arising from characteristics beyond the site scale, four 'broader landscape types', representing different landscape risk levels, are described in the DELWP technical guide *Planning Applications Bushfire Management Overlay* (DELWP, 2017). These are intended to streamline decision-making and support more consistent decisions based on the landscape risk.

The four types range from low risk landscapes where there is little hazardous vegetation beyond 150m of the site and extreme bushfire behaviour is not credible, to extreme risk landscapes. The landscape around Kennett River best accords with the highest risk Broader Landscape Type 4, with limited evacuation options and the potential for fire behaviour exceeding the AS 3959-BMO

‘design fire’ conditions. Large fires could have a long time to develop and build to a significant intensity. The extensive BMO coverage of surrounding land is indicative of the significant hazard in the landscape.

Table 1 - Landscape risk typologies (from DELWP, 2017).

Broader Landscape Type 1	Broader Landscape Type 2	Broader Landscape Type 3	Broader Landscape Type 4
<ul style="list-style-type: none"> • <i>There is little vegetation beyond 150 metres of the site (except grasslands and low-threat vegetation).</i> • <i>Extreme bushfire behaviour is not possible.</i> • <i>The type and extent of vegetation is unlikely to result in neighbourhood- scale destruction of property.</i> • <i>Immediate access is available to a place that provides shelter from bushfire.</i> 	<ul style="list-style-type: none"> • <i>The type and extent of vegetation located more than 150 metres from the site may result in neighbourhood-scale destruction as it interacts with the bushfire hazard on and close to a site.</i> • <i>Bushfire can only approach from one aspect and the site is located in a suburban, township or urban area managed in a minimum fuel condition.</i> • <i>Access is readily available to a place that provides shelter from bushfire. This will often be the surrounding developed area.</i> 	<ul style="list-style-type: none"> • <i>The type and extent of vegetation located more than 150 metres from the site may result in neighbourhood-scale destruction as it interacts with the bushfire hazard on and close to a site.</i> • <i>Bushfire can approach from more than one aspect.</i> • <i>The site is located in an area that is not managed in a minimum fuel condition.</i> • <i>Access to an appropriate place that provides shelter from bushfire is not certain.</i> 	<ul style="list-style-type: none"> • <i>The broader landscape presents an extreme risk.</i> • <i>Fires have hours or days to grow and develop before impacting.</i> • <i>Evacuation options are limited or not available.</i>
I N C R E A S I N G R I S K 			



Map 2 – Bushfire Hazard Landscape Assessment Plan.



Map 3 - Bushfire Hazard Local Landscape Assessment.

4.3 Fire Management Zones

Fire Management Zones (FMZs) are areas of public land where fire is used for specific asset, fuel and overall forest and park management objectives. Four different FMZs are defined for Victoria, with each FMZ differing in its intended fuel treatment aims and associated performance measures. Although the name of the zone indicates the primary purpose for that zone, multiple objectives may be achieved when undertaking activities in a given zone. For example, a burn undertaken primarily for land management purposes may also have asset protection results (DSE, 2012).

The type and location of FMZs in the local landscape surrounding the site are shown in Map 3. Within 1km of the site, all four FMZ types occur.

Asset Protection Zone (APZ)

The APZ aims to provide the highest level of localised protection to human life and property and key community assets. As shown in Map 3, narrow strips of public land abutting the Kennett River settlement, including immediately south of 9 Cara Court, are managed as an APZ. The goal of fuel treatment in this zone is to reduce radiant heat and ember attack in the event of a bushfire. To do this, the fuel (vegetation) hazard needs to be reduced and kept at low levels, requiring more frequent fuel treatment. Fuel treatment will be carried out in the APZ through a combination of planned burning and other methods such as mowing, slashing or vegetation removal (DSE, 2012).

Bushfire Moderation Zone (BMZ)

This zone aims to reduce the speed and intensity of bushfires. The use of planned burning in the BMZ is designed to protect nearby assets, particularly from ember spotting during a bushfire. Large areas of public forest around Kennett River are designated as a BMZ. Where practicable, the BMZ will aim to achieve ecologically desirable fire regimes, provided that bushfire protection objectives can still be met. This may include using other fuel management methods (DSE, 2012).

Landscape Management Zone (LMZ)

Beyond the BMZ, areas of public forest are managed as an LMZ. Within this zone, planned burning is used for three broad aims:

- *'Bushfire protection outcomes by reducing the overall fuel and bushfire hazard in the landscape;*
- *Ecological resilience through appropriate fire regimes; and*
- *Management of the land for particular values including forest regeneration and protection of water catchments at a landscape level (DSE, 2012).*

Fuel reduction methods other than planned burning may also be used within this zone (DSE, 2012).

Planned Burn Exclusion Zone (PBEZ)

This zone excludes the use of planned burning, primarily in areas intolerant to fire (DELWP, 2012). It includes areas of public land along the Great Ocean Road.

The extensive areas of FMZs around the township may assist to moderate the landscape risk; but they cannot be relied upon to alter conditions at the site or enable reduced bushfire protection measures.

