PP132/2019-1

33 McRae Road WYE RIVER

Lot: 2 PS: 742250 V/F: 11854/858

Construction of double storey Dwelling and Removal of Easements E-1 & E-2 and associated earthworks

Rosevear Planning Associates

Officer - Helen Evans

EXHIBITION FILE

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

If you would like to make a submission relating to a planning permit application, you must do so in writing to the Planning Department

Colac Otway SHIRE

Office Use Only			
Application No.:			Fee: $
Date Lodged:	/	/	Receipt No.:
Date Allocated:	/	/	Ward:
Allocated to:			Zone(s):
			Overlay(s):

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

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.:	Street Name:
33	McRae Road

Suburb/Locality: Wye River Postcode: 3234

Formal Land Description

This information can be found on the certificate of title.

Lot No.: 2 on Lodged Plan, Title Plan or Subdivision Plan No.: PS: 742250M

OR

Crown Allotment No.: Section No.: Parish Name:

(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.

Single Dwelling

(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.

Construction of a replacement Dwelling and removal of redundant Easements.

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 $ 1.1 million ⚠ 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

(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: Philip Rosevear

Organisation (if applicable): Rosevear Planning Associates

Postal address: 7 Sky Court

Jan Juc Postcode: 3228

Contact phone:

Mobile phone: 0418 398 652

Email: rosevearpa@bigpond.com

Fax:

Indicate preferred contact method

Applicant

The person or organisation who wants the permit.

☐ Same as contact. If not, complete details below.

Name:

Organisation (if applicable):

Postal address:

Postcode:

Owner

The person or organisation who owns the land.

☐ Same as contact ☐ 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): Lawvan Pty Ltd

Organisation (if applicable):

Postal address: 56 Electra Street

Williamstown Postcode: 3016

Checklist

(12) Have you?

☐ Filled in the form completely?

☐ Paid or included the application fee?

☐ Attached all necessary supporting information and documents?

☐ Completed the relevant council planning permit checklist?

☐ 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

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

B Owner

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

Signature

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

Applicant

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

Signature

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

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 Rosevear Planning Associates

Date: 19 / 06 / 2019

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
Fax: (03) 5232 1046
Email: inq@colacotway.vic.gov.au
TTY: (03) 5231 6787

For help or more information

REGISTER SEARCH STATEMENT (Title Search) Transfer of Land Act 1958

VOLUME 11854 FOLIO 858

Security no : 124075257515G
Produced 06/12/2018 10:51 AM

LAND DESCRIPTION

Lot 2 on Plan of Subdivision 742250M.
PARENT TITLES :
Volume 06624 Folio 654 Volume 09208 Folio 150
Created by instrument PS742250M 16/02/2017

REGISTERED PROPRIETOR

Estate Fee Simple
Sole Proprietor
LAWVAN PTY LTD of 56 ELECTRA STREET WILLIAMSTOWN VIC 3016
AN484560W 23/01/2017

ENCUMBRANCES, CAVEATS AND NOTICES

MORTGAGE AN484698Q 23/01/2017
NATIONAL AUSTRALIA BANK LTD

Any encumbrances created by Section 98 Transfer of Land Act 1958 or Section 24 Subdivision Act 1988 and any other encumbrances shown or entered on the plan set out under DIAGRAM LOCATION below.

AGREEMENT as to part Section 173 Planning and Environment Act 1987
AD654481J 01/06/2005

DIAGRAM LOCATION

SEE PS742250M FOR FURTHER DETAILS AND BOUNDARIES

ACTIVITY IN THE LAST 125 DAYS

NIL

----------END OF REGISTER SEARCH STATEMENT----------

Additional information: (not part of the Register Search Statement)

Street Address: 33 MCRAE ROAD WYE RIVER VIC 3234

ADMINISTRATIVE NOTICES

NIL

eCT Control 00009E NATIONAL AUSTRALIA BANK
Effective from 16/02/2017

DOCUMENT END

Imaged Document Cover Sheet

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Document Type	**Plan**
Document Identification	**PS742250M**
Number of Pages (excluding this cover sheet)	**2**
Document Assembled	**06/12/2018 11:03**

D19/78889

PLAN OF SUBDIVISION

EDITION 1

PS 742250M

LOCATION OF LAND

PARISH: WONGARRA

TOWNSHIP:

SECTION: A

CROWN ALLOTMENT: 2 (PART)

CROWN PORTION:

TITLE REFERENCE: VOL 09208 FOL 150
VOL 06624 FOL 654

LAST PLAN REFERENCE: LOT 1 TP170187Q
LOT 6 LP14927

POSTAL ADDRESS: 25 GREAT OCEAN ROAD &
(at time of subdivision) 33 McRAE ROAD
WYE RIVER
VIC. 3234

MGA CO-ORDINATES: E: 751 495 ZONE: 54
(of approx centre of land in plan) N: 5 719 615 GDA 94

Council Name: Colac Otway Shire

Council Reference Number: 318/2016-1
Planning Permit Reference: PP256/2015-1
SPEAR Reference Number: S085912J

Certification

This plan is certified under section 6 of the Subdivision Act 1988

Statement of Compliance

This is a statement of compliance issued under section 21 of the Subdivision Act 1988

Public Open Space

A requirement for public open space under section 18 of the Subdivision Act 1988
Has not been made at Certification

Digitally signed by: Ian Williams for Colac Otway Shire on 30/08/2016

VESTING OF ROADS AND/OR RESERVES

IDENTIFIER	COUNCIL/BODY/PERSON

NOTATIONS

DEPTH LIMITATION

SURVEY:
This plan is/~~is not~~ based on survey.

STAGING:
This ~~is~~/is not a staged subdivision.
Planning Permit No. PP256/2015-1

This survey has been connected to permanent marks No(s).

In Proclaimed Survey Area No.

NOTATIONS

EASEMENT INFORMATION

LEGEND: A - Appurtenant Easement E - Encumbering Easement R - Encumbering Easement (Road)

Easement Reference	Purpose	Width (Metres)	Origin	Land Benefited/In Favour Of
E-1	DRAINAGE	2.01	LP14927	LOTS ON LP14927
E-2	WATER AND RIGHT OF ENTRY	2.01	INSTRUMENT 2155252	BENEFITED LAND DESCRIBED IN INSTRUMENT 2155252
E-3	ANY EASEMENTS	2.01	INSTRUMENT 2155252	BENEFITED LAND DESCRIBED IN INSTRUMENT 2155252

AH & LJ JEAVONS
LAND SURVEYORS
South West Survey Group
m: 0430 401 954 t: 5261 2971
14 Ocean Boulevard, Jan Juc, VIC 3228
tonyjeavons@swsg.com.au www.swsg.com.au

SURVEYORS FILE REF: 0632PS

ORIGINAL SHEET SIZE: A3

SHEET 1 OF 2

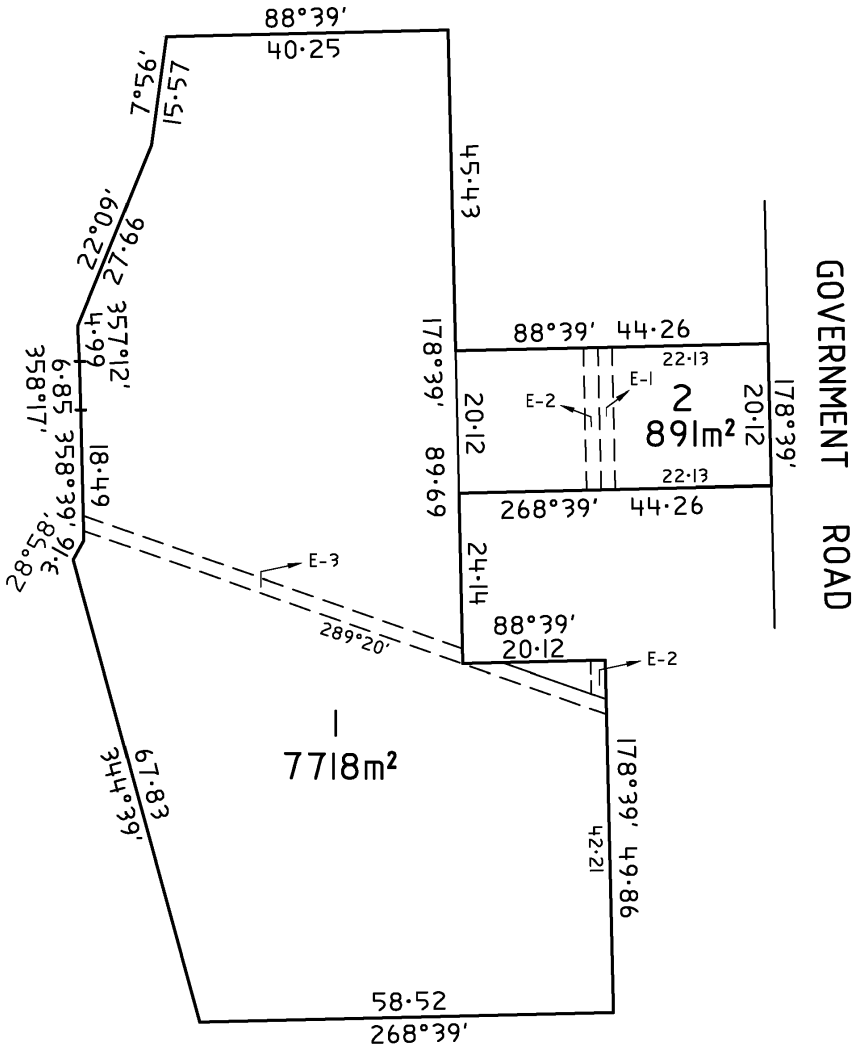
Digitally signed by: ANTHONY HAROLD JEAVONS (A H and L J Jeavons), Surveyor's Plan Version (02), 22/05/2016

PLAN REGISTERED
TIME: 06:21 DATE: 16/02/2017

Assistant Registrar of Titles

D19778889

PS 742250M



AH & LJ JEAVONS LAND SURVEYORS South West Survey Group m: 0430 401 954 t: 5261 2971 14 Ocean Boulevard, Jan Juc, VIC 3228 tonyjeavons@swsg.com.au www.swsg.com.au	SCALE 1:750	7.5 0 7.5 15 22.5 30 LENGTHS ARE IN METRES	ORIGINAL SHEET SIZE: A3 / SHEET 2
	Digitally signed by: ANTHONY HAROLD JEAVONS (A H and L J Jeavons), Surveyor's Plan Version (02), 22/05/2016		Digitally signed by: Colac Otway Shire, 30/08/2016, SPEAR Ref: S085912J

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Document Type	**Instrument**
Document Identification	**AD654481J**
Number of Pages (excluding this cover sheet)	**8**
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D1978889

EXTRA FEES PAID

AD654481J
01/06/2005 $110 173

Lodged by: Sewells Larkins McCarthy, Lawyers, Colac
Telephone: (03) 5231 9400
Ref: PFF:MJC:21357
Code: 1558N

OFFICE OF TITLES R.BI. VICTORIA

90120 (1cts)

VICTORIA

APPLICATION BY A RESPONSIBLE AUTHORITY FOR THE MAKING OF A RECORDING OF AN AGREEMENT under Section 181(1) of the Planning and Environment Act 1987.

The Authority having made an Agreement requires a recording to be made in the Register for the land.

Land

Certificate of Title Volume 9242 Folio 660, Volume 9208 Folios 149, 150 and 151, Volume 9264 Folio 684 and Volume 8661 Folio 736 Volume 10592 Folio 836

Authority

Colac Otway Shire of 2-6 Rae Street, Colac 3250

Section and Act Under Which Agreement Made

Section 173 of the Planning and Environment Act 1987

DAD654481J-1-0

A copy of the Agreement is attached to this Application.

Signature for the Responsible Authority .....

Name of Officer TRACEY SLATTER

~~Public~~ Chief Executive Officer

Date 25/2/05

RB 1.6.05

THIS AGREEMENT is made pursuant to Section 173 of the Planning and Environment Act 1987 ("the Act") the 25th day of February 2004 2005.

BETWEEN:

COLAC-OTWAY SHIRE COUNCIL of 2-6 Rae Street, Colac 3250 ("the Council"); and

DOMINO MANOR PTY LTD ACN 007 037 032 of Wye River Valley Tourist Park, Great Ocean Road, Wye River 3221 ("the Owner").

INTRODUCTION:

A. The Owner is the registered proprietor of the property as described in Certificate of Title Volume 9242 Folio 660, Volume 9208 Folios 149, 150 and 151, Volume 9264 Folio 684, Volume 8661 Folio 736 and Volume 10592 Folio 836 ("the Owner's land or the Subject Land").

B. The Council is the Responsible Authority pursuant to the Act for the Planning Scheme.

C. The Owner seeks to use and develop the Owner's Land to build a Manager's Residence which the Council has agreed to do in Planning Permit PPA/169/2001 ("the Permit") of which condition 15 requires that the Owner would enter into this Agreement that none of the Owner's land referred to in condition 14 of the Permit may be disposed of separately without appropriate alternative arrangement being made with regard to the effluent disposal system to the satisfaction of the Responsible Authority and the Environmental Protection Agency and subject to further written consent of the Responsible Authority

D. The parties enter into this Agreement to achieve and advance the objectives of planning in Victoria and the objectives of the Planning Scheme in respect of the Subject Land.

IT IS AGREED:

1. **DEFINITION**

In this Agreement the words and expressions set out in this clause have the following meaning unless the context admits otherwise -

1.1 "Act" means the Planning & Environment Act 1987.

1.2 "Agreement" means this Agreement and any agreement executed by the parties expressed to be supplemental to this Agreement.

1.3 "the Owner" means the person or persons registered by the Registrar of Titles from time to time as proprietor of an estate in fee simple of the Owner's Land or any part

thereof and a reference to the Owner in this Agreement is also a reference to a Mortgagee-in-Possession.

1.4 "Planning Scheme" means the Colac-Otway Planning Scheme and any other planning scheme which applies to the Subject Land.

1.5 "Mortgagee" means the person registered or entitled from time to time to be registered by the Registrar of Titles as Mortgagee of the Subject Land or any part of it.

2. INTERPRETATION

2.1 The singular includes the plural and vice versa.

2.2 A reference to a gender includes a reference to a firm, corporation or other corporate body and that person's successors in law.

2.3 If a party consists of more than one person this Agreement binds them jointly and each of them severally.

2.4 A reference to an Act, Regulation or the Planning Scheme includes any Acts, Regulations or amendments amending, consolidating or replacing the Act, Regulation or Planning Scheme.

2.5 The introductory clauses to this Agreement are and will be deemed to form part of this Agreement.

AGREEMENT UNDER SECTION 173 OF THE ACT

The Council and the Owner agree that without limiting or restricting their respective powers to enter into this Agreement and, insofar as it can be so treated, this Agreement is made pursuant to Section 173 of the Act.

EFFECT OF AGREEMENT

4.1 Except as otherwise provided in this Agreement, this Agreement comes into force from the date it is executed by the parties.

4.2 The obligations of the Owner under this Agreement will take effect as separate and several covenants which are annexed to and run at law and equity with the Subject Land and each part of it.

5. OWNER'S WARRANTIES

Without limiting the operation or effect which this Agreement has the Owner warrants :

5.1 That it is the registered proprietor of the Owner's land.

5.2 That there are no mortgages, liens, charges, easements or other encumbrances or any rights inherent in any person affecting the Subject Land and not disclosed by the usual searches.

6. SUCCESSORS IN TITLE

Without limiting the operation or effect which this Agreement has, the Owner must ensure that, until such time as a memorandum of this Agreement is registered on the title to the Subject Land, the Owner will bring this Agreement to the attention of all prospective purchasers, mortgagees, transferees and assigns and successors in title who must be required to:

6.1 give effect to and do all acts and sign all documents which will require those successors to give effect to this Agreement; and

6.2 execute a deed agreeing to be bound by the terms of this Agreement.

7. SPECIFIC COVENANT OF OWNER

The Owner covenants and agrees with the Council that none of the Owner's land referred to in condition 14 of the Permit may be disposed of separately without appropriate alternative arrangement being made with regard to the effluent disposal system to the satisfaction of the Responsible Authority and the Environmental Protection Agency and subject to further written consent of the Responsible Authority

8. FURTHER COVENANT OF OWNER

8.1 Further Actions

8.1.1 The Owner will do all things necessary, including signing any further agreements, undertakings, covenant and consents, approvals or other documents necessary for the purpose of ensuring that the Owner carries out the Owner's covenant under this Agreement and to enable the Council to enforce the performance by the Owner of such covenant and undertakings;

8.1.2 The Owner will consent to the Council making application to the Registrar of Titles to make a recording of this Agreement in the Register on the Certificates of Title comprising the Subject Land in accordance with Section 181 of the Act and to do all things necessary to enable the Council to do so including signing any further agreement, acknowledgement or document or procuring the consent to

this Agreement of any mortgagee or caveator to enable the recording to be made in the Register under that Section.

8.2 Council's Costs to be Paid

The Owner will immediately pay to the Council, Council's reasonable costs and expenses (including legal expenses) of and incidental of any consequent Agreement and the enforcement and implementation of the Agreement and anything done in anticipation of the enforcement of any obligations imposed on the Owner and the cancellation or amendment of the Agreement which costs are and until paid will remain a charge on the Subject Land. To the extent that any such cost and expenses constitute legal professional costs the Council may have them assessed by the Law Institute of Victoria Cost Service and the Owner shall be bound by the amount of such assessment with any fee for obtaining such assessment being borne equally by the Owner and the Council.

9. GENERAL

9.1 Notices

A notice or other communication required or permitted to be given or served by a party on other party must be in writing and may be given or served:

9.1.1 by delivering it personally to that party;

9.1.2 by sending it by prepaid post addressed to that party at the address set out in this Agreement or subsequently notified to each party from time to time; or

9.1.3 by sending it by facsimile provided that a communication sent by facsimile must be confirmed immediately in writing by the sending party by hand delivery or prepaid post.