5 Planning and design response

This section identifies how the proposed development responds to the bushfire risk and the planning provisions at Clause 13.02, Clause 44.06 and associated Clause 53.02 in the Colac Otway Planning Scheme.

5.1 Clause 13.02 Response

The strategies stipulated in Clause 13.02 are detailed in Table 2 below and a summary response is provided about how the proposed development responds to the applicable strategies.

Table 2 - Summary response to Clause 13.02

Strategy	Response
Protection of human life	
<p><i>‘Give priority to the protection of human life by:</i></p> <ul style="list-style-type: none"> • <i>Prioritising the protection of human life over all other policy considerations</i> • <i>Directing population growth and development to low risk locations and ensuring the availability of, and safe access to, areas where human life can be better protected from the effects of bushfire.</i> • <i>Reducing the vulnerability of communities to bushfire through consideration of bushfire risk in decision-making at all stages of the planning process’</i> (Colac Otway Planning Scheme (2018c). 	<p>Other applicable policy considerations have not influenced the development proposal above the priority to protect human life. The development does not comprise population growth, but is rather infill development within the settlement boundary of the existing township. The development is not in a low risk location, however this is the case for all development in a BMO area. Safe access will be provided to an accredited private bushfire shelter where human life can be protected. This report provides the basis for incorporating bushfire risk into the planning decision.</p>
Bushfire hazard identification and assessment	
<p><i>‘Identify bushfire hazard and undertake appropriate risk assessment by:</i></p> <ul style="list-style-type: none"> • <i>Applying the best available science to identify vegetation, topographic and climatic conditions that create a bushfire hazard.</i> • <i>Considering the best available information about bushfire hazard including the map of designated bushfire prone areas prepared under the Building Act 1993 or regulations made under that Act.</i> • <i>Applying the Bushfire Management Overlay to areas where the extent of vegetation can create an extreme bushfire hazard.</i> • <i>Considering and assessing the bushfire hazard on the basis of:</i> <ul style="list-style-type: none"> • <i>Landscape conditions - meaning the conditions in the landscape within 20 kilometres and potentially up to 75 kilometres from a site;</i> 	<p>The hazard has been identified in accordance with the commonly accepted methodologies of <i>AS 3959-2018 Construction of buildings in Bushfire Prone areas</i>, guidance provided in the technical guide <i>Planning Permit Applications – Bushfire Management Overlay</i> (DELWP, 2017), additional CFA guidance for high risk landscapes (CFA 2018), and guidance for assessing and responding to bushfire risk at Clause 13.02 in Planning Advisory Note 68 <i>Bushfire State Planning Policy Amendment VC140</i> (DELWP, 2018a).</p> <p>The CFA have been consulted during the design phase including a pre-application meeting held onsite. Feedback received has been</p>

Strategy	Response
<ul style="list-style-type: none"> • <i>Local conditions – meaning conditions in the area within approximately 1 kilometre from a site;</i> • <i>Neighbourhood conditions – meaning conditions in the area within 400 metres of a site; and</i> • <i>The site for development.</i> • <i>Consulting with emergency management agencies and the relevant fire authority early in the process to receive their recommendations and implement appropriate bushfire protection measures.</i> • <i>Ensuring that strategic planning documents, planning scheme amendments, planning permit applications and development plan approvals properly assess bushfire risk and include appropriate bushfire protection measures.</i> • <i>Not approving development where a landowner or proponent has not satisfactorily demonstrated that the relevant policies have been addressed, performance measures satisfied or bushfire protection measures can be adequately implemented’ (Colac Otway Planning Scheme (2018c).</i> 	<p>incorporated into the current development plan including:</p> <ul style="list-style-type: none"> • Increasing the dwelling setback from the Forest to the southwest to 10m; • Reducing the building size from 3 storeys to 2 storeys; • Reducing building vulnerabilities including the size, number and location of windows; • Increasing wind resistance to a minimum 50m/s N3 rating; and • Incorporating an accredited private bushfire shelter into the proposal. <p>All of the proposed bushfire protection measures are commensurate with the risk and can be implemented and maintained on an ongoing basis.</p>
Settlement planning	
<p><i>‘Plan to strengthen the resilience of settlements and communities and prioritise protection of human life by:</i></p> <ul style="list-style-type: none"> • <i>Directing population growth and development to low risk locations, being those locations assessed as having a radiant heat flux of less than 12.5 kilowatts/square metre under ‘AS 3959-2009 Construction of buildings in bushfire-prone areas’ (Standards Australia, 2009).</i> • <i>Ensuring the availability of, and safe access to, areas assessed as a BAL-Low rating under AS 3959-2009 Construction of buildings in bushfire-prone areas (Standards Australia, 2009) where human life can be protected from the effects of bushfire.</i> • <i>Ensuring the bushfire risk to existing and future residents, property and community infrastructure will not increase as a result of future land use and development.</i> • <i>Achieving no net increase in risk to existing and future residents, property and community infrastructure, through the implementation of</i> 	<p>The development proposal does not comprise settlement planning, as it is infill development in a TZ within the existing settlement boundary.</p> <p>No strategic planning document, local planning policy or planning scheme amendment is required.</p>