9.2 A Notice of other Communication is deemed served

9.2.1 if delivered, on the next following business day;

9.2.2 if posted, on the expiration of two business days after the date of posting; or

9.2.3 if sent by facsimile, on the next following business day unless the receiving party has requested re-transmission before the end of that business day.

9.3 No Waiver

Any time or other indulgence granted by the Council to the Owner or variation of the terms and conditions of this Agreement or any judgement or order obtained by the

Council against the Owner will not in anyway amount to a waiver of any of the rights or remedies of the Council in relation to the terms of this Agreement.

9.4 Severability

If a court, arbitrator, tribunal or other competent authority determines that a word, phrase, sentence, paragraph or clause of this Agreement is unenforceable, illegal or void then it must be severed and the other provisions of this Agreement will remain operative.

9.5 No Fettering of Council's Powers

It is acknowledged and agreed that this Agreement does not fetter or restrict the power or discretion of the Council to make any decision or impose any requirements or conditions in connection with the granting of any planning approval or certification of any plans of subdivision applicable to the Subject Land or relating to any use or development of the Subject Land.

9.6 Cessation

The Agreement shall continue to bind the Subject Land until the Owner and the Council enter into an agreement pursuant to Section 177 of the Act at the Owner's expense to end the Agreement.

AD654481J
01/06/2005 $110 173

D19/78889

EXECUTED AS A DEED.

THE COMMON SEAL of COLAC-OTWAY SHIRE COUNCIL was hereto affixed in accordance with its Local Law No. 4

COLAC OTWAY SHIRE COMMON SEAL

Warren Ruthes
.....
Councillor

Frederick Mercer
.....
Councillor

.....
Chief Executive Officer

THE COMMON SEAL of DOMINO MANOR PTY LTD ACN 007 037 032 was affixed in the presence of the authorised persons:

DOMINO MANOR PTY. LTD. A.C.N. 007 037 032 THE COMMON SEAL OF

x
Ray
.....
Sole Director and
Sole Company Secretary

RAYMOND CHARLES EDWARDS
.....

25 GREAT OCEAN RD
.....
Usual Address

WYE RIVER 3221.

DAD654481J-7-9

AD654481J
01/06/2005 $110 173

DATED 2004

COLAC-OTWAY SHIRE COUNCIL

- and -

DOMINO MANOR PTY LTD ACN 007 037

AGREEMENT

Sewells Larkins McCarthy
Lawyers
119 Murray Street
COLAC 3250

REF: Mr. PF Falkiner
TEL: (03) 5231 9400

Imaged Document Cover Sheet

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Document Type	**Instrument**
Document Identification	**2155252**
Number of Pages (excluding this cover sheet)	**4**
Document Assembled	**18/07/2019 11:15**

85/181 4562974

215252

FEE 2/6 T.O.

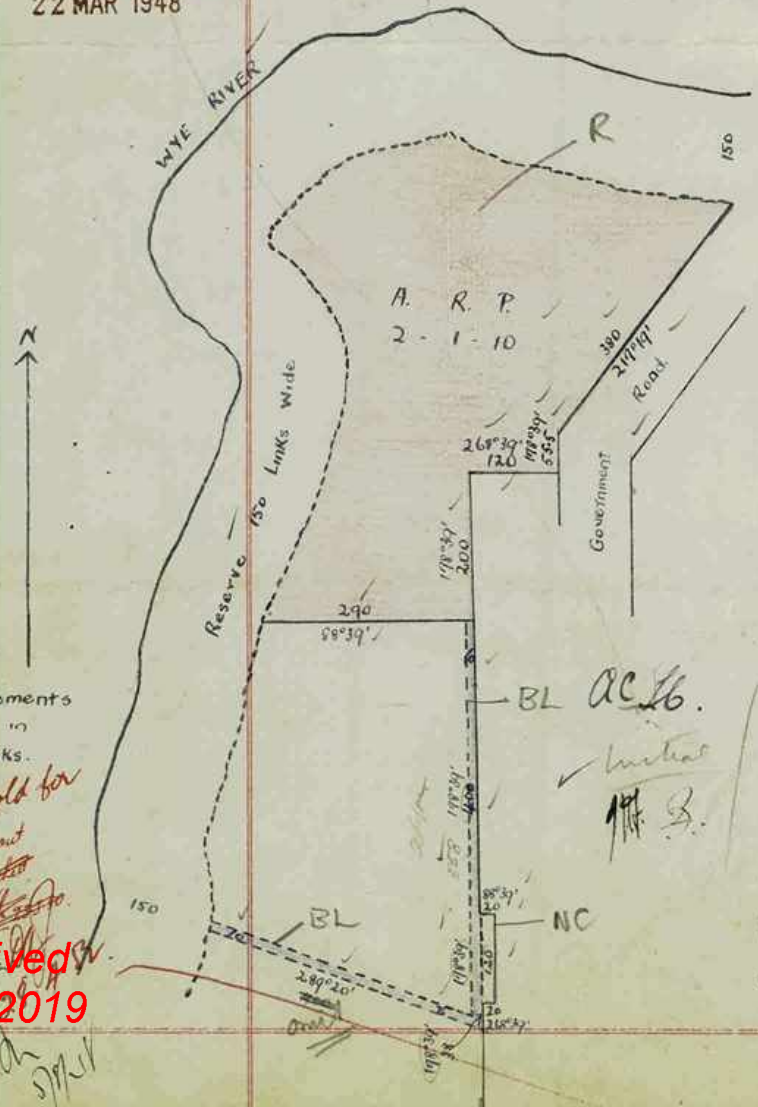
FEE 25/- T.O.

VICTORIA.

TRANSFER OF LAND.

WE THOMAS ANGUS ROBERTSON CLARKE Engineer AUDREY CLARKE Married Woman both formerly of 261 Boosey Road Ormond and JACK HUNTER - FLETCHER Engineer and JOYCE MARGARET FLETCHER Married Woman both formerly of 76 Centre Road Brighton now all of Wye River being registered as the proprietors as tenants in common in equal shares in an estate in fee simple in the land hereinafter described subject to the encumbrances notified hereunder in pursuance of an agreement for partition of the said lands and other lands nothing being paid by the transferees for equality of partition and in consideration of certain other assurances and transfers of even date herewith DO HEREBY TRANSFER to the said Thomas Angus Robertson Clarke and the said Audrey Clarke as tenants in common in equal shares Firstly All those pieces of land being Crown Allotments 29J and 29L and lots 2, 3, 4, 5, 6 and 7 on Plan of Subdivision No. 15732 lodged in the Office of Titles being part of Crown Allotment 29D and also all other parts of Crown Allotment 29D and part of Crown Allotment 29E all in the Parish of Kaanglang County of Polwarth which lands are comprised in Certificate of Title entered in the Register Book Volume 6871 Folio 1374066 and and Secondly All that piece of land delineated and colored red on the plan in the margin hereof and being part of Crown Allotment 2 Section A Parish of Wongarra County of Polwarth together with full and free right and liberty to and for the said Thomas Angus Robertson Clarke and the said Audrey Clarke their

VICTORIA — THIS INSTRUMENT IS NOT CHARGEABLE WITH ANY STAMP DUTY
22 MAR 1948



respective executors administrators and transferees owners for the time being of said land colored red to convey water through over and along the land delineated and colored blue on the said plan being other part of said Crown Allotment 2 Section A Parish of Wongarra to the said land colored red ~~from the Wye River~~ by means of the pump lines tank and other devices now on the said land colored blue and any other devices substituted thereon for any such And Also from time to time and at all times to enter upon the said land colored blue with or without animals or vehicles and carry out thereon - such work of maintenance repair replacement or inspection of the - said devices as may be necessary And thirdly Lot 1 on Plan of Subdivision No. 114927 lodged in the Office of Titles and being part of Crown Allotment 2 Section A Parish of Wongarra County of Polwarth.

DATED this 24th day of October 1947.

SIGNED by the said THOMAS ANGUS ROBERTSON CLARKS in Victoria in the presence of - T.A.R. Clarke

SIGNED by the said AUDREY CLARKE in Victoria in the presence of - Audrey Clarke

SIGNED by the said JACK HUNTER FLETCHER in Victoria in the presence of - J.H. Fletcher

SIGNED by the said JOYCE MARJORIE FLETCHER in Victoria in the presence of - J. Fletcher

ENCUMBRANCES ABOVE REFERRED TO.

As to the land colored green and green hatched on the map in the margin of said Certificate of Title, and the land colored blue on the map in the margin of Certificate of Title entered in the Register Book Volume 6763 Folio 135 [illegible] -

Any easements implied under Section 212 of the Transfer of Land Act 1928.

3 certs. to Issue.

1st cert. 6871-066 plan

2nd cert. 6763-554 part & E/E.
Area:- 2A. 1R. 10P.
being part of L.A. 2 Section A
Parish of Wongarra
County of Polwarth
Sog. etc. right to ~~conv~~ convey
water etc. yellow & sog. etc.
right to enter etc. yellow

3rd cert. 6763-555 plan

28.4.52.

13-5-52

Ext 15/5/52.

DATED 1947

MR. T. A. R. CLARKE & OTHERS.

- to -

MR. J. H. & MRS. J. M. FLETCHER.

TRANSFER.

NORVAL H. DOOLEY & BREEN
Solicitors,
31 Queen Street,
MELBOURNE C.1.

I CERTIFY
that a Memorial of the within Instrument No. P/555352
was entered on the 1 April 1948
in the Register Book Vols. 6871 Fols. 066
6763 554 and 555

Assistant Registrar of Titles

Rosevear Planning Associates

7 Sky Court
Jan Juc Victoria 3228
Phone: 0418 398 652
E-Mail: rosevearpa@bigpond.com

June 2019.

Revision: 2.

33 McRae Road, Wye River.

1: Introduction:

The application seeks a planning permit to allow the **construction of a new dwelling and removal of easements** at 33 McRae Road, Wye River.

The property has been mostly cleared to lawn and contains a moderate cover of canopy trees on the rear (eastern) half of the land. It is currently developed by an existing dwelling that will be demolished prior to construction of the new development.

The proposal will require the removal of a number of trees and shrubs located at the rear of the existing dwelling, to provide defendable space in accordance with the requirements of the Bushfire Management plan lodged with the application. All vegetation to be removed will be exempt from planning approval under the provisions of Clause 52.12-5 upon the issue of a permit with standard CFA conditions.

The site is covered by the Township Zone (TZ), Bushfire Management Overlay (BMO), Design and Development Overlay Schedule 4 (DDO4), Erosion Management Overlay Schedule 1 (EMO1), Neighbourhood Character Overlay Schedule 1 (NCO1) and Significant Landscape Overlay Schedule 2 (SLO2) under the provisions of the Colac Otway Planning Scheme.

A planning permit is required to undertake buildings and works associated with the construction of a dwelling under the provisions of the BMO, SLO2, NCO1 and EMO1.

2: Proposal:

The proposal will comprise two stories and is elevated above the Great Ocean Road in a position that is substantially screened from public viewing points by vegetation within the road reserve and the intervening properties.

At ground level the dwelling will contain a bunkroom, toilet, laundry, rumpus and store with access to the upper level by a stairway and lift. Water tanks are located on the north side of the building, below the upper level deck and a garage with adequate space for bin storage and to park one car undercover is also provided. The proposal will provide sufficient space for parking a second car in tandem within the proposed driveway.

The first floor includes three additional bedrooms, 2 with walk-in robes and master with ensuite, together with a shared bathroom and toilet, open plan kitchen, dining and living area with access to deck areas on the east and west side of the building.

The dwelling is located close to the McRae Road frontage and oriented to maximise coastal views to the east. The proposal maintains the existing front setback at 4.1m but steps back to 5.5m in front of the garage to accommodate the second car parking space.

Side setbacks will be 2.0m to the north side boundary and 3.0m to the south side boundary.

The building height is largely determined by the sloping nature of the site and while it achieves a maximum of 7.1m above the excavated level on the west elevation, the highest point above natural ground level will be 6.54m or (R.L.32.93) at the northeast corner.

The external walls of the building will be finished in a combination of Hardwood shiplap boards with a natural finish and steel battens finished in ‘night sky’. The roof of the new dwelling will be clad with Colorbond steel finished in ‘Basalt’.

The proposal also requires the removal of 2 easements from the relevant title plan on the basis that these are now redundant.

3: Existing Site Conditions and Surrounding Area:

McRae Road runs generally parallel to the Great Ocean Road at the south end of the Wye River Township. The road way is narrow and unsealed with dwellings generally located in close proximity to the road formation to maximise the opportunity for coastal views to the east.

33 McRae Road is located on the high (west) side of the road adjoining two other lots of similar size, which have all been developed by single dwellings. The subject land comprises approximately 891sqm and is generally rectangular in shape, it is 20.12m wide, 44.26m long and has a frontage to McRae Road along the east boundary.

The established character of this area is generally defined by single dwellings on lots of similar size to that of the subject land, with an extensive cover of native vegetation adjacent the rear property boundaries acting as a visual screen to the Wye River Caravan Park, which is located further to the west.

The adjoining dwellings at 31 & 35 McRae Road are typical of the area as shown in the following images:

The above image shows the existing dwelling on the subject land with 31 McRae Road in the background.

The above image shows the existing dwelling on the subject land on the left and the adjoining dwelling at 35 McRae Road on the right.

4: Title:

Under Section 61(4) of the *Planning & Environment Act 1987* the Responsible Authority must not issue a planning permit that would result in a breach of a registered restriction.

The subject land is described, as Lot 2 on PS:742250M and the title certificate shows that Section 173 Agreement AD654481J applies to the site.

The Section 173 Agreement (AD654481J) provides specific obligations on the Owner as follows:

> *The Owner covenants and agrees with the Council that none of the Owners land referred to in condition 14 of the Permit may be disposed of separately without appropriate alternative arrangements being made with regard to the effluent disposal system to the satisfaction of the Responsible Authority and the Environmental Protection Agency and subject to further written consent of the Responsible Authority.*

The Section 173 Agreement derives from planning permit 'PPA/169/2001' which allowed the Development of a Managers Residence associated with the adjoining Wye River Valley Tourist Park, on the land. A subsequent exchange of land was executed through Plan of Subdivision 742250M for which a Statement of Compliance was issued by Council on 30/08/2016, allowing a section of Lot 1 to be consolidated into the adjoining Lot 2 (Lot 2 being the subject land).

The Section 173 Agreement is dated 25/02/2005 and was therefore clearly in place at the time of the land exchange. It can therefore be assumed that Council was satisfied that the requirements of the Agreement had been appropriately completed prior to the exchange occurring.

The Section 173 Agreement does not make any reference to the construction of a new dwelling on the land and the proposal will not breach any of the relevant restrictions. The application can therefore be assessed on merit.

5: Aboriginal Cultural Heritage:

Pursuant to Section 52(1) of the Aboriginal Heritage Act 2006 if a Cultural Heritage Management Plan (CHMP) is required a planning permit cannot be granted until a copy of the approved CHMP is provided and cannot grant a permit for an activity that is inconsistent with the approved CHMP [s. 52(3)].

The subject site is located within an area of cultural heritage sensitivity however the construction of a single dwelling on the land is a low impact activity under the provisions of the Act and a CHMP is not required.

6: Zoning & Overlay Provisions:

The land is zoned Township Zone under the provisions of the Colac Otway Planning Scheme and a planning permit is not required for the use and development of a dwelling or the associated removal of native vegetation under Clause 32.05 as follows:

Township - TZ

Criteria	Standard	Proposal	Comment
Clause 32.05-2 **Use of land**	No permit required to use the land for a dwelling provided: • The requirements of Clause 32.05-2 are met.	Dwelling: The requirements of Clause 32.05-2 will be met	No permit required.
Clause 32.05-3 **Use for a dwelling or a dependent person's unit**	A lot may be used for a dwelling provided requirements are met in relation to: • Waste water disposal • Water supply • Electricity supply	Dwelling: The requirements for treatment of wastewater, provision of potable water and connection to a reticulated electricity supply will be met.	No permit required
Clause 32.05-5 **Subdivision**	A permit is required to subdivide land. Must meet the Objectives & Standards specified in Clauses 56.03-5, 56.04-2, 56.04-3, 56.04-5 & 56.06-8 to 56.09-2	N/A	
Clause 32.05-6 **Construction & extension of medium density housing and residential buildings**	A permit is required to construct &/or extend: • One dwelling on a lot of < 300sqm • A dwelling if there is at least one dwelling on the lot • Two+ dwellings on the lot • Extend a dwelling if there are 2+ dwellings on a lot • A residential building.	Subject Lot is > 300sqm. Only one dwelling proposed	N/A
Clause 32.05-7 **Buildings & works**	A permit is required to construct a building or construct or carry out works for a use in Section 2 of Clause 32.01-1.	Buildings & works associated with Section 1 use	No permit required
Clause 32.01-6 **Advertising signs**	Advertising sign requirements are at Clause 52.05. Category 3.	N/A	N/A

The land is also affected by the Bushfire Management Overlay (BMO), Design and Development Overlay Schedule 4 (DDO4), Erosion Management Overlay Schedule 1 (EMO1), Neighbourhood Character Overlay Schedule 1 (NCO1) and Significant Landscape Overlay Schedule 2 (SLO2), and is assessed against the relevant provisions as follows:

Bushfire Overlay (WMO or BMO) *last updated VC109*

Clause	Requirement	Proposal	Permit Required
Clause 44.06-1 **Buildings & works**	*A permit is required to construct a building or to construct or carry out works associated with the following uses:* • *Accommodation* • *Child care centre* • *Education centre* • *Hospital* • *Industry* • *Place of assembly* • *Retail premises* • *Timber production* *This does not apply to any of the following:* • *If a schedule to this overlay specifically states that a permit is not required.* • *A building or works consistent with an agreement under Section 173 of the Act prepared in accordance with a condition of permit issued under the requirements of Clause 44.06-3.* • *An alteration or extension to an existing building used for a dwelling or a dependent person's unit that is less than 50 percent of the gross floor area of the existing building.* • *An alteration or extension to an existing building (excluding a dwelling and a dependent person's unit) that is less than 10 percent of the gross floor area of the existing building.* • *A building or works ancillary to a dwelling if the following requirements are met:* - *The combined floor area of all buildings ancillary to the dwelling does not exceed 150 square metres.* - *The building or works are located more than 10 metres from any existing building used for Accommodation.* • *A building or works associated with Timber production provided the buildings or works are not within 150 metres of Accommodation or land zoned for residential or rural residential purposes.*	Buildings & works associated with Accommodation (Dwelling)	**Permit required**
Clause 44.06-1	*A permit is required to subdivide land.*	N/A	N/A

Subdivision			

Design and Development Overlay – Schedule 4 (DDO4)

Coastal Towns: Skenes Creek, Kennett River, Wye River and Separation Creek.