Strategy	Response
<p><i>bushfire protection measures and where possible reduce bushfire risk overall.</i></p> <ul style="list-style-type: none"> ● <i>Assessing alternative low risk locations for settlement growth on a regional, municipal, settlement, local and neighbourhood basis.</i> ● <i>Not approving any strategic planning document, local planning policy, or planning scheme amendment that will result in the introduction or intensification of development in an area that has, or will on completion have, more than a BAL-12.5 rating under AS 3959-2009' (Colac Otway Planning Scheme (2018c).</i> 	
Areas of high biodiversity conservation value	
<p><i>'Ensure settlement growth and development approvals can implement bushfire protection measures without unacceptable biodiversity impacts by discouraging settlement growth and development in bushfire affected areas that are important areas of biodiversity' (Colac Otway Planning Scheme (2018c).</i></p>	<p>Terramatrix are not aware if the biodiversity conservation value of the area is high. However, it is considered unlikely that there would be any unacceptable biodiversity impacts associated with the proposal.</p>
Use and development control in a Bushfire Prone Area	
<p><i>'In a bushfire prone area designated in accordance with regulations made under the Building Act 1993, bushfire risk should be considered when assessing planning applications for the following uses and development:</i></p> <ul style="list-style-type: none"> ● <i>Subdivisions of more than 10 lots.</i> ● <i>Accommodation.</i> ● <i>Child care centre.</i> ● <i>Education centre.</i> ● <i>Emergency services facility.</i> ● <i>Hospital.</i> ● <i>Indoor recreation facility.</i> ● <i>Major sports and recreation facility.</i> ● <i>Place of assembly.</i> ● <i>Any application for development that will result in people congregating in large numbers.</i> <p><i>When assessing a planning permit application for the above use and development:</i></p> <ul style="list-style-type: none"> ● <i>Consider the risk of bushfire to people, property and community infrastructure.</i> ● <i>Require the implementation of appropriate bushfire protection measures to address the identified bushfire risk.</i> 	<p>The development comprises 'Accommodation' in a designated Bushfire Prone Area covered by the BMO. Accordingly, this report assesses and responds to the bushfire risk. It proposes bushfire protection measures that have no apparent unacceptable biodiversity impacts; and which exceed compliance with the applicable approved measures at Clause 53.02-3 (see Sections 5.2 and 5.3 following).</p> <p>It is noted that Planning Advisory Note 68 states that if a planning permit is required for the use or development under Clause 44.06 Bushfire Management Overlay, then the use and development control strategy is addressed through the relevant application requirements and decision guidelines in Clause 53.02 (DELWP, 2018a).</p>

Strategy	Response
<ul style="list-style-type: none"> • <i>Ensure new development can implement bushfire protection measures without unacceptable biodiversity impacts</i> (Colac Otway Planning Scheme (2018c). 	

5.2 Clause 53.02-3 Bushfire Management Statement

Clause 53.02-3 applies to an application to construct a single dwelling, or construct or carry out works associated with a single dwelling, if all of the following requirements are met:

- The land is zoned Neighbourhood Residential Zone, General Residential Zone, Residential Growth Zone, Urban Growth Zone, Low Density Residential Zone, Township Zone or Rural Living Zone;
- There is only one dwelling on the lot; and
- All of the approved measures contained in Clause 53.02-3 are met.

The application meets all of the requirements and approved measures specified at Clause 53.02-3 (CFA, 2018). The applicable objective that must be met for dwellings in existing settlements is:

'To specify bushfire design and construction measures for a single dwelling or alteration and extension to an existing dwelling that reduces the risk to life and property to an acceptable level' (Colac Otway Planning Scheme, 2018a).

This objective is deemed to be satisfied by compliance with the following approved measures.

5.2.1 Approved measure 1.1 - Siting

'A building is sited to ensure the site best achieves the following:

- *The maximum separation distance between the building and the bushfire hazard.*
- *The building is in close proximity to a public road.*
- *Access can be provided to the building for emergency service vehicles'* (Colac Otway Planning Scheme, 2018a).

The siting and layout maximises the setback from the Forest to the southwest as far as practicable, achieving a 10m minimum setback (see Map 4). Siting options are significantly constrained by the need to provide a viable effluent envelope within the constraints imposed by the topography and to site a private bushfire shelter with appropriate development setbacks. Additionally, due to the small property size and close proximity of the Forest, alternative siting options will not appreciably reduce the risk or eliminate the possibility of flame contact.

The proposed development is close to the road and access and egress can comply with the requirements for emergency vehicles.

5.2.2 Approved measure 1.2 - Defendable space and BAL standard

'A building provides the defendable space in accordance with Table 1 Columns A, B, C, D or E and Table 6 to Clause 53.02-5. Adjoining land may be included as defendable space where there is a reasonable assurance that the land will remain or continue to be managed in that condition as part of the defendable space.