Clause	Requirement	Proposal	Permit required
Clause 43.02-2 combined with Schedule 4 **Permit triggers - Buildings and works**	*A permit is required to:* ▪ *construct a building or to construct or carry out works. This does not apply if:* ○ *If a schedule to this overlay specifically states that a permit is not required.* ○ *To the construction of an outdoor swimming pool associated with a dwelling unless a specific requirement for this matter is specified in a schedule to this overlay.* ▪ *Construct a fence if specified in a schedule to this overlay*	Buildings & Works Schedule 4 provides at Clause 2 that: *A permit is not required to construct a building or carry out works* N/A N/A	No permit required
Clause 43.02-2 combined with Schedule 4 **Permit triggers - fences**	*A permit is required to construct a fence if specified in a schedule to this overlay.*	Schedule 4 does not specify that a permit is required to construct a fence	No permit required
Clause 43.02-3 combined with Schedule 4 **Permit trigger - Subdivision**	*A permit is required to subdivide land.*	No Subdivision proposed	N/A
Clause 43.02-3 combined with Schedule 4: 3.0 **Subdivision**	*A new lot must have the following minimum lot size in the relevant Precinct as shown (see table at Clause 3)* *Lots created by subdivision must:* • Provide for a dwelling or dwellings that will meet the Vision for the township, the preferred character of the Precinct and associated design guidelines; and • Where creating a battle-axe style lot, not include the area of any driveway in the lot area calculations; and	No subdivision proposed	N/A

	• Where creating new streets, incorporate layout and public domain features, such as street trees and kerbing that meet the township Vision and preferred character of the Precinct. .		
Clause 43.02-4 and Schedule **Advertising signs**	*Advertising sign requirements are at Clause 52.05-9 Category 4*	N/A	N/A

Significant Landscape Overlay – Schedule 2 (SLO2)

Coastal Towns: Skenes Creek, Kennett River, Wye River and Separation Creek.

Clause	Requirement	Proposal	Permit required
Clause 42.03-2 combined with Schedule 2 **Permit triggers – buildings and works**	*A permit is required to:* • *construct a building or carry out works. This does not apply:* ○ *If a schedule to this overlay specifically states that a permit is not required.* ○ *To the conduct of agricultural activities including ploughing and fencing (but not the construction of dams) unless a specific requirement for that activity is specified in a schedule to this overlay.*	Buildings & Works Schedule 2 does not exempt buildings and works N/A	**Permit required**
Clause 42.03-2 combined with Schedule 2 : 3.0 **Permit triggers – construct fence**	*A permit is required to* • *Construct a fence if specified in the schedule to this overlay.* *Clause 3.0 of Schedule 2 requires a permit to construct a fence, other than:* • *a post and wire fence that is less than 1.2 metres in height if on the front boundary* • *a post and wire fence that is less than 1.5m in height if on any other boundary.* *For the purpose of this clause a post and wire fences includes wire strands, wire mesh ('ringlock'), chainmesh and similar open rural style fencing.*	No fencing proposed	No permit required
Clause 42.03-2 combined with	*A permit is required to:* • *Remove, destroy or lop any vegetation*		Permit required

Schedule 2: 3.0 **Permit triggers - Vegetation**	*specified in a schedule to this overlay. This does not apply:* ○ *If the table to Clause 42.03-3 specifically states that a permit is not required.* ○ *To the removal, destruction or lopping of native vegetation in accordance with a native vegetation precinct plan specified in the schedule to Clause 52.16.* *Clause 3.0 of Schedule 2 requires a permit to remove, destroy or lop a tree, This does not apply to:* ○ *A tree having a single trunk circumference less than 0.5 metre at a height of one metre above the ground level.* ○ *The pruning of a tree for regeneration or ornamental shaping.* ○ *A tree which is dead or dying.*		

Neighbourhood Character Overlay Schedule 1 (NCO1)

Coastal Towns: Skenes Creek, Kennett River, Wye River and Separation Creek.

Clause	Requirement	Proposal	Permit required
Clause 43.05-2 combined with Schedule 1: 3.0 **Buildings and works**	*A permit is required to construct a building or to construct or carry out works, including* ▪ *To construct an outdoor swimming pool associated with a dwelling.* ▪ *To construct or extend an outbuilding normal to a dwelling.*	Buildings and works	**Permit required**
Clause 43.05-2 combined with Schedule 1: 3.0 ***Demolition***	*A permit is NOT required to demolish or remove a building.*		No permit required
Clause 43.05-2 combined with Schedule 1: 3.0 **Trees**	*A permit is NOT required to Remove, destroy or lop trees*		No permit required

Erosion Management Overlay Schedule 1

Erosion Management Overlay			
Criteria	**Standard**	**Proposal**	**Comment**
Permit requirement *Clauses: 44.01-1,*	A permit is required to: • Construct a building or construct or carry out works.	Construct dwelling and associated works	Permit required.

44.01-2 *44.01-4*	• Remove, destroy or lop any vegetation. • Subdivide land.	Remove destroy or lop vegetation N/A	Permit required
Schedule 1: 5.0 **Exemptions from permit requirements**	Schedule 1 to the EMO provides a number of exemptions from the need to obtain a planning permit for earthworks, retaining walls, alterations and additions to existing dwellings, roadworks, and vegetation removal.	The exemptions do not apply to the proposal	Permit required.

7: Discussion:

A planning permit is not required to construct a replacement dwelling on the subject land under the provisions of the Township Zone, however a permit is required to undertake buildings and works associated with the construction of a dwelling under the BMO, NCO1, SLO2, and EMO1.

The BMO and EMO1 require technical assessment of the levels of risk to life and property associated with a proposed development as a result of bushfire and landslide. The application is supported by reports prepared in accordance with the application requirements, which conclude that the proposal is an appropriate development response to the site and the surrounding area and provide recommendations to ensure the property is managed appropriately.

NCO1 and SLO1 provide the main objectives and performance criteria to ensure the proposal results in an outcome that is consistent with the preferred neighbourhood character for the area and Schedule 1 of the NCO also modifies a number of standards within Clause 54.

The proposed development has been assessed against Clause 54 as modified by NCO1 and a copy of this assessment is included as an attachment to this report.

Generally the development complies with the objectives of Clause 54 however minor variations to the standards relating to front and side setbacks are proposed. These variations are discussed in details below.

Setbacks

The proposed dwelling will provide a front setback at the upper level of 5.32m to the wall of the building and 4.1m to the front of the deck, which complies with the Standard A3 of Clause 54 based on the average of the existing buildings on the adjoining allotments as follows:

Front setback to No.35 McRae Road = 7.2m.
Front setback to No.31 McRae Rd = 0.899m.
7.2+0.899/2 = 4.04m. avg.

NCO1 varies Standard A3 and requires that:

Walls of buildings should be setback at least 7 metres from the front street.

In this case it is submitted that the proposal is acceptable as it exceeds the front setback achieved by the existing dwelling on the land and will provide an appropriate 'infill' between the adjoining properties when viewed from the street. It is therefore consistent with the relevant neighbourhood character objective, which seeks:

To ensure new buildings respect and complement the scale, setback, siting, materials and overall form of existing buildings.

Similarly whilst easily compliant with the normal requirements of Standard A10, the proposal will result in a minor variation of the side setbacks preferred under NCO1 as follows.
The proposal will provide minimum setbacks of 3.0m to both side boundaries and >22m to the rear boundary apart from the stairs leading to 'deck 2', which are an allowable encroachment. It therefore complies with the first two criteria of varied Standard A10, but falls marginally short of the third criteria which requires that:

A new building should be setback from the side or rear boundary a minimum of 3 or 5 metres as required above, plus 0.3 metres for every metre of height over 3.6 metres up to 6.9 metres, plus 1 metre for every metre of height over 6.9 metres.

In this case the proposal encroaches the preferred side setbacks relative to building height by 210mm to the wall of the northern façade and 120 – 330mm for the southern façade.

The decision guidelines relevant to the assessment of setbacks require the responsible authority to consider the following:

- *The effect of the building or works on the nationally significant Great Ocean Road Region landscape.*
- *Whether the extension or modification to a building contributes to the township vision and preferred character of the area.*
- *Whether the siting, bulk, form and appearance of any building or works will contribute to the township vision and preferred character of the township.*
- *Whether the building is sited to provide large setbacks from front, side and rear boundaries.*
- *Whether the building respects the predominantly low scale forms in the area.*
- *Whether the building materials contribute to the preferred neighbourhood character.*

In this case it is submitted that the required encroachments are particularly minor and will not cause the proposal to be visible from the Great Ocean Road. The new dwelling will therefore have no impact on

the landscape character of the region and will deliver a low scale, contemporary building entirely in keeping with the preferred character for new development in Wye River. The proposed setbacks will provide space around the building, which can be planted in accordance with the requirements of the Bushfire Management Plan.

The siting of the dwelling at the front of the site will allow maximum retention of the existing vegetation growing on the rear half of the property, which provides a visual buffer to the adjoining caravan park.

The proposal will also facilitate coastal views to the east, but is respectful of adjoining residents and the neighbourhood character of the area.

Site Coverage

A minor variation is also required pursuant to varied Standard A5, which sets a preferred maximum site coverage of 20% in Wye River.

NCO1 references character precincts, which are set out at Clause 21.03-6 of the Local Planning Policy Framework and identify the subject land as being located within Wye River Precinct 2.

The preferred Character Statement for this Precinct provides that:

> *This precinct will achieve a more consistent native vegetation coverage to provide a unifying feature throughout. Space around dwellings will be sufficient to maintain trees and understorey, and minimises the appearance of building bulk and density. On hill slopes, buildings will relate to topography and be set amongst and beneath a dominant, native tree canopy. Buildings and structures in prominent locations when viewed from the Great Ocean Road will be designed to reduce their visual intrusion. Retention and planting of canopy trees in the public domain and around dwellings will be encouraged to establish a consistent tree canopy.*

These requirements and the objective to establish a consistent tree canopy have been largely diminished by the requirements of Clauses 13.02-1S and 53.02 which elevate the need to provide defendable space in response to the high bushfire risk associated with this area. Not withstanding this however, the performance criteria applied through the NCO are still an appropriate guide to ensure proposed development is in keeping with the preferred neighbourhood character.

In this case the proposal will achieve a maximum site coverage of 24.1%, which exceeds the preferred criteria nominated in NCO1 by 4.1% or 36.5sqm. It is submitted that this encroachment is appropriate as a significant proportion of the building footprint consists of unroofed deck which reduces the perception of building bulk and sufficient space will be provided for landscape planting, in accordance with the requirements of the BMP, at the front and rear of the building to ensure it presents in a manor which is consistent with the preferred neighbourhood character.

The proposal is compliant with all other Standards and Objectives provided in Clause 54 including those varied by NCO1, pursuant to Building Height, Walls on Boundaries and Design Detail.

Native Vegetation Removal

The removal of native vegetation from the site is controlled through the provisions of SLO2 and EMO1 however in this case Clause 52.12-1 provides an exemption allowing the removal of any vegetation within 10 metres of the existing dwelling without a planning permit.

Some additional vegetation removal will be required beyond 10m of the exiting dwelling to provide defendable space in accordance with the requirements of the BMP however this will be exempt under Clause 52.12-5 upon the issue of a permit with standard CFA conditions.

The Landslip Risk assessment prepared by AGR Geosciences Pty Ltd has considered the impact of the vegetation removal on the stability of the site and concludes:

> *Suitable vegetation contributes greatly to the stability of a site by reducing the soil moisture content, minimising soil erosion and binding the soil structure together. Existing trees should remain unless they interfere with the building or the minimum defendable space for fire protection in which case they should be cut off at ground level and the root structures left intact.*
>
> *We recommend revegetation over and below the existing scarp. Suitable deep-rooted trees, shrubs and grasses should be established an appropriate distance from the building with regard to fire risk to assist the overall slope stability.*
>
> *Revegetation of the site, especially over and below the existing scarp and will provide root-binding effects, help mitigate excess moisture building up in the soil profile, increase suction, assist with rainfall and surface flow interception and reduce the velocity of overland flow in turn reducing the risk of slope failures.*

The removal of native vegetation from the site will be undertaken in accordance with the recommendations of the Geotech report.

Easement removal

The proposal also seeks approval to remove Easements E-1 & E-2 from the relevant title plan to allow the new water treatment and disposal system to be installed as efficiently as possible and in accordance with the recommendations of the LCA and LRA lodged in support of this application.

Section 52.02 of the planning scheme seeks:

> *To enable the removal and variation of an easement or restrictions to enable a use or development that complies with the planning scheme after the interests of affected people are considered.*

It also establishes that a permit is required before a person proceeds:

> *Under Section 23 of the Subdivision Act 1988 to create, vary or remove an easement or restriction or vary or remove a condition in the nature of an easement in a Crown grant.*

It is submitted that the easement removal can be supported on the basis of redundancy for the following reasons:

- Easement E-2 was originally required to allow water to be pumped from storage tanks on the adjoining caravan park to a nearby dwelling held in common ownership. The dwelling was later sold and the pipes have been removed from the easement.
- Easement E-1 was intended to be used for drainage but has never been used and does not contain any assets.

7: Conclusion

The subject land presents a number of site-specific challenges in relation to Bushfire and Landslip. The application is supported by reports prepared by suitably qualified experts in these fields, which support the development subject to appropriate mitigation treatments.

The replacement dwelling has been assessed against the relevant provisions of the planning scheme and proposes minor variations to the performance criteria preferred under NCO1, which have been discussed previously in this report.

On balance it is concluded that the proposal has made an appropriate response to the site and will deliver an outcome consistent with the established and preferred neighbourhood character.

ATTACHMENT – ASSESSMENT AGAINST CLAUSE 54 WITH NCO1 VARIATIONS

MODIFIED STANDARDS IDENTIFIED BY SHADING *Last updated as at VC116*

54.02 NEIGHBOURHOOD CHARACTER				
54.02-1 Neighbourhood Character Objectives	**Met?**	***Standard A1***	**Met?**	**Comments**
To ensure that the design respects the existing neighbourhood character or contributes to a preferred neighbourhood character. *To ensure that development responds to the features of the site and the surrounding area*	Yes	*The design response must be appropriate to the neighbourhood and the site. The proposed design must respect the existing or preferred neighbourhood character and respond to the features of the site.*	Yes	The proposal will deliver a modern contemporary home, which will present as a low scale building with sufficient separation to property boundaries to ensure the planting and retention of vegetation in accordance with the requirements of the relevant Bushfire Management Plan and the Neighbourhood Character Objectives described in NCO1.
54.02-2 Integration With The Street Objective	**Met?**	***Standard A2***	**Met?**	**Comments**
To integrate the layout of development with the street	Yes	*Development should be oriented to front existing and proposed streets*	Yes	
		High fencing in front of dwellings should be avoided if practicable	Yes	No new fencing proposed.
		Dwellings should be designed to promote the observation of abutting streets and any abutting public open spaces	N/A	

54.03 SITE LAYOUT AND BUILDING MASSING				
54.03-1 Street Setback Objective	***Met?***	***Standard A3***	***Met?***	***Comments***
To ensure that the setbacks of buildings from a street respect the existing or preferred neighbourhood character and make efficient use of the site	Yes	***NCO modified requirements*** *Walls of buildings should be set back at least 7 metres from the front street and side street setbacks should meet the distances specified below:* *The site is on a corner:* *The same distance as the setback of the front wall of any existing building on the abutting allotment facing the street or 2 metres whichever is the lesser.* .	**NO**	The proposal will achieve a front setback of 5.32m. to the building wall and 4.1m, to the front deck. See discussion
		Porches, pergolas and verandahs that are < 3.6m high and eaves may encroach ≤ 2.5m into the setbacks of this standard	N/A	
54.03-2 Building Height Objective	***Met?***	***Standard A4***	***Met?***	***Comments***
To ensure that the	Yes	***NCO modified standard***		

height of buildings respects the existing or preferred neighbourhood character		- *The maximum building height should not exceed 8.0 metres or two storeys whichever is the lesser.* - *Buildings should be stepped to follow the contours of the site.* - *Changes of building height between existing buildings and new buildings should be graduated*	Yes N/A	The maximum building height will be 7.1m above the excavated level on the west elevation and 6.54m or R.L. 32.93 above natural ground level at the northeast corner.
54.03-3 Site Coverage Objective	***Met?***	***Standard A5***	***Met?***	***Comments***
To ensure that the site coverage respects the existing or preferred neighbourhood character and responds to the features of the site	Yes	***NCO modified requirements*** The site area covered by buildings should not exceed the following amounts in the Precincts as shown on the Character Precinct Maps at Clause 21.04-13 (Skenes Creek), 21.04-14 (Kennett River) and 21.04-15 (Wye River and Separation Creek): - Wye River Precinct 1 – 20% - Wye River Precinct 2 – 20% - Kennett River Precinct 1 – 20% - Kennett River Precinct 2 – 20% - Separation Creek Precinct 1 – 25% - Skenes Creek Precinct 1 – 20% - Skenes Creek Precinct 2 – 25% - .	**NO**	Wye River Precinct 2: - 20%. Building site coverage = 214.7sqm = 24.1%. See discussion
54.03-4 Permeability Objectives	***Met?***	***Standard A6***	***Met?***	***Comments***
To reduce the impact of increased stormwater run-off on the drainage system *To facilitate on-site stormwater infiltration*	Yes	*The site area covered by pervious surfaces should be at least 20% of the site.*	Yes	Hard surface: 232.46sqm. including the driveway = 26.1% Pervious surface area = 658.04sqm. – 73.89%
54.03-5 Energy Efficiency Protection Objectives	***Met?***	***Standard A7***	***Met?***	***Comments***
To achieve and protect energy efficient dwellings *To ensure the orientation and layout of development reduce fossil fuel energy use and make appropriate use of daylight and solar energy*	Yes	*Buildings should be:* • *Orientated to make appropriate use of solar energy* • *Sited and designed to ensure that the energy efficiency of existing dwellings is maximised*	Yes	Complies
		Living areas and private open space should be located on the north side of the development if practicable	Yes	Complies
		Dwellings should be designed so that solar access to north facing windows is maximised.	Yes	The dwelling has been designed to maximise access to views on the east side but still has good solar access to the living room and the adjoining decks.

54.03-6 Significant Trees Objectives	***Met?***	***Standard A8***	***Met?***	***Comments***
To encourage development that respects the landscape character of the neighbourhood *To encourage the retention of significant trees on the site.*	Yes	*Development should provide for the retention or planting of trees, where these are part of the neighbourhood character.* *Development should provide for the replacement of any significant trees that have been removed in the 12 months prior to the application being made.*	Yes	Vegetation can be retained/replanted on the site in accordance with the requirements of the Bushfire Management Plan which takes precedence over al other planning policy pursuant to the provisions of Clause 13.02-1S.

54.04 AMENITY IMPACTS				
54.04-1 Side and Rear Setback Objective	***Met?***	***Standard A10***	***Met?***	***Comments***
To ensure that the height and setback of a building from a boundary respects the existing or preferred neighbourhood character and limits the impact on the amenity of existing dwellings.	Yes	***NCO modified requirements*** *A new building should be set back from both side boundaries a minimum of 3 metres.* *A new building should be setback a minimum of 5 metres from the rear boundary.* *A new building should be setback from the side or rear boundary a minimum of 3 or 5 metres as required above, plus 0.3 metres for every metre of height over 3.6 metres up to 6.9 metres, plus 1 metre for every metre of height over 6.9 metres.* *Sunblinds, verandahs, balconies, porches, eaves, fascias, gutters, chimneys, flues, pipes, domestic fuel or water tanks, and heating or cooling equipment associated with a dwelling, may encroach into the setbacks of this standard.*	**Yes** **YES** **NO** **YES**	*3.0m to the north side boundary (except for stair which is an allowable encroachment pursuant to varied Std.A10)* *3.0m to the south side boundary.* *Setback to rear boundary >5m.* *North side boundary:* *Building height* *Clerestory – 6.13m* *Wall - 4.3m* *Prop. setback:* *Clerestory - 4.0m* *Wall - 3.0m* *Req. setback;* *Clerestory – 3.78m* *Wall - 3.21* *South side boundary:* *Building height– 4.0 – 4.7m* *Prop. setback:- 3.0m* *Req. setback;- 3.12– 3.33m* *East rear boundary:* *Building height – 6.9m* *Prop. setback:- >22m* *Req. setback;- 5.99m* *See discussion*
		Sunblinds, verandahs, porches, eaves, fascias, gutters, masonry chimneys, flues, pipes, domestic fuel or water tanks, and heating or cooling equipment or other services may encroach not more than 0.5 metres into the setbacks of this standard.	N/A	

		Landings having an area of not more than 2 square metres and less than 1 metre high, stairways, ramps, pergolas, shade sails and carports may encroach into the setbacks of this standard.	N/A	*See varied Std. above*
54.04-2 Wall On Boundaries Objective	***Met?***	***Standard A11***	***Met?***	***Comments***
To ensure that the location, length and height of a wall on a boundary respects the existing or preferred neighbourhood character and limits the impact on the amenity of existing dwellings	Yes	***NCO modified requirements*** *A new wall should not be constructed on a boundary.*	Yes	No walls on boundary proposed.
		.		
54.04-3 Daylight To Existing Windows Objective	***Met?***	***Standard A12***	***Met?***	***Comments***
To allow adequate daylight into existing habitable room windows	Yes	*Buildings opposite an existing habitable room window should provide for a light court to the existing window that has a minimum area of 3sqm and minimum dimensions of 1m clear to the sky. The calculation of the area may include land on the abutting lot*	N/A	No existing habitable room windows within 3 m.
		Walls or carports more than 3m in height opposite an existing habitable room window should be set back from the window at least 50% of the height of the new wall if the wall is within a 55^{o} arc from the centre of the existing window. The arc may be swung to within 35^{o} of the plane of the wall containing the existing window *Where the existing window is above ground floor level, the wall height is measured from the floor level of the room containing the window* *Refer to diagram A2*	N/A	No walls or carport opposite existing habitable room windows
54.04-4 North Facing Windows Objective	***Met?***	***Standard A13***	***Met?***	***Comments***
To allow adequate solar access to existing north-facing habitable room windows	Yes	*If a north-facing habitable window of an existing dwelling is within 3m of a boundary on an abutting lot, a building should be setback from the boundary 1m, plus 0.6m for every metre of height over 3.6m up to 6.9m, plus 1m for every metre of height over 6.9m, for a distance of 3m from the edge of each side of the window* *Refer to Diagram A3*	Yes	The adjoining dwelling to the south has north facing windows within 3.0m of the boundary shared with the subject land. *Building height on south façade – 4.0 – 4.7m* *Prop. setback:- 3.0m* *Req. setback;- 1.24–1.66m* Complies

54.04-5 Overshadow Open Space Objective	***Met?***	***Standard A14***	***Met?***	***Comments***
To ensure buildings do not significantly overshadow existing secluded private open space	Yes	*Where sunlight to secluded private open space of an existing dwelling is reduced, at least 75%, or 40sqm with minimum dimension of 3m, whichever is the lesser area, of the secluded private open space should receive a minimum of five hours of sunlight between 9am and 3pm on 22 September*	Yes	Overshadowing diagrams provided in support of the application show compliance with the Standard. Complies
		If existing sunlight to the secluded private open space of an existing dwelling is less than the requirements of this standard, the amount of sunlight should not be further reduced	N/A	
54.04-6 Overlooking Objective	***Met?***	***Standard A15***	***Met?***	***Comments***
To limit views into existing secluded private open space and habitable room windows	Yes	*A habitable room window, balcony, terrace, deck or patio should be located and designed to avoid direct views into the secluded private open space of an existing dwelling within a horizontal distance of 9m (measured at ground level) of the window, balcony, terrace, deck or patio. Views should be measured within a 45° angle from the plane of the window or perimeter of the balcony, terrace, deck or patio, and from a height of 1.7m above the floor level*	Yes	Overlooking to the adjoining properties at 31 & 35 McRae Road will not be increased beyond the existing circumstances. Additionally the interfaces between these properties are not fenced and therefore areas within 9.0m of the new development cannot be considered as Secluded Private Open Space pursuant to the definition provided at Clause 73.01 of the planning scheme.  

		A habitable room window, balcony, terrace, deck or patio with a direct view into a habitable room window of an existing dwelling within a horizontal distance of 9m (measured at ground level) of the window, balcony, terrace, deck or patio should be either: • *offset a minimum of 1.5m from the edge of one window to the edge of the other, or* • *have sill heights of at least 1.7m above floor level, or* • *have obscure glazing in any part of the window below 1.7m above floor level, or* • *have permanently fixed external screens to at least 1.7m above floor level and be no more than 25% transparent*	Yes	*Overlooking already occurs from the existing dwelling to the adjoining dwelling at 35 McRae Rd within a horizontal distance of 9m.*  *Overlooking from the proposal has been appropriately addressed through the use of 1.7m sill heights to habitable rooms located within 9.0m of the adjoining dwellings.* *See discussion.*
		Obscure glazing in any part of the window below 1.7m above floor level may be openable provided that there are no direct views as specified in this standard	N/A	
		Screens used to obscure a view should be: • *perforated panels or trellis with a maximum of 25% openings or solid translucent panels* • *permanent, fixed and durable* • *designed and coloured to blend with the development*	N/A	
		This standard does not apply to a new habitable room window, balcony, terrace, deck or patio which faces a property boundary where there is a visual barrier at least 1.8m high and the floor level of the habitable room, balcony, terrace, deck or patio is less than 0.8m above ground level at the boundary *Refer to Diagram A4*	N/A	

54.05 ON-SITE AMENITY AND FACILITIES				
54.05-1 Daylight To New Windows Objective	**Met?**	**Standard A16**	**Met?**	**Comments**
To allow adequate daylight into new habitable room windows	Yes	*A window in a habitable room should be located to face:* • *an outdoor space clear to the sky or a light court with min. area of 3sqm and min. dimension of 1m clear to the sky, not including land on an abutting lot, or* • *a verandah provided it is open for at least one third its perimeter, or* • *a carport provided it has two or more open sides and is open for at least one third of its perimeter*	Yes	
54.05-2 Private Open Space Objective	**Met?**	**Standard A17**	**Met?**	**Comments**
To provide adequate private open space for the reasonable recreation and service needs of residents	Yes	*Dwelling should have private open space:* • *of 80sqm or 20% of the lot area, whichever is the lesser but not less than 40sqm* • *at least one part of the POS should consist of 25sqm secluded POS with a min. width of 3m at the side or rear with convenient access from a living room*	Yes	36.96sqm of secluded private open space is provide by the decks located either side of the living room.
54.05-3 Solar Access To Open Space Objective	**Met?**	**Standard A18**	**Met?**	**Comments**
To allow solar access into the secluded private open space of a new dwelling	Yes	*The private open space should be located on the north side of the dwelling, if practicable*	Yes	
		The southern boundary of secluded private open space should be set back from any wall on the north of the space at least (2 + 0.9h) metres, where h is the height of the wall *Refer to Diagram A5*	Yes	

54.06 DETAILED DESIGN				
54.06-1 Design Detail Objective	**Met?**	**Standard A19**	**Met?**	**Comments**
To encourage design detail that respects the existing or preferred neighbourhood character	Yes	*The design of buildings, including:* • *Facade articulation and detailing,* • *Window and door proportions,* • *Roof form, and* • *Verandahs, eaves and parapets,* *should respect the existing or preferred neighbourhood character.* *Garages and carports should be visually compatible with the development and the existing or preferred neighbourhood character.*	Yes	

		NCO modified requirements *In addition to the attributes in clause 54.06-1, the design of buildings including* • The number of storeys, • Verandahs, eaves and parapets, • Materials, colours and finishes, and • Building siting, including space around buildings *should respect the preferred neighbourhood character of the area.*	Yes	The development, as proposed is consistent with the preferred neighbourhood character of the area, in relation to: • Built form & scale, • Building height, • Setbacks to front & side, • Materiality.
54.06-2 Front Fences Objective	***Met?***	***Standard A20***	***Met?***	***Comments***
To encourage front fence design that respects the existing or preferred neighbourhood character	Yes	*The design of front fences should complement the design of the dwelling and any front fences on adjoining properties*	N/A	No fencing proposed
		NCO modified requirements *A front fence within 3 metres of a street should not exceed a height of 1.2 metres and should be at least 50% transparent.*	N/A	No fencing proposed

PROPOSED DWELLING AT

33 MCRAE ROAD

WYE RIVER, 3234 VIC

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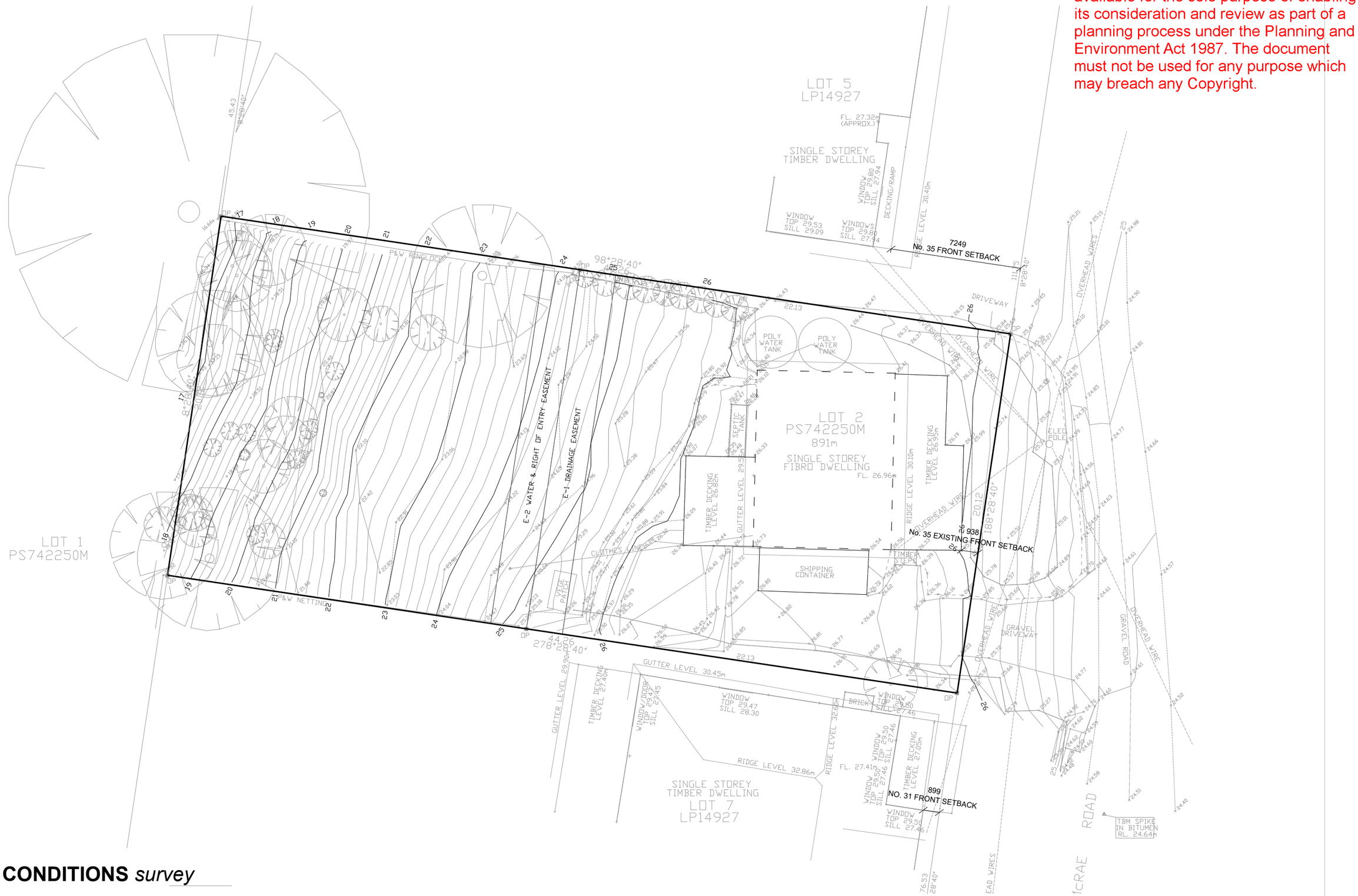

EXISTING CONDITIONS *survey*

PROJECT	**PROPOSED NEW DWELLING**
ADDRESS	33 MCRAE ROAD, WYE RIVER VIC 3234
CLIENT	S + R
DATE	14.11.19

TITLE	**EXISTING CONDITIONS**
SCALE	1:200 @ A3
DRAWN	PB
DWG	191114_01
REVISION	

BAL	29
STRUC / CIVIL	TBA
GEOTECH	DJH
SURVEYOR	LJP
NATHERS	TBA

REVISION

NO.	DATE	DESCRIPTION
1	--/--/--	-

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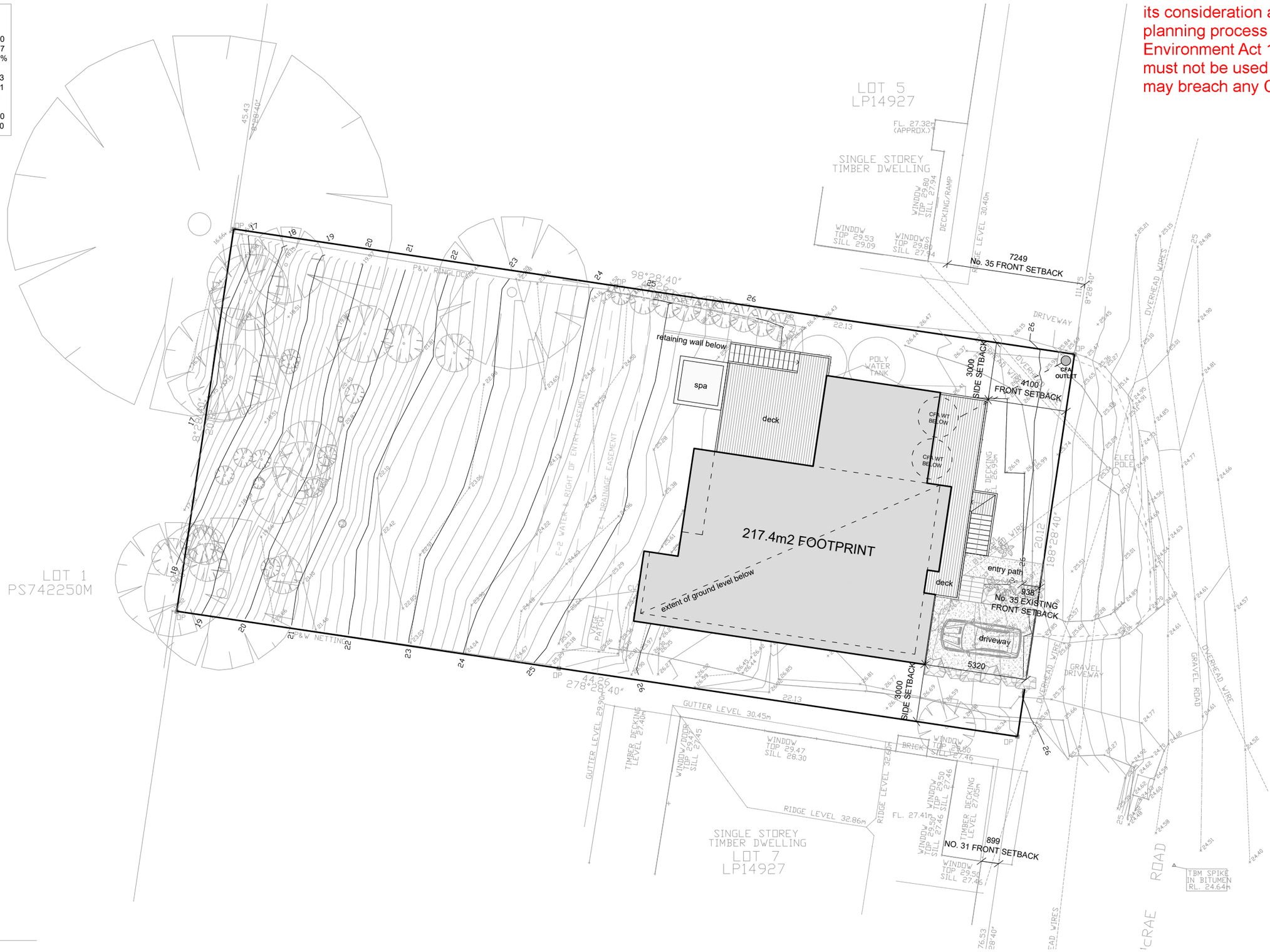
AREA SCHEDULE, m2