A building is constructed to the bushfire attack level:

- *That corresponds to the defendable space provided in accordance with Table 1 to Clause 53.02-5, or*
- *The next lower bushfire attack level that corresponds to the defendable space provided in accordance with Table 1 of Clause 53.02-5 where all the following apply:*
 - *A private bushfire shelter (a Class 10c building within the meaning of the Building Regulations 2006) is constructed on the same land as the dwelling.*
 - *A minimum bushfire attack level of BAL-12.5 is provided in all circumstances'* (Colac Otway Planning Scheme, 2018a).

The minimum defendable space distance for a BAL-40 dwelling, in accordance with Table 1 Column D to Clause 53.02-5, is 50m in response to Forest in the Downslope >15°-20° slope class. However, due to the steep downslope to the southwest that exceeds 20°, additional defendable space for BAL-40 would need to be calculated and provided (although it should be noted the length of slope is relatively short). But irrespective of the applicable slope, only 10m of defendable space to the southwest can be achieved within the property boundary. Further, there is no assurance that overlap of defendable space onto neighbouring residential properties in other directions, will be managed as defendable space at the standards specified in Table 6 to Clause 43.02-5 (see Appendix B).

Accordingly, full BAL-FZ construction is proposed for the whole building. The proposed defendable space within the site will extend to all property boundaries¹⁰ (see Map 4). The defendable space on the property can meet the vegetation management requirements stipulated in Table 6 at Clause 53.02-5. This is detailed in the Bushfire Management Plan provided as Map 4.

5.2.3 Approved measure 1.3 - Water supply and access

'A building is provided with:

- *A static water supply for fire fighting and property protection purposes specified in Table 4 to Clause 53.02-5. The water supply may be in the same tank as other water supplies provided that a separate outlet is reserved for firefighting water supplies.*

¹⁰ Note that in response to modified vegetation, Table 1 to Clause 53.02-5 requires defendable space extending for 50m or to the property boundary, whichever is the lesser distance.

- *Vehicle access that is designed and constructed as specified in Table 5 to Clause 53.02-5' (Colac Otway Planning Scheme, 2018a).*

Water

Table 4 to Clause 53.02-5 requires that a static water supply be provided, based on the property size and the proximity of the building to a hydrant, as detailed in Table 3 of this report.

Table 3 - Water supply requirements from Table 4 to Clause 53.02-5.

Property size (m ²)	Hydrant within 120m of the rear of the building	Tank capacity (litres)	CFA fittings and access required
Less than 500	Not applicable	2,500	No
500 - 1000	Yes	5,000	No
500 – 1000	No	10,000	Yes
1,001 and above	Not applicable	10,000	Yes

As the property is 640m² in area and there will not be a hydrant within 120m, the development includes a minimum 10,000L capacity static water supply for fire-fighting, located in an above ground, non-combustible tank/s near the street frontage (see Map 4).

The tank will be within 60m of the outer edge of the dwelling and be provided with a CFA compliant outlet according to CFA specifications (see specifications in Appendix C).

Access

As the driveway will be less than 30m long, and access to the water outlet will be from Cara Court, no specific design and construction requirements apply.

Map 4 following, comprises a Bushfire Management Plan (BMP), detailing all of the proposed bushfire protection measures for the development, consistent with the CFA's standard permit conditions and BMP guidance (CFA, 2017).



Map 4 - Bushfire Management Plan.

Construction Standard

The dwelling must be designed and constructed to BAL-FZ (Flame Zone) standard. Additionally, wind speed rating and design will be for minimum 50m/s as per N3 loading. An accredited private bushfire shelter must be installed and maintained in accordance with the manufacturer's specifications.

Water Supply

A minimum 10,000L of effective water supply for fire fighting purposes must be provided in accordance with the following requirements:

- Be stored in an above ground water tank/s constructed of concrete or metal.
- Have all fixed above-ground water pipes and fittings required for fire fighting purposes made of corrosive resistant metal.
- Include a separate outlet for site occupant use.
- Be readily identifiable from the building or appropriate identification signage to the satisfaction of the CFA.
- Be located within 60 metres of the outer edge of the approved building.
- The outlet/s of the water tank/s must be within 4m of the accessway and unobstructed.
- Incorporate a separate ball or gate valve (British Standard Pipe (BSP) 65mm) and coupling (64 mm CFA 3 thread per inch male fitting).
- Any pipework and fittings must be a minimum of 65 mm (excluding the CFA coupling).

Vehicle Access

Vehicle access to the water supply outlet must be provided in accordance with the following requirements:

- All-weather construction.
- A load limit of at least 15 tonnes.
- Provide a minimum trafficable width of 3.5 metres.
- Be clear of encroachments for at least 0.5 metres on each side and at least 4 metres vertically.
- Curves must have a minimum inner radius of 10 metres.
- The average grade must be no more than 1 in 7 (14.4%) (8.1°) with a maximum grade of no more than 1 in 5 (20%) (11.3°) for no more than 50 metres.
- Dips must have no more than a 1 in 8 (12.5 per cent) (7.1 degrees) entry and exit angle.