SITE	891.0
FOOTPRINT	214.7
SITE COVERAGE	24.1%
LOWER FLOOR AREA	115.3
UPPER FLOOR AREA	161.1
DECK AREA	53.6
PROPOSED TOTAL AREA	330.0
EFFLUENT FIELD	158.0



SITE *plan*

PROJECT	**PROPOSED NEW DWELLING**
ADDRESS	33 MCRAE ROAD, WYE RIVER VIC 3234
CLIENT	S + R
DATE	14.11.19

TITLE	**SITE PLAN**
SCALE	1:200 @ A3
DRAWN	PB
DWG	191114_02
REVISION	

BAL	29
STRUC / CIVIL	TBA
GEOTECH	DJH
SURVEYOR	LJP
NATHERS	TBA

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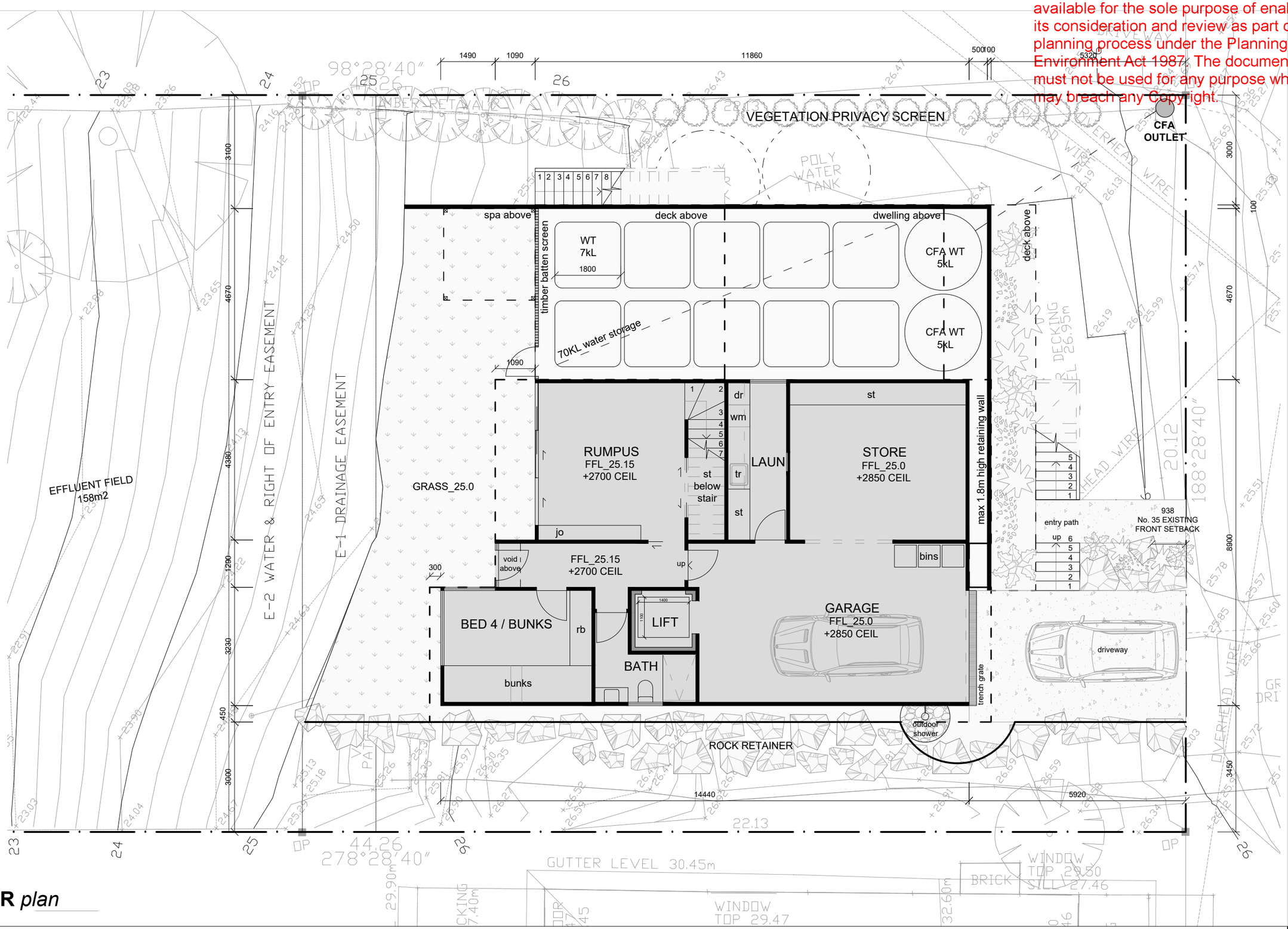
LEGEND

st	STORAGE
sh	SHELVING
jo	JOINERY
fp	FIRE PLACE
wo	WOOD OVEN
gh	GAS HEATER
ac	AIR CONDITIONER
acc	A/C CONDENSER
dw	DISHWASHER
fr	FRIDGE
sv	STOVE/OVEN
si	SINK
pnt	PANTRY
tr	TROUGH
dr	CLOTHES DRYER
w	WASHING MACHINE
rb	ROBE
lin	LINEN STORAGE
dsk	DESK
s/l	SKYLIGHT
WT	WATER TANK
dp	DOWNPIPE
	HARD WIRED SMOKE DETECTOR
	EXHAUST FAN (WITH DAMPER)
	ELECTRICAL SWITCHBOARD
hws	HOT WATER SERVICE
TIMB	POLISHED TIMBER
CAR	CARPET
TILE	TILES
CONC	CONCRETE



GROUND FLOOR *plan*

PROJECT	**PROPOSED NEW DWELLING**
ADDRESS	33 MCRAE ROAD, WYE RIVER VIC 3234
CLIENT	S + R
DATE	14.11.19

TITLE	**GROUND FLOOR PLAN**
SCALE	1:100 @ A3
DRAWN	PB
DWG	191114_03
REVISION	

BAL	29
STRUC / CIVIL	TBA
GEOTECH	DJH
SURVEYOR	LJP
NATHERS	TBA

REVISION

NO.	DATE	DESCRIPTION
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LEGEND

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dw	DISHWASHER
fr	FRIDGE
sv	STOVE/OVEN
si	SINK
pnt	PANTRY
tr	TROUGH
dr	CLOTHES DRYER
w	WASHING MACHINE
rb	ROBE
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dsk	DESK
s/l	SKYLIGHT
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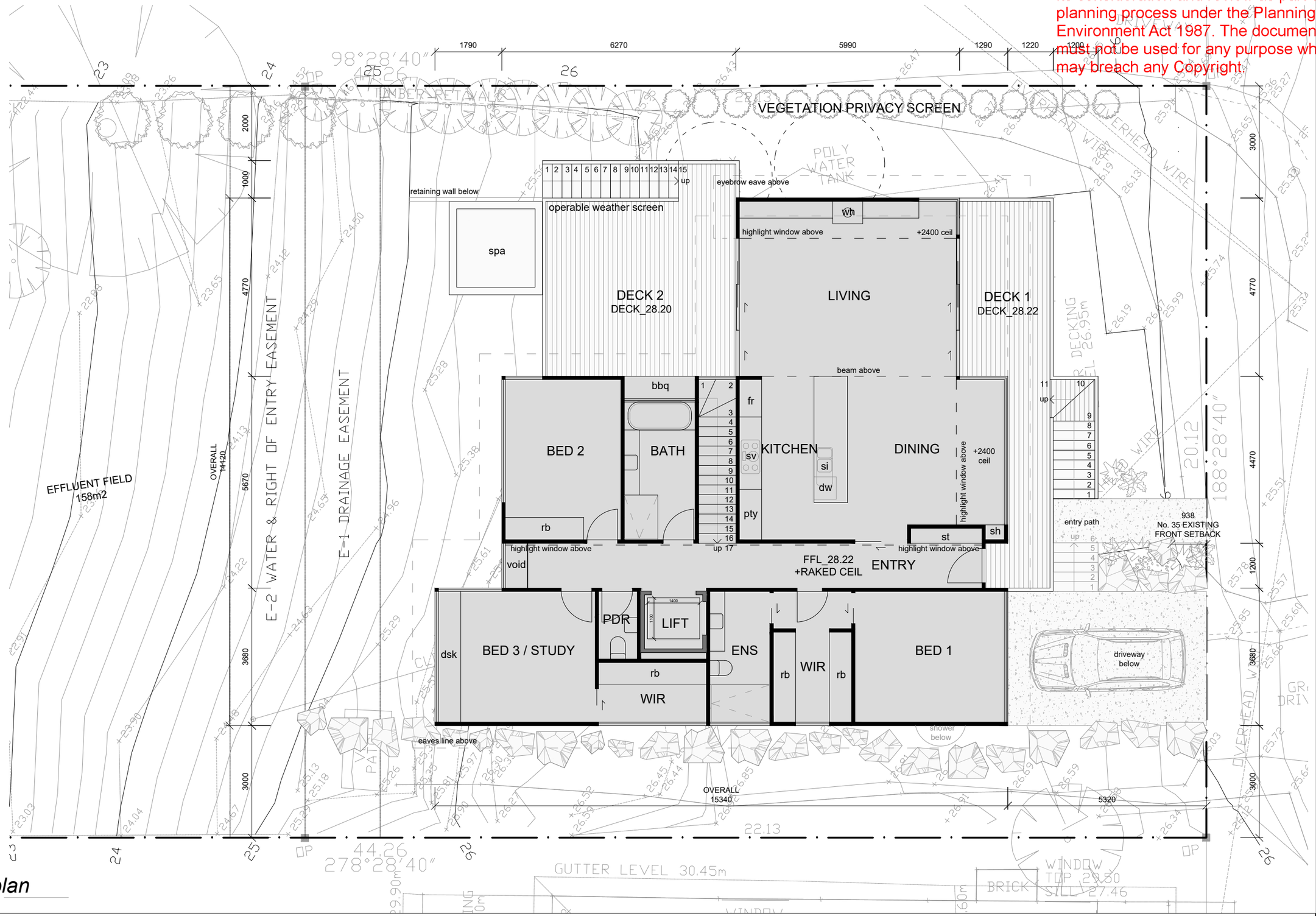
dp	DOWNPIPE
	HARD WIRED SMOKE DETECTOR
	EXHAUST FAN (WITH DAMPER)
	ELECTRICAL SWITCHBOARD
hws	HOT WATER SERVICE
TIMB	POLISHED TIMBER
CAR	CARPET
TILE	TILES
CONC	CONCRETE



FIRST FLOOR *plan*

PROJECT	**PROPOSED NEW DWELLING**	TITLE	**FIRST FLOOR PLAN**	BAL	29	REVISION	
ADDRESS	33 MCRAE ROAD, WYE RIVER VIC 3234	SCALE	1:100 @ A3	STRUC / CIVIL	TBA	NO. DATE DESCRIPTION	
CLIENT	S + R	DRAWN	PB	GEOTECH	DJH	1 --/--/-- -	
DATE	14.11.19	DWG	191114_04	SURVEYOR	LJP		
		REVISION		NATHERS	TBA		

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EFFLUENT FIELD	158.0

LEGEND

st	STORAGE
sh	SHELVING
jo	JOINERY
fp	FIRE PLACE
wo	WOOD OVEN
gh	GAS HEATER
ac	AIR CONDITIONER
acc	A/C CONDENSER
dw	DISHWASHER
fr	FRIDGE
sv	STOVE/OVEN
si	SINK
pnt	PANTRY
tr	TROUGH
dr	CLOTHES DRYER
w	WASHING MACHINE
rb	ROBE
lin	LINEN STORAGE
dsk	DESK
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WT	WATER TANK
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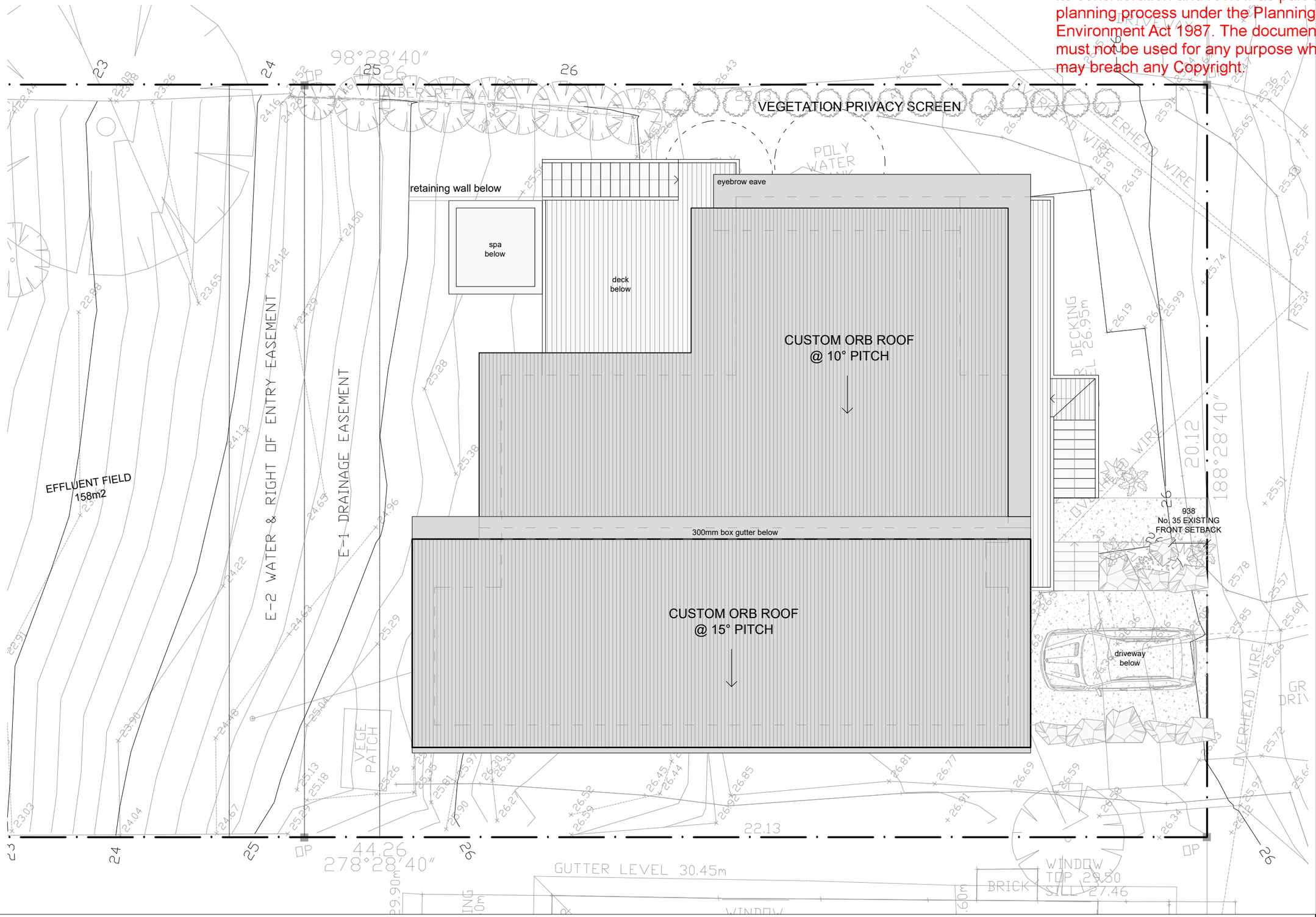
hws	HOT WATER SERVICE
TIMB	POLISHED TIMBER
CAR	CARPET
TILE	TILES
CONC	CONCRETE



ROOF *plan*

PROJECT	**PROPOSED NEW DWELLING**	TITLE	**ROOF PLAN**	BAL	29
ADDRESS	33 MCRAE ROAD, WYE RIVER VIC 3234	SCALE	1:100 @ A3	STRUC / CIVIL	TBA
CLIENT	S + R	DRAWN	PB	GEOTECH	DJH
DATE	14.11.19	DWG	191114_05	SURVEYOR	LJP
		REVISION		NATHERS	TBA

REVISION

NO.	DATE	DESCRIPTION
1	--/--/--	-

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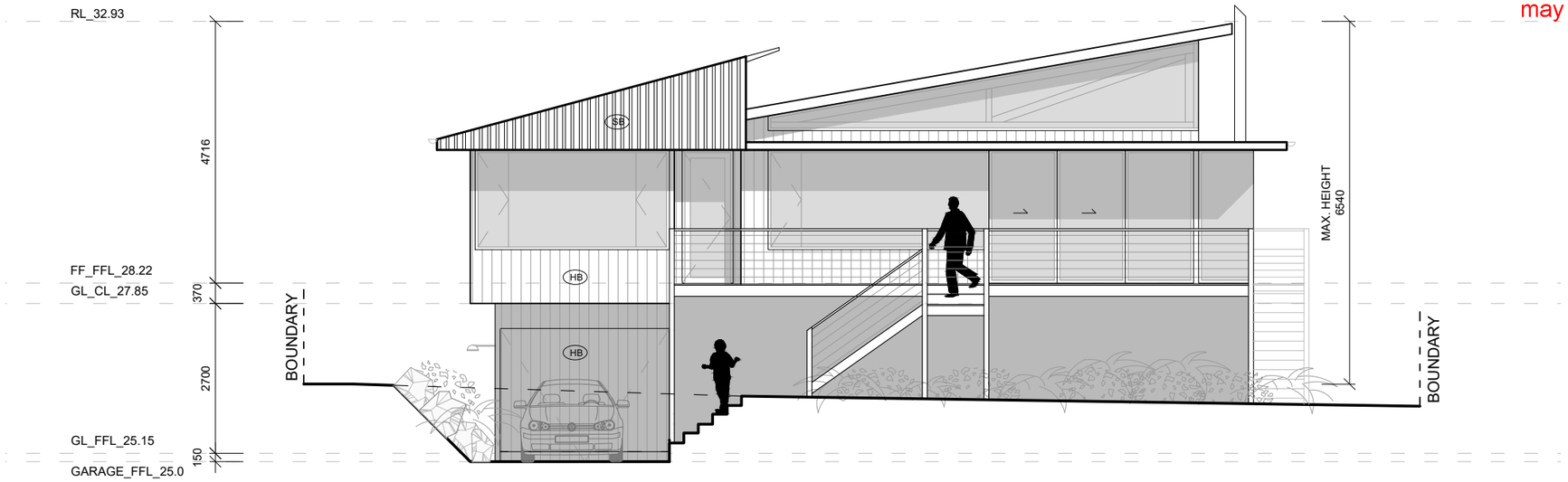
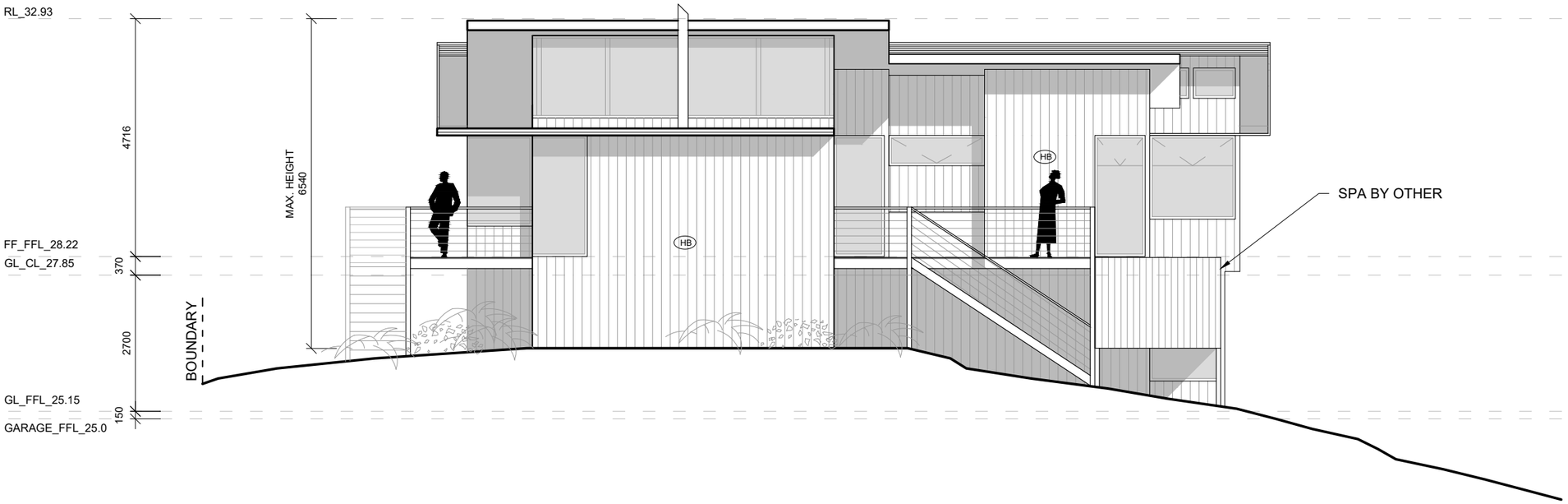


e EAST *elevation*



n NORTH *elevation*

CLADDING LEGEND

(HB) HARDWOOD SHIPLAP BOARDS
natural timber finish

(SB) STEEL BATTENS
night sky finish

ALUMINUM WINDOW / DOOR FRAMES + FASCIAS
night sky finish

COLORBOND ROOF
basalt finish

PROJECT	**PROPOSED NEW DWELLING**
ADDRESS	33 MCRAE ROAD, WYE RIVER VIC 3234
CLIENT	S + R
DATE	14.11.19

TITLE	**ELEVATIONS 1**
SCALE	1:100 @ A3
DRAWN	PB
DWG	191114_06
REVISION	

BAL	29
STRUC / CIVIL	TBA
GEOTECH	DJH
SURVEYOR	LJP
NATHERS	TBA

REVISION

NO.	DATE	DESCRIPTION
1	--/--/--	-

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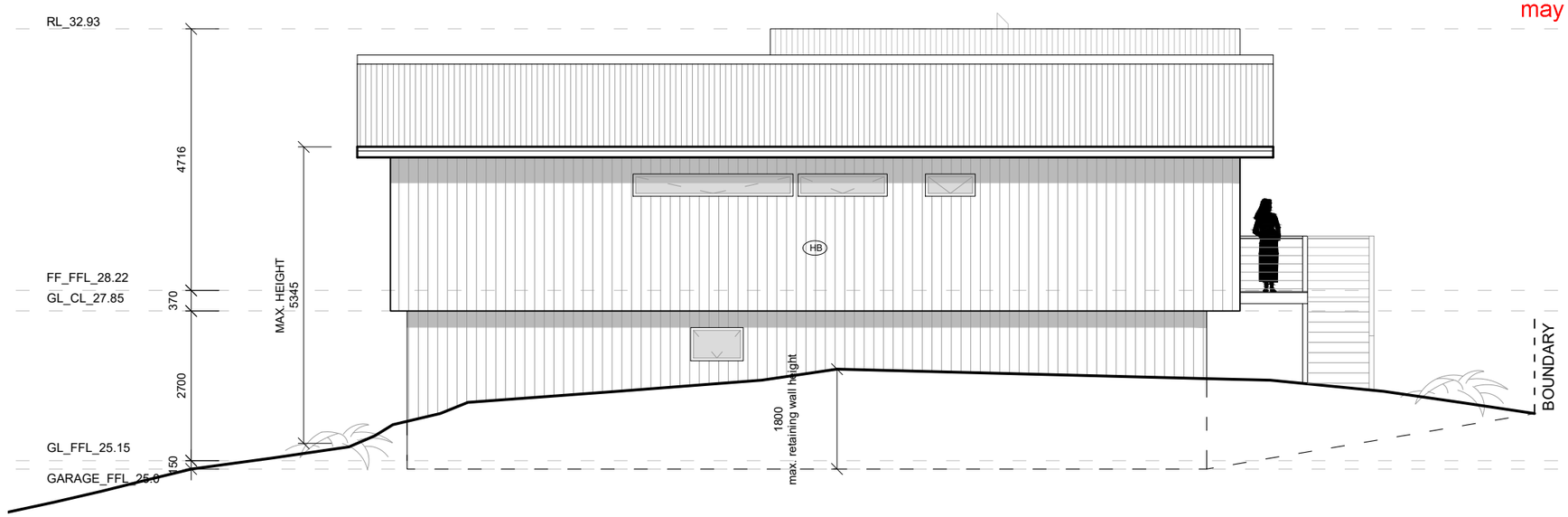

SOUTH *elevation*

WEST *elevation*

CLADDING LEGEND

HB HARDWOOD SHIPLAP BOARDS
natural timber finish

SB STEEL BATTENS
night sky finish

ALUMINUM WINDOW / DOOR FRAMES + FASCIAS
night sky finish

COLORBOND ROOF
basalt finish

PROJECT	**PROPOSED NEW DWELLING**
ADDRESS	33 MCRAE ROAD, WYE RIVER VIC 3234
CLIENT	S + R
DATE	14.11.19

TITLE	**ELEVATIONS 2**
SCALE	1:100 @ A3
DRAWN	PB
DWG	191114_07
REVISION	

BAL	29
STRUC / CIVIL	TBA
GEOTECH	DJH
SURVEYOR	LJP
NATHERS	TBA

REVISION

NO.	DATE	DESCRIPTION
1	--/--/--	-

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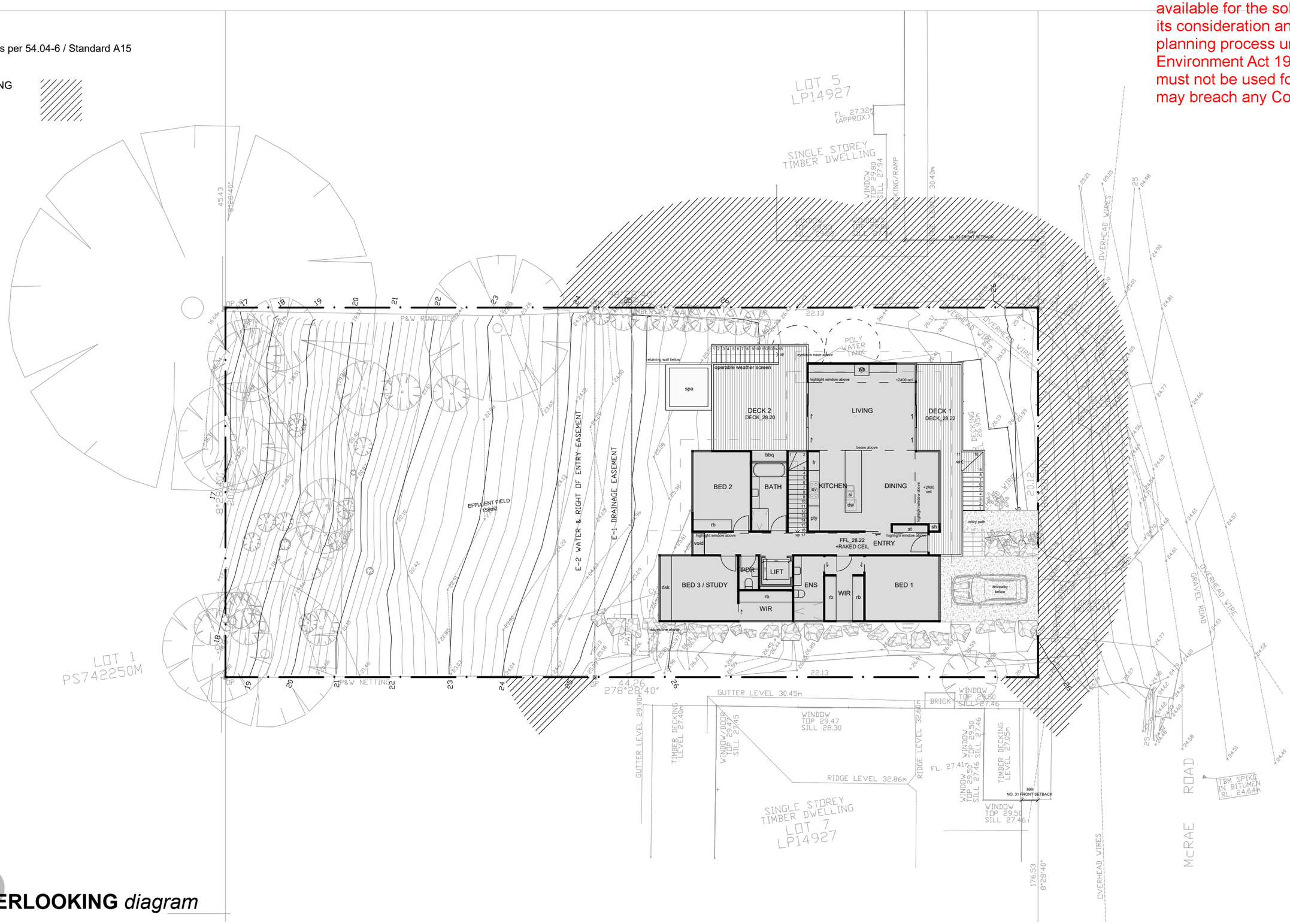
NOTES

Overlooking as per 54.04-6 / Standard A15

OVERLOOKING



0 OVERLOOKING *diagram*

PROJECT	**PROPOSED NEW DWELLING**
ADDRESS	33 MCRAE ROAD, WYE RIVER VIC 3234
CLIENT	S + R
DATE	14.11.19

TITLE	**OVERLOOKING DIAGRAM**
SCALE	1:200 @ A3
DRAWN	PB
DWG	191114_08
REVISION	

BAL	29
STRUC / CIVIL	TBA
GEOTECH	DJH
SURVEYOR	LJP
NATHERS	TBA

REVISION

NO.	DATE	DESCRIPTION
1	--/--/--	-

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NOTES

Overshadowing as per 54.04-5 / Standard A14
September 22

LEGEND

9AM

12 NOON

3PM

9 OVERSHADOWING *diagram*

PROJECT	**PROPOSED NEW DWELLING**	TITLE	**OVERSHADOWING DIAGRAM**	BAL	29	REVISION	
ADDRESS	33 MCRAE ROAD, WYE RIVER VIC 3234	SCALE	1:150 @ A3	STRUC / CIVIL	TBA	NO. DATE DESCRIPTION	
CLIENT	S + R	DRAWN	PB	GEOTECH	DJH	1 --/--/-- -	
DATE	14.11.19	DWG	191114_09	SURVEYOR	LJP		
		REVISION		NATHERS	TBA		

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3D

3-dimensional *image*

PROJECT	**PROPOSED NEW DWELLING**	TITLE	**3D IMAGE 1**	BAL	29	REVISION	
ADDRESS	33 MCRAE ROAD, WYE RIVER VIC 3234	SCALE	NTS @ A3	STRUC / CIVIL	TBA	NO. DATE DESCRIPTION	
CLIENT	S + R	DRAWN	PB	GEOTECH	DJH	1 --/--/-- -	
DATE	14.11.19	DWG	191114_10	SURVEYOR	LJP		
		REVISION		NATHERS	TBA		

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3D

3-dimensional *image*

PROJECT	**PROPOSED NEW DWELLING**	TITLE	**3D IMAGE 2**	BAL	29	REVISION	
ADDRESS	33 MCRAE ROAD, WYE RIVER VIC 3234	SCALE	NTS @ A3	STRUC / CIVIL	TBA	NO. DATE DESCRIPTION	
CLIENT	S + R	DRAWN	PB	GEOTECH	DJH	1 --/--/-- -	
DATE	14.11.19	DWG	191114_11	SURVEYOR	LJP		
		REVISION		NATHERS	TBA		

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3D

3-dimensional *image*

PROJECT	**PROPOSED NEW DWELLING**
ADDRESS	33 MCRAE ROAD, WYE RIVER VIC 3234
CLIENT	S + R
DATE	14.11.19

TITLE	**3D IMAGE 3**
SCALE	NTS @ A3
DRAWN	PB
DWG	191114_12
REVISION	

BAL	29
STRUC / CIVIL	TBA
GEOTECH	DJH
SURVEYOR	LJP
NATHERS	TBA

REVISION

NO.	DATE	DESCRIPTION
1	--/--/--	-

ISSUED FOR:

PLANNING APPROVAL

Josh Crosbie
Architects
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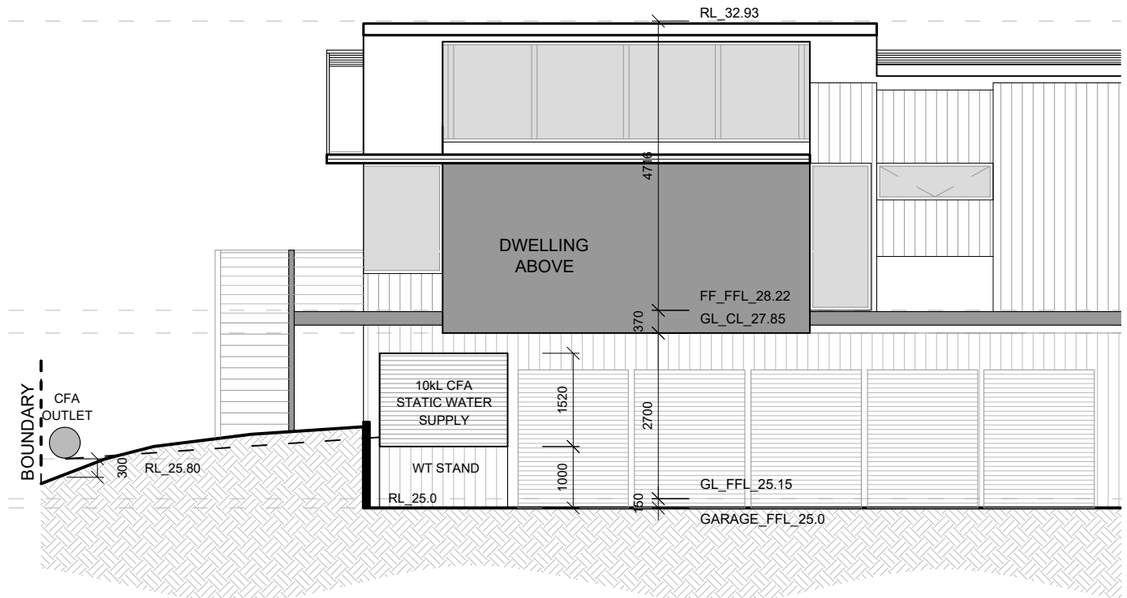
AREA SCHEDULE, m2