Defendable Space Management

Defendable space must be provided to all property boundaries, and be managed in accordance with the following requirements:

- Grass must be short cropped and maintained during the declared fire danger period.
- All leaves and vegetation debris must be removed at regular intervals during the declared fire danger period.
- Within 10 metres of a building, flammable objects must not be located close to the vulnerable parts of the building.
- Plants greater than 10 centimetres in height must not be placed within 3m of a window or glass feature of the building.
- Shrubs must not be located under the canopy of trees.
- Individual and clumps of shrubs must not exceed 5m² in area and must be separated by at least 5m.
- Trees must not overhang or touch any elements of the building.
- The canopy of trees must be separated by at least 5m.
- There must be a clearance of at least 2 metres between the lowest tree branches and ground level.

5.3 Additional bushfire protection measures

As identified in Section 4, the landscape is one of extreme bushfire risk, where bushfire behaviour may exceed BMO expectations and design parameters. Accordingly, additional protection measures are proposed to mitigate the risk, based on the highest possible BAL-FZ construction standard with the maximum amount of defensible space achievable, extending to all property boundaries, to maximise the setback from hazardous vegetation.

The dwelling design has been carefully considered and significantly amended from the previous design proposal, in response to the bushfire hazard and consultation with the CFA (see proposed building plans). The size of the dwelling has been reduced with the former proposed three-storey dwelling now amended to a smaller two-storey design. The vulnerability associated with having large areas of floor to ceiling glazing, especially on the more exposed western and southern building elevations, has been minimised by a substantial reduction in the size and number of proposed windows. The building will have a relatively simple, non-complex facade and low profile.

Additionally, the dwelling will be designed and constructed to a higher wind loading rating (minimum 50m/s wind speed as per N3 loading) to provide greater resistance to strong winds that may be experienced in a bushfire.

Due to the hazardous location, and as the dwelling cannot provide enough defensible space to the southwest to avoid flame contact, an accredited private bushfire shelter will be installed and maintained. This will ensure a shelter-in-place option is available, to provide for life safety in a bushfire emergency if evacuation is not possible. Consistent with CFA messaging however, the first option will be to not occupy the site on days of higher risk i.e. leave the site prior to 10am on days when the forecast fire danger rating is Extreme or Code Red. This can be implemented by the proponent developing a Bushfire Survival Plan using CFA templates and could be incorporated into an endorsed Bushfire Management Plan.

It is noted that whilst large and intense 'landscape-scale' fires could develop and impact the site, occupants would in all likelihood have significant advance warning of such a fire, that would enable early evacuation from the site.

The approach to providing additional protection is in accordance with CFA guidance for development proposals in higher risk landscapes, including

- *'...defendable space should be provided based on worst case, to all aspects of the building.*
- *Increase the level of defensible space beyond that required by Clause 53.02.*
- *Enhance the level of construction through bushfire sensitive design.*
- *Enhance the building's resistance to strong winds.*
- *Build to a higher BAL' (CFA, 2018b).*

6 Conclusion

The proposed development of a dwelling at 9 Cara Court, Kennett River, was assessed for compliance with Clauses 13.02, 44.06 and 53.02 in the Colac Otway Planning Scheme. The development is for a single dwelling in the Township Zone and therefore this report includes a 'Pathway 1' response in accordance with Clause 53.02-3.

The dwelling is exposed to Forest and Modified vegetation. As defensible space for BAL-40 construction cannot be achieved to the southwest, a BAL-FZ construction standard is proposed for all elevations. Additional protection measures, to prioritise protection of human life, are proposed in response to the significant landscape risk in accordance with CFA guidance. These measures include an accredited private bushfire shelter, defensible space to the property boundaries and enhanced building design and construction to withstand greater wind forces.

The approved measures for water and access can be met, including a 10,000L static water capacity with an accessible and compliant CFA outlet.

The proposal is a considered and comprehensive response to the bushfire risk that offers enhanced protective features above and beyond BMO compliance. All BMO objectives can be met by complying with approved measures specified in the planning provisions, and therefore it can be deemed that the risk is acceptable. It is noted that:

- The BMO and accompanying Clause 53.02 explicitly provide for a BAL-FZ outcome for this type of application. The use and development control strategy of Clause 13.02 requires consideration of the bushfire risk beyond the site scale for development applications comprising accommodation, and this application has considered and responded to the risk including proposing additional protection measures that exceed the minimum requirements for a Clause 53.02-3 application.
- To support re-building following the 2015 bushfire in Wye River and Separation Creek, the state government, with DELWP and the CFA, are facilitating BAL-FZ and BAL-40 with a private bushfire shelter development applications in nearby and similarly high risk locations on the edge of the Wye River and Separation Creek settlements to the northwest.