SITE	891.0
FOOTPRINT	214.7
SITE COVERAGE	24.1%
LOWER FLOOR AREA	115.3
UPPER FLOOR AREA	161.1
DECK AREA	53.6
PROPOSED TOTAL AREA	330.0
EFFLUENT FIELD	158.0

CFA 10KL STATIC WATER SUPPLY + OUTLET

AS PER BUSHFIRE MANAGEMENT STATEMENT (REF: 2018-299, V4)

- 2 X 5KL STEEL WATER TANKS
- 3M MAX. FALL TO CFA OUTLET
- THE MATERIAL OF MANUFACTURE OF THE REMOTE OUTLET PIPING WILL BE HDPE PIPE OF A DIAMETER OF 90mm



CFA
STATIC WATER SUPPLY *plan*

PROJECT	**PROPOSED NEW DWELLING**	TITLE	**CFA STATIC WATER SUPPLY**	BAL	29	REVISION	
ADDRESS	33 MCRAE ROAD, WYE RIVER VIC 3234	SCALE	1:200 @ A3	STRUC / CIVIL	TBA	NO.	DATE / DESCRIPTION
CLIENT	S + R	DRAWN	PB	GEOTECH	DJH	1	--/--/-- -
DATE	14.11.19	DWG	191114_13	SURVEYOR	LJP		
		REVISION		NATHERS	TBA		

ISSUED FOR:

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LANDSLIP RISK ASSESSMENT

FOR

33 MCRAE ROAD
WYE RIVER, VICTORIA

Prepared for:	Richard van der Merwe
Prepared by:	David J Horwood Senior Engineering Geologist *BAppSc (Geology); MAusIMM CP(Geo)*
Approved by:	
Reference No.	19A341LRA
Date:	20/3/2019
Revised:	

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EXECUTIVE SUMMARY

Our assessment has found that as with many sites in the Wye River area, there are risks to property due to conceivable landslide events on the subject site.

- Developed property with an existing dwelling, a single storey bungalow and a container storage structure with decking. Existing dwelling has a balcony and decking which surrounds the building and extends to the south.
- Saddle of a north-south trending ridge line parallel to the coast line within the foothills of the Otway Range. Site has a local relief of 9m to the west.
- Natural slope angles on site range from 12° to 33° generally to the west and 11° to the east. The crest of the ridge is gently rounded.
- Natural soils consist of very low plasticity clayey SILT with trace sand overlying medium to high plasticity mottled, silty CLAY to CLAY with trace fine grained sand grading sandy at depth. Occasional highly weathered rock fragments are present deeper in the profile.
- Bedrock structure was observed in the Morley Avenue road cutting east of the property. Bedrock strata dip at 26° toward a dip direction of 90° (Dip/D'Dir: 26°/90°). The dip direction is perpendicular to the slope direction on the western side of the ridge with bedrock strata dipping into the slope. Bedding strike in this location is sub-parallel with the strike of the ridge.
- A large historical landslide scarp cuts through the property near the western boundary. This landslide feature is old and dormant showing signs of dissection although more resent failures have occurred over the scarp slopes.
- The local ground model for landslide hazards involves shallow and deep seated translational earth slides and earth flows, shallow rotational earth/debris slides, local failures in cuttings and regression of existing landslide scarps.

The Geotechnical Assessment was up graded to a Landslide Risk Assessment due to the steep slopes exceeding the tolerances specified within Schedule 1 to the Colac-Otway Ranges Shire EMO and the presence of pre-existing slope failures.

The risks to property associated with developing a residential dwelling on the subject site can be considered as LOW or VERY LOW for most assessed hazards while some hazards remain at MODERATE risk level. In quantitative terms, the risk to life has been assessed as below the recommended TOLERABLE risk limit for all relevant hazard elements.

Based on our assessments of the risks, we conclude that there are no geotechnical reasons to prevent the issue of a permit to develop on this site, subject to the implementation of the recommendations outlined in Section 9.0 of the report.

1.0 INTRODUCTION

Landslides and other forms of earth and rock movements are common throughout the Otway Ranges and like erosion, they are a natural process of geological shaping of the environment.

Any building within a "geologically active" environment such as the Otway Ranges is potentially at risk of damage due to natural soil movements. In some circumstances, 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 can often be taken to manage or reduce the risks to acceptable levels, it is not feasible to eliminate the risks of damage or injury entirely.

2.0 SCOPE OF REPORT

AGR Geosciences Pty Ltd (AGR) was commissioned by Josh Crosbie Architects on behalf of Richard van der Merwe (the Client) to provide a Geotechnical Assessment of No. 33 McRae Road Wye River (the Site) to meet the geotechnical assessment requirements of the Colac-Otway Shire Planning Scheme Amendment C68: Schedule 1 to the Erosion Management Overlay (EMO). A decision was reached to advance the Geotechnical Assessment to a Landslip Risk Assessment on the basis that automatic trigger conditions as defined in Schedule 1 to the EMO did exist on site including the presence of existing landslides.

The principles used in conducting the Landslip Risk Assessment follow the guidelines published in the Australian Geomechanics Society (AGS) journal Volume 42 No 1 of March 2007, entitled "Landslide Risk Management". This report contains all the information required for a Geotechnical Assessment as well as all additional information required for a Landslip Risk Assessment as defined by Schedule 1 to the EMO.

The purpose of the assessment is to identify any possible landslide hazards within and near the elements at risk and to provide guidance and options on how the risks can be reduced, avoided or controlled. As this assessment has been conducted as part of a retrospective planning permit following completion of the development, the focus here is to assess any impact the finished works have had on existing slope stability. As a duty of care in accordance with the AGS Guidelines, this assessment has also considered the site as a whole and made comments on hazards not directly related to the recently completed development.

For the purpose of this Landslip Risk Assessment, "the elements at risk" for the proposed development are defined as the proposed dwelling and any related infrastructure, drive ways, access roads or ancillary structures, and all users or residents of the proposed dwelling and any related infrastructure, drive ways, access roads or ancillary structures.

2.1 IMPACTS OF PAST FIRE EVENTS

In December 2015 severe wildfire decimated the townships of Wye River and Separation Creek destroying over 100 houses and burring more than 2000 hectares of forest surrounding the settlements. Not only did the fires destroy infrastructure and buildings but they have also impacted on the already high landslide susceptibility of the area. Additional hazards are likely to have eventuated as a result of these fires including hazards directly related to fire damage such burnt out retaining walls and also indirect hazards relating to alteration of soil structure, removal of vegetation and increase run off.

This report recognises that the impacts of fire to the Wye River and Separation Creek area has created additional infrastructure related hazards and also had an impact on the type, severity and potential frequency of naturally occurring landslide hazards which can and do occur in the region.

Number 33 McRae Road Wye River and the immediately surrounding area was not affected by the 2015 fires and as a result fire related landslide hazards are not relevant to this assessment.

3.0 DEVELOPMENT DESCRIPTION

- Demolition of existing dwelling.
- Replacement four-bedroom, double storey, light weight, clad, residential dwelling with approximate 217m^2 footprint.
- North and east facing first floor decking, spa and access ramp to the east.
- Maximum 1.8m proposed site cut for ground floor garage.
- Three proposed 32kL water tanks under decking to the north.
- New effluent disposal system.

A site plan for the proposed development is attached as Appendix II.

4.0 HAZARD ANALYSIS

4.1 DATA GATHERING – DESK TOP STUDIES AND PREVIOUS INVESTIGATIONS

Numerous landslide risk assessments and landslide studies have been conducted in the Otway Ranges, many by private consultants for individual clients and some published reports are also available. Many of these reports confirm that landslide hazards are present and that in some cases, inappropriate development can lead to slope failure.

In preparation for conducting a field investigation of the site, preliminary data was gathered from the following sources:

- Landslide and Erosion Susceptibility mapping published by the Corangamite Catchment Management Authority.
- Landslide and Erosion Inventory mapping published by the Corangamite Catchment Management Authority.
- Fed Uni Spatial Landslide and Erosion Database Online.
- Geological Reports and Maps published by the Geological Survey of Victoria and published 1:50,000 and 1:250,000 geological mapping published online via GeoVic and Earth Resources Victoria.
- Factor Data Sets such as slope, elevation, rainfall, aspect, land use, vegetation, geomorphology and soil landforms published by the Corangamite Catchment Management Authority.
- Geomorphological, landform, topographic, soil and climatic data published by the Department of Environment and Primary Industries available via Victorian Resources Online.
- Aerial photos and maps published by Google and NearMaps.
- Previous investigations and reports by AGR and other consultants both published and unpublished.

- Architectural designs prepared by Josh Crosbie Architects.

4.1.1 Geology and Geomorphology

Regional development of the Otway Ranges began as Australia pulled away from Antarctica during the Late Jurassic to Early Cretaceous initiating rift valley volcanism and deposition which ultimately formed the Otway Ranges. Lower Cretaceous sediments of the regionally expansive Otway Group make up most of the Otway Ranges in southwestern Victoria. The Eumeralla Formation, by far the most expansive formation in Otway Group, comprises mostly of fluvial channel deposited lithic sandstones, mudstones, siltstones and minor mud-clast conglomerate.

The sandstones and mudstones are characteristically quartz-poor volcanogenic sediments high in calcic feldspars derived from dacitic volcanic material which originated from contemporaneous rift valley volcanism to the north of the Otway Ranges. Post deposition the Otway Group has been gently folded, faulted and uplifted along a series of parallel faults trending north-east.

The composition of the Eumeralla Formation makes it highly susceptible to weathering producing clay rich soils typically 0.5-1m thick in sandstone dominant areas and up to and greater than 2m deep in siltstone/mudstone dominant areas. A typical soil profile is generally well developed overlying and sometimes grading into extremely and highly weathered rock. The weathering profile continues to progressively grade into fresh rock.

Following significant uplift during the Late Cretaceous a period of widespread erosion prevailed resulting in the deposition of terrestrial sediments during the Paleocene in braided river systems belonging to a high energy fluviatile environment. At the cessation of this period of erosion, the sea again transgressed and a variety of sediments were deposited in the mostly marine conditions which existed on the flanks of the Otway Ranges throughout the Tertiary Period. At this time, these marine sediments were lapping the Otway Ranges which protruded from the sea like and island. During the Late Miocene the sea began to retreat giving way to shallower marine conditions.

During the Pliocene, following widespread uplift, a peneplain developed over Miocene sediments formed in shallow marine conditions following shallowing of the sea during the Oligocene. At this time sea level again rose depositing the sediments in a shallow marginal-marine environment extensively covering the Otway Basin and flanks of the Otway Ranges.

The local geology of the subject site has been mapped to entirely include Eumeralla Formation sediments.

Since the end of the Tertiary sea levels have consistently fluctuated with the last major interglacial period occurring around 110,000BP (before present). Between 14,000 and 6,000BP sea levels rose rapidly following the last glacial maximum around 17,000 to 20,000BP. As the sea advanced it pushed coastal dunes in front of it on lapping Tertiary aged sediments along the coast until sea levels again dropped slightly renewing erosion rates around 6,000 years ago.

Wye River can be described as belonging to the Lorne Land System or the deeply dissected upland ranges of the Southern Uplands (Geomorphic Unit 3.1.2). This land system occupies much of the coast line from Lorne to Apollo Bay along the Great Ocean Rd characterized by steep hills, coastal cliffs and rock shore platforms. Inland from the coast the topography consists of steeply dissected hills, spurs and ridges of moderate relief with cliffs and waterfalls.

Geomorphic development of the landscape is heavily influenced by landslides. Rapid valley development by the rivers and creeks and their tributaries resulted from uplift of the Otway Ranges and fluctuations in sea levels. Landslide activity is commonly correlated to over steepened valley slopes where their occurrence has continuously shaped the landscape over the past 5000-6000 years since lower stream base levels and warmer (wetter) climates have prevailed.

Figure 1: Regional geology of the greater Wye River area

4.1.2 Regional Landslide Factors

Landslides are rarely attributed to a single geomorphic factor alone and usually require a combination of factors to exist often with equal bearing on the susceptibility of a site to landslide activity. Terrain slope, aspect and rainfall along with the geology and geomorphology are all factors which can have a profound influence on the occurrence of landslides. Landslide susceptibility mapping conducted by A.S. Miner Geotechnical (2006) in the Wye River area indicates that the site has **MODERATE** landslide susceptibility.

Slope angle has been attributed as a contributing factor in landslide occurrence (Cooney, 1980; Wood, 1980), although the steepest slope angles do not always pose the greatest risk.

The depth of weathering of a regolith profile can be related to slope aspect in the Otway Ranges and incised valleys of the Otway Ranges with deeper more weathered regolith profiles typically occurring on the wetter southwestern slopes. It is logical to assume some relationship between aspect and landslide activity although no direct correlation has been observed in previous studies.

Extreme rainfall is a dominant trigger for landslides in the Otway Ranges and previous studies locally, nationally and globally tend to confirm that intense or prolonged rainfall is the most common trigger of landslides in general.

Earthquakes attributed to active fault lines are another potential trigger for landslides on the Otway region. Intraplate earthquakes such as those experienced in Victoria are extremely unpredictable and occur unexpectedly. These types of earthquakes are caused by compressive stresses associated

with thrust faults. The nearest large fault to the region is the Torquay Fault which is considered to be active and may be correlated to historical earthquake activity. Higher magnitude earthquakes could trigger landslides and townships proximal to a fault line with a history of higher magnitude earthquakes puts them at a higher risk than other localities. In the greater Wye River region more than 40 earthquakes have been recorded since 1837 with three measured as being greater than a magnitude of four.

While not a direct triggering event itself, fire is also a significant factor contributing to an areas susceptibility to landslides. Steeply sloping areas burnt by fires may be subject to increased risk of landslide in the months and even years following the fire event, especially if the fire is followed by a prolonged wet season or high rain fall event. The shallow soil layers become more susceptible to erosion and potential landslides following fires for several reasons including the removal of organic matter from the surface and upper soil layers which otherwise has a strong influence on soil structure. Drying and aeration of the soil structure following fire can weaken the shear strength of the soil making it more susceptible to failure given exposure to triggering events. When fires remove ground cover and lower storey vegetation, the root binding effects on soil structure are also removed. Fires expose bare soils to the impacts of surface run off and erosion without vegetation to bind the soils and intercept rain fall and surface water flow. A reduction in vegetation may also create medium to long term effects on soil moisture as the reduction in vegetation results in an increase in surface water infiltration and shallow sub-surface through flow. Increasing soil moisture (groundwater or surface infiltration) is a trigger of landslides.

Fires alter surface hydrology, especially in steep mountain catchments. The removal of vegetation from the landscape increases surface flow and run-off. Following fires, surface soils can also undergo chemical alteration and become hydrophobic. Hydrophobic soils contribute to surface run-off and increased surface flow velocity. High volume, high velocity surface run-off is one of the triggering factors of debris flows.

Other risk factors which may influence the initiation of landslides include unfavourable orientation of the rock strata, inherently weak rock mass, anthropogenic alterations to the slope morphology, hydrology and drainage.

Table 1 provides a general summary of some of the typical climatic and physiological features for the Soil Landform Unit 64 belonging to the Lorne Land System of Otway Ranges which characterises the Wye River area.

Table 1: Regional Features for Hills of the Soil Landform Unit 64

GEOMORPHIC UNIT	Dissected upland ranges of the Southern Uplands (3.1.2)		
LANDFORM	Hills		
LANDFORM ELEMENT	Lower slope and drainage line	South and east facing slopes	Steepest slopes
ELEVATION	0-400m		
LOCAL RELIEF	150m		
SLOPE ANGLE AND RANGE (%)	20 (1-35)	45 (5-65)	60 (20-70)
SLOPE SHAPE	Concave	Linear	Linear
RAINFALL	850-1300mm Annual		
TEMPERATURE	13º Annual Average		

4.1.3 Previous Landslides Movements

Numerous landslide studies and geotechnical investigations have been previously conducted in the Wye River area. Roberts (2006), Dahlhaus (2003), Cooney (1980), Dahlhaus (1991) and Neilson (1987) have all identified previous landslide failures from either aerial stereo photogrammetry interpretation, Lidar interpretation or field mapping in and around the subject site and more widely in the Wye River area as can be seen in Figure 4.

Coffee Geotechnics (2011) reviewed the Wye River and Separation Creek inventory utilising remote sensing interpretation as well as detailed field mapping and ground proofing of inventory listed landslides. The results confirmed the majority of the previously listed landslides as well as delineating some additional ancient or fossil landslides and areas of instability in old colluvium coinciding with previously mapped failures.

There are several known areas in Wye River with landforms which consist of either active or relict landslides or which are susceptible to instability. The three main large landslide complexes in Wye River include the Illowra Landslide, a 40ha relict landslide north-east of the Wye River, the Riverside Drive Landslide complex, an active landslide at the toe of the Illowra Landslide and the Morley Avenue Landslide, a 3ha active rockslide between Morley Avenue and the Great Ocean Road south of the main Township.