7 Appendices

7.1 Appendix A: BALs explained

Bushfire Attack Level (BAL)	Risk Level	Construction elements are expected to be exposed to...	Comment
BAL-Low	VERY LOW: There is insufficient risk to warrant any specific construction requirements but there is still some risk.	No specification.	At 4kW/m ² pain to humans after 10 to 20 seconds exposure. Critical conditions at 10kW/m ² and pain to humans after 3 seconds. Considered to be life threatening within 1 minute exposure in protective equipment.
BAL-12.5	LOW: There is risk of ember attack.	A radiant heat flux not greater than 12.5 kW/m ²	At 12.5kW/m ² standard float glass could fail and some timbers can ignite with prolonged exposure and piloted ignition.
BAL-19	MODERATE: There is a risk of ember attack and burning debris ignited by windborne embers and a likelihood of exposure to radiant heat.	A radiant heat flux not greater than 19 kW/m ²	At 19kW/m ² screened float glass could fail.
BAL-29	HIGH: There is an increased risk of ember attack and burning debris ignited by windborne embers and a likelihood of exposure to an increased level of radiant heat.	A radiant heat flux not greater than 29 kW/m ²	At 29kW/m ² ignition of most timbers without piloted ignition after 3 minutes exposure. Toughened glass could fail.
BAL-40	VERY HIGH: There is a much increased risk of ember attack and burning debris ignited by windborne embers, a likelihood of exposure to a high level of radiant heat and some likelihood of direct exposure to flames from the fire front.	A radiant heat flux not greater than 40 kW/m ²	At 42kW/m ² ignition of cotton fabric after 5 seconds exposure (without piloted ignition).
BAL- FZ (i.e. Flame Zone)	EXTREME: There is an extremely high risk of ember attack and a likelihood of exposure to an extreme level of radiant heat and direct exposure to flames from the fire front.	A radiant heat flux greater than 40 kW/m ²	At 45kW/m ² ignition of timber in 20 seconds (without piloted ignition).

Source: derived from AS 3959-2018 (Standards Australia, 2018)

7.2 Appendix B: Vegetation management requirements

As per Table 6 to Clause 53.02-5:

'Defendable space is provided and is managed in accordance with the following requirements:

- *Grass must be short cropped and maintained during the declared fire danger period.*
- *All leaves and vegetation debris must be removed at regular intervals during the declared fire danger period.*
- *Within 10 metres of a building, flammable objects must not be located close to the vulnerable parts of the building.*
- *Plants greater than 10 centimetres in height must not be placed within 3m of a window or glass feature of the building.*
- *Shrubs must not be located under the canopy of trees.*
- *Individual and clumps of shrubs must not exceed 5 sq. metres in area and must be separated by at least 5 metres.*
- *Trees must not overhang or touch any elements of the building.*
- *The canopy of trees must be separated by at least 5 metres.*
- *There must be a clearance of at least 2 metres between the lowest tree branches and ground level*

Unless specified in a schedule or otherwise agreed in writing to the satisfaction of the relevant fire authority' (Colac Otway Planning Scheme, 2018a).

7.3 Appendix C: Water supply requirements

Table 4 from Clause 53.02-5 - Capacity, fittings and access (Colac Otway Planning Scheme, 2018a)

Capacity, fittings and access			
Lot sizes (square meters)	Hydrant available	Capacity (litres)	Fire authority fittings and access required
Less than 500	Not applicable	2,500	No
500-1,000	Yes	5,000	No
500-1,000	No	10,000	Yes
1,001 and above	Not applicable	10,000	Yes

Note 1: A hydrant is available if it is located within 120 metres of the rear of the building

Fire Authority Requirements

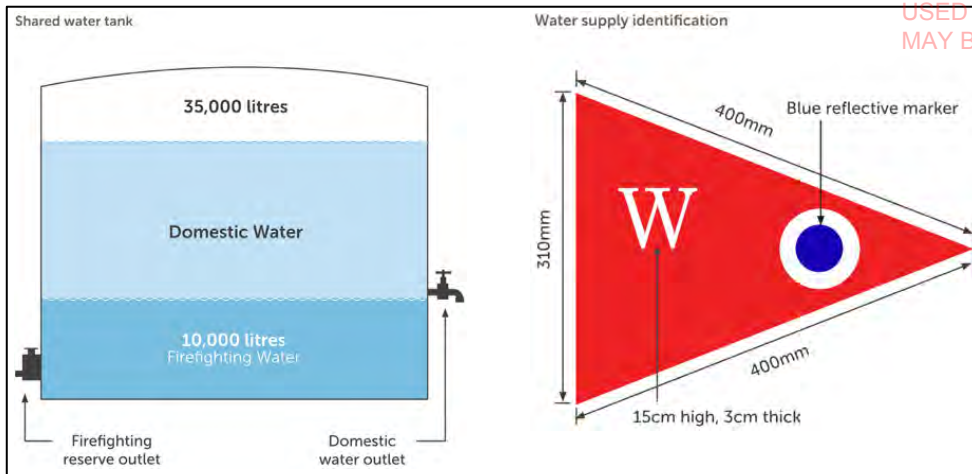
'Unless otherwise agreed in writing by the relevant fire authority, the water supply must:

- *Be stored in an above ground water tank constructed of concrete or metal.*
- *Have all fixed above ground water pipes and fittings required for firefighting purposes made of corrosive resistant metal.*
- *Include a separate outlet for occupant use.*

Where a 10,000 litre water supply is required, fire authority fittings and access must be provided as follows:

- *Be readily identifiable from the building or appropriate identification signage to the satisfaction of the relevant fire authority.*
- *Be located within 60 metres of the outer edge of the approved building.*
- *The outlet/s of the water tank must be within 4 metres of the accessway and unobstructed.*
- *Incorporate a separate ball or gate valve (British Standard Pipe (BSP 65 millimetre) and coupling (64 millimetre CFA 3 thread per inch male fitting).*
- *Any pipework and fittings must be a minimum of 65 millimetres (excluding the CFA coupling)' (Colac Otway Planning Scheme, 2018a).*

The water supply may be provided in the same water tank as other water supplies provided they are separated with different outlets. See figure below illustrating signage and an example of outlets where fire fighting water will be in the same tank as water for other use.



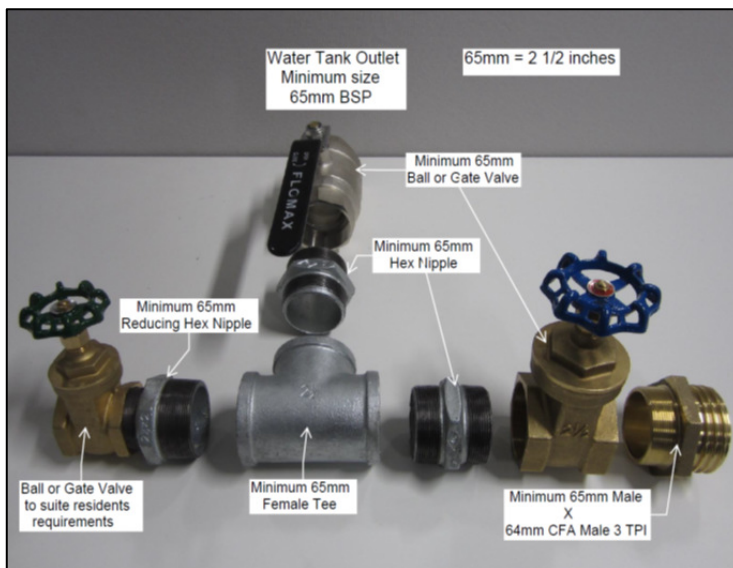
(DELWP, 2017)

CFA Fittings (CFA, 2014)

'If specified within Table 4 to Clause 53.02-5 (if fire brigade access to your water supply is required), CFA's standard BMO permit conditions require the pipe work, fittings and tank outlet to be a minimum size of 64 mm.

65 mm BSP (British Standard Pipe) is the most common size available. A 65 mm fitting is equivalent to the old 2 1/2 inch. A 65 mm BSP (2 1/2 inch) fitting exceeds CFA's requirements and will therefore comply with CFA's standard permit conditions for the BMO.

The diagram below shows some common tank fittings available at most plumbing suppliers which meet the connection requirements. It includes a 65 mm tank outlet, two 65 mm ball or gate valves with a 65 mm male to 64 mm CFA 3 threads per inch male coupling. This is a special fitting which allows the CFA fire truck to connect to the water supply. An additional ball or gate valve will provide access to the water supply for the resident of the dwelling'.



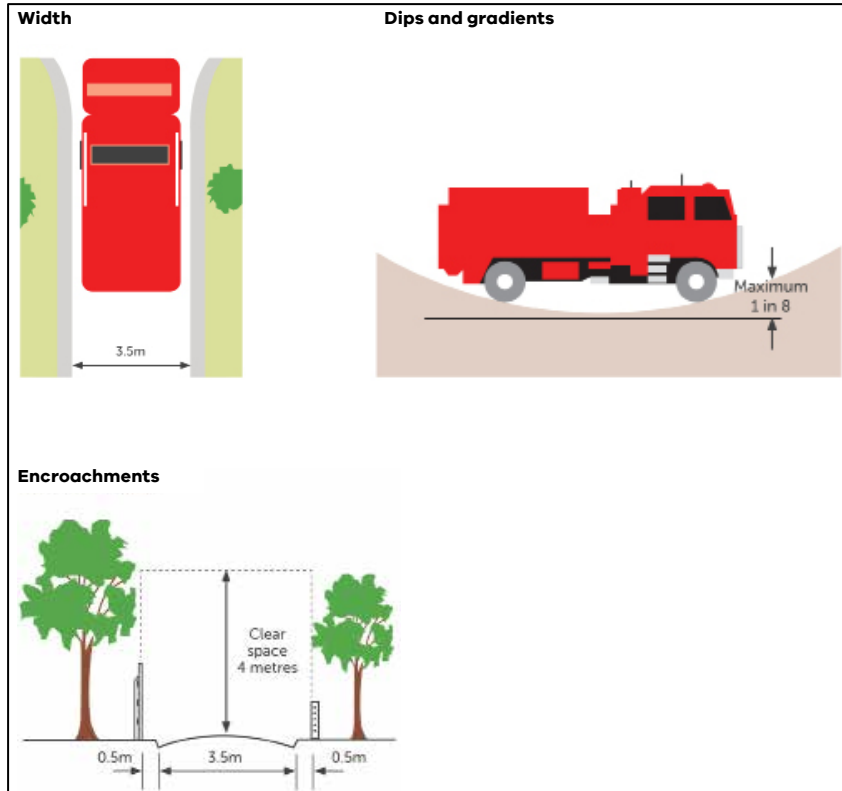
7.4 Appendix D: Access requirements

Driveways less than 30m long have no specific requirements unless access to the water supply outlet is required, in which case the following apply as appropriate.

Access between 30m and 100m in length

Where the length of access is greater than 30 metres the following design and construction requirements apply (*the length of access should be measured from a public road to either the building or the water supply outlet, whichever is longer* (Colac Otway Planning Scheme, 2018a)):

- Curves must have a minimum inner radius of 10 metres.
- The average grade must be no more than 1 in 7 (14.4%) (8.1°) with a maximum of no more than 1 in 5 (20%) (11.3°) for no more than 50 metres.
- Dips must have no more than a 1 in 8 (12.5%) (7.1°) entry and exit angle.
- A load limit of at least 15 tonnes and be of all-weather construction.
- Provide a minimum trafficable width of 3.5 metres.
- Be clear of encroachments for at least 0.5 metres on each side and at least 4 metres vertically.
- A cleared area of 0.5 metres is required to allow for the opening of vehicle doors along driveways.
- Dips must have no more than a 1 in 8 (12.5 per cent) (7.1 degrees) entry and exit angle.

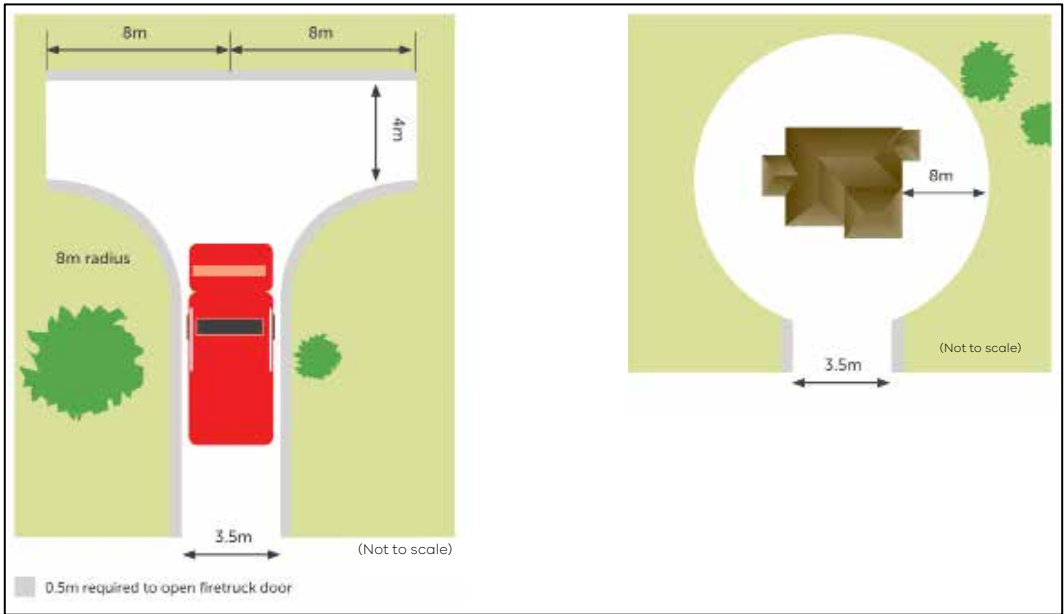


(DELWP, 2017)

Access between 100m and 200m in length

In addition to the 30m-100m requirements above, a turning area for fire fighting vehicles must be provided close to the building by one of the following:

- a turning circle with a minimum radius of 8 metres
- a driveway encircling the dwelling
- other vehicle turning heads such as a T or Y head which meet the specification of Austroad Design for an 8.8 metre service vehicle.

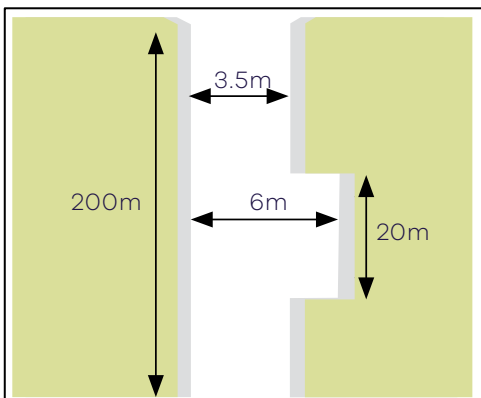


(DELWP, 2017)

Access greater than 200m in length

In addition to the requirements above, passing bays are required at least every 200 metres that are:

- a minimum of 20 metres long
- with a minimum trafficable width of 6 metres.



(DELWP, 2017)

8 References

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