In the McRae Road area, most of the recent landslide activity has occurred on the south side of the ridge above Morley Avenue. Two prominent historical landslide scarps from are located within 20m to the east of the subject site coinciding with the current positions of McCrae Rd and Morley Avenue. These scarps probably relate to successive rock slide failure initiating from the McCrae Rd scarp which appears to have slid along a curved shear plane within the weathered sandstone rock possibly along a weakened bedding plane.

Another well-defined headscarp relates to the active Morley Avenue rockslide mapped by Dahlhaus (2003) and located between numbers 4 and 12 Morley Avenue. The main feature of the landslide is anecdotally believed to have moved during the 1960's. A retaining wall was built across the headscarp below the current day 6 Morley Avenue to prevent continual slumping of the scarp impacting the road. The scarp regularly failed by way of small debris slides until the 1990's including a small debris flow recorded in 1987 (Figure 2).

Several other landslide features were identified along Morley Avenue by Roberts (2006), including a landslide scarp located along the western boundary of number 17 Morley Avenue and two medium sized landslides futher above the Great Ocean Road originating on the up-slope side of Morley Avenue.

In 1986 a field-based landslide investigation was undertaken by P. Dahlhaus and A. Cooney of the Geological Survey of Victoria on Lot 1 Morley Avenue (No. 32 of the current subject site) the results of which were recorded in an internal government report. At the time of the investigation the site was undeveloped and covered in native forest. Slope angles were measured at around 27°. The investigation concluded that the site had been subjected to historical landslide activity although it is unclear whether the investigation was in response to recently observed slope movement. Dahlhaus and Cooney classified the landslide as a Single, Slide of Recent age and determined the activity state as Active.

In 1991 a field based landslide investigation was undertaken by P. Dahlhaus of the Geological Survey of Victoria on Lot 14 Morley Avenue (Current day No. 16 Morley Avenue) the results of which were recorded in an internal government report. At the time of the investigation the site was undeveloped and covered in native forest. The investigation concluded that the site had been subjected to historical landslide activity although it is unclear whether the investigation was in response to recently observed slope movement. Dahlhaus classified the landslide as a Single, shallow Slide of Recent age and determined the activity state at the time as Active.

The historical evidence suggests that the Morley Avenue area has a strong history of landslide activity.

Figure 2 illustrates the density of historical landslides recorded in the landslide inventory while Figure 3 is a Hill Shade DEM image (azimuth 45° and 45° vertical illumination) of interpreted landslides.

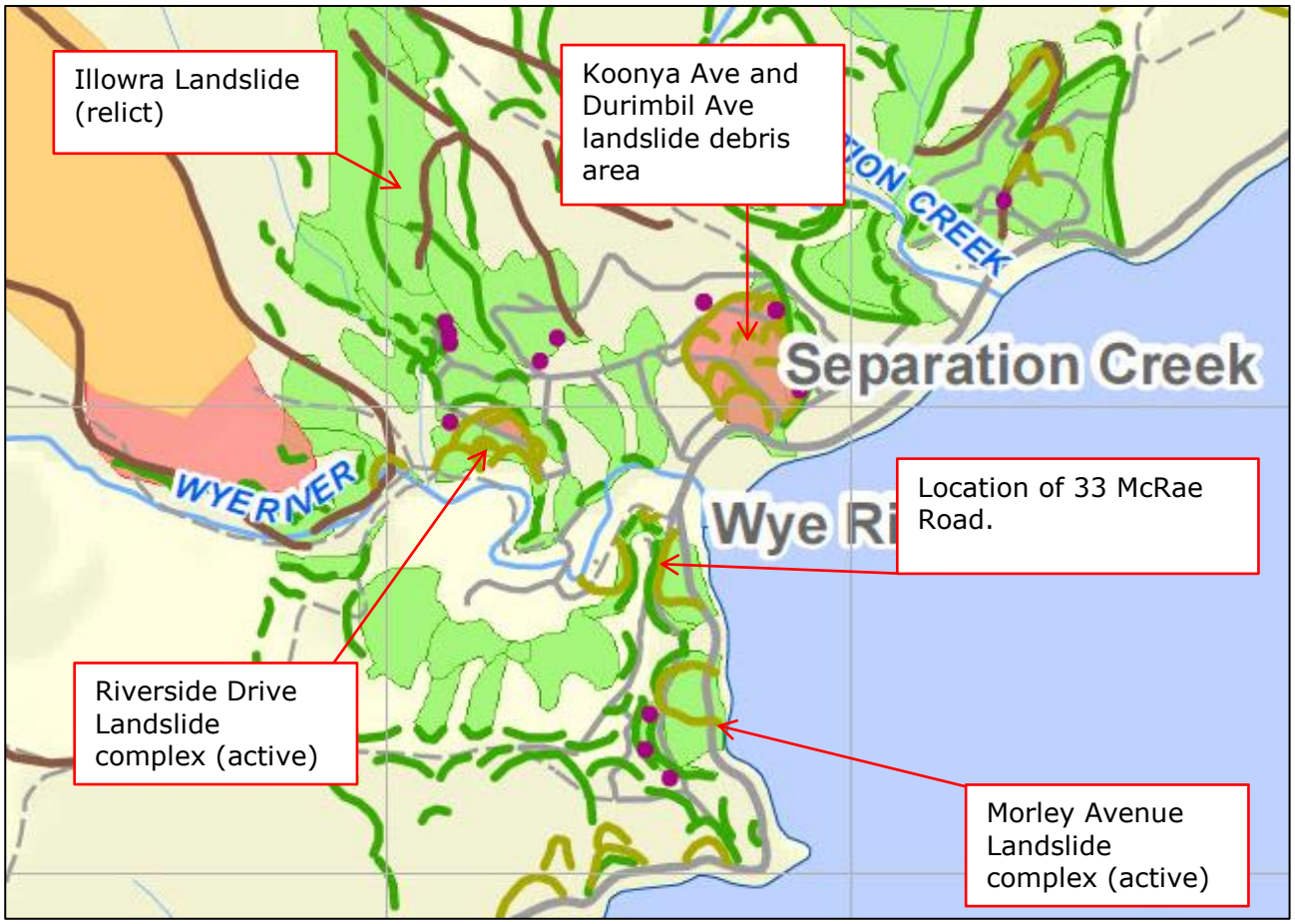

Figure 2: Previously recorded landslides on the landslide inventory (modified from AS Miner Geotechnical, 2007)

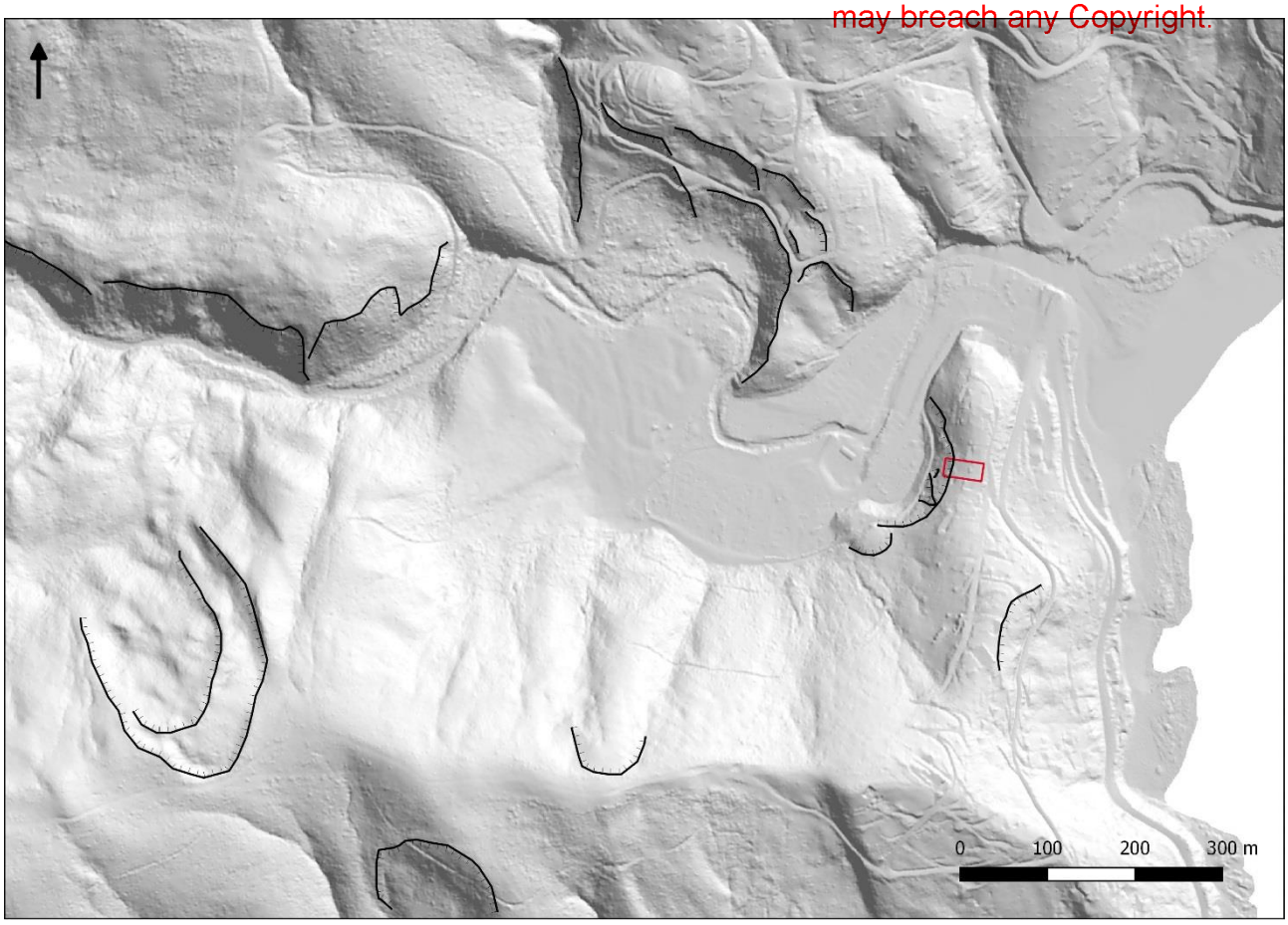

Figure 3: Hill Shade DEM of Major Landslides proximal to McRae Road.

4.2 FIELD INVESTIGATIONS

4.2.1 Site Inspection and Mapping

A thorough visual appraisal was made of the geomorphological features of the proposed development site and the surrounding area to search for evidence of slope instability and past slope failures. Slope angles were measured with a laser Forestry Range Finder and inclinometer and a Brunton geological compass.

A scaled engineering geology and geomorphology map showing the main features of the subject site is presented in Figure 4 while the local geological model is presented in cross-section in Figure 5. Site photographs are also attached as Appendix III.

4.2.2 Site Description and Physiography

Development:

- Developed property with an existing dwelling, a single storey bungalow and a container storage structure with decking. Existing dwelling has a balcony and decking which surrounds the building and extends to the south.
- Existing cut and fill earthworks and landscape alteration. Established gardens, shrubs and trees.

Landscape position and Landforms:

- Located on the west side of McRae Road. The property has westerly aspect and slope orientation.
- Saddle of a north-south trending ridge line parallel to the coast line within the foothills of the Otway Range. Site has a local relief of 9m to the west.
- Clearly defined scarps and breaks of slope cut through the property near the western boundary.

Slopes:

- Natural slope angles on site range from 12° to 33° generally to the west and 11° to the east. The crest of the ridge is gently rounded.
- Steepest slopes rate between 21° and 33° west of an historical landslide scarp near the western boundary.
- Overall ground slope is approximately 18° to the west.

Slope shapes:

- Slope shapes on and surrounding the site are typically convex and convergent.
- A pronounced convex break in slope located across the western boundary.
- Numerous undefined small breaks in slope (terrecets), small failure scarps and an uneven hummock ground surface are located downslope of the western boundary.

Drainage:

- Generally fair drainage conditions over the western part of the property due to moderate to steep slopes.
- Typically cry surface and sub-surface conditions across most of the site at the time of the investigation
- Flatter areas for ponding surface water present on around the existing dwelling across the crest of the ridge.

Observations and evidence of instability:

Evidence of instability and existing hazards are described below and annotated on the engineering geology map in Figure 5.

a) Existing septic tank

b) Recent re-vegetation works.

c) Storm water pit.

d) Small scarp and concave depression.

e) Small rotational slide or slump with steep well defined head scarp and flat, rotated bench and toe heave. Head scarp 2m high, 10-15m wide and bench 4m deep.

f) Colluvium identified in slope.

g) Area of small scarps and sheet erosion.

h) Uniform slope.

i) Major break in slope and historical landslide scarp. Rounded headscarp; minor dissection and evidence of subsequent failures across the scarp slope.

4.2.3 Sub-Surface Conditions

Subsurface conditions were investigated via inspection of soil and cuttings retrieved from boreholes established using hand held soil augers and inspection of exposed cuttings both on and near site.

- The natural soil profile is between 1200-1700mm thick.
- Natural soils consist of very low plasticity clayey SILT with trace sand overlying medium to high plasticity mottled, silty CLAY to CLAY with trace fine grained sand grading sandy at depth. Occasional highly weathered rock fragments are present deeper in the profile.
- Highly to moderately weathered, massive to medium coarse-grained sandstone was observed in the road cutting in front of number 6 Morley Avenue, located on the high side of Morley Avenue south of the subject site.
- In a road cutting above Morley avenue to the south of the property there is a 40-50mm wide moist to very moist, soft to very soft clay seam. The clay seam is concurrent with bedding and is inferred to be a bedding parallel fault or bedded shear.
- The underlying geology encountered is consistent with that of the Lower Cretaceous Eumeralla Formation referenced in published geological maps and confirmed by drilling.
- The composition of the upper soil layers indicates the natural soils are interpreted as a belonging to a residual profile having formed in-situ.

Full subsurface descriptions can be observed in the logs for Test Sites 1-4 in Appendix IV.

Test Site locations are provided in Figure 4.

4.2.4 Geological Structure

Geological mapping of outcrop exposures and cuttings near site was undertaken to establish geological structure.

- Bedrock structure was observed in the Morley Avenue road cutting east of the property. Bedrock strata dip at 26° toward a dip direction of 90° (Dip/D'Dir: 26°/90°). The dip direction is perpendicular to the slope direction on the western side of the ridge with bedrock strata dipping into the slope. Bedding strike in this location is sub-parallel with the strike of the ridge.
- Further south, bedding dips around 9°.
- Discontinuity development is related to flexural slip on open anticlinal folds and gentle monoclines typical of the regional structure of the Otway Ranges. Bedding plane shears, conjugate diagonal shear joints and open, longitudinal and traverse joints are common.
- The orientation of discontinuities such as jointing and faulting were observed during this investigation in the a cutting south of the property. Three prominent joints sets were

observed. One dipping 80° towards 330° (longitudinal joint set), a second dipping 80° towards 60° (traverse joint set) and a third dipping 55° towards 211° (diagonal shear joint set). In this location bedrock strata dip at 16° toward a dip direction varying between 137° and 157° (Dip/D'Dir: 16°/137° and 16°/157°) and with a plunge of 5° towards the east.

- A clay seam embedded in sandstone outcropping in Morley Avenue is concurrent with bedding as is most likely a bedding plane shear, shearing in the same direction as the bedding dip direction (137-157°).

- Discontinuities and the abrupt change in dip and dip direction in the bedding structure south along Morley Avenue is interpreted to be the result of possible left lateral thrust slip on a fault proximal to the bend in Morley Avenue. Faulting has most likely occurred over a zone of shearing (100-200m wide or more) rather than along a discrete fault plane.

4.2.5 Groundwater Conditions

- Soil conditions were generally considered dry.

- Mottling was observed throughout clayey subsoil suggesting surface water infiltration and periodic seepage of shallow groundwater through the profile.

- A "perched water table" often develops in the soil layers after prolonged wet periods form surface water infiltrating the soil profile. Such a perched water table can prove problematic on many sites if construction is commenced after wet periods and deep excavations may collapse without warning.

- Perched groundwater was not observed at the time of this investigation.

- Groundwater seeps were not directly observed discharging from any of the exposed cuttings on Morley Avenue or on site. It is common for groundwater to seep from open joints and bedding shears in cuttings in Wye River and discharging seeps have been observed by AGR on along Morley Avenue in the past.

- Regional groundwater exists as fractured aquifers throughout the Otway Group sediments of the Otway Ranges within fractures, open joints and discontinuities as well as between bedding layers of less weathered rock throughout the Otway Group bedrock strata. Seeps and discharging groundwater are often seen discharging out of steep rock cliffs and road cuttings such as the Great Ocean Road. Fractured rock groundwater can influence rock failures and create excavation hazards if encountered during deep excavations.

4.2.6 Existing Retaining Walls, Excavations, Embankments, Cuts/Fills

- There are no existing retaining walls or site cuts on site.

- Minor shallow fill batters are present to the east and south-west of the existing building. Neither fill batter show any evidence of recent instability.

- The McRae road fill batter slopes at 25° to the west above the Morley Avenue road cutting.

4.2.7 Existing Vegetation

- The majority of the property has been cleared of vegetation.

- Open, native forest vegetation consisting of mature native trees and large shrubs covers the steeper slopes below the scarp line near the western boundary. Understorey vegetation is lacking in this location and bare soils are exposed.

4.2.8 Features of Adjacent Sites

- Adjacent lots to the north and south are developed and contain existing dwellings.

- Vegetation coverage is dense to the west, north-west and south-west of the subject site occupying the steep slopes between the ridge and the caravan park located on the colluvial slopes and flood plain of the Wye River to the west.

- Colluvial debris is present to the west of site and within the boundaries of the caravan park. Numerous small slope failures have occurred over the scarp slopes of the large landslide feature that cuts across the western boundary.

- A large identifiable landslide scarp is located immediately east of the subject site. The head scarp is located above Morley Avenue and is likely an historical deep-seated rock slide.

- Morley Avenue is well known for recent landslide activity including documented rock and debris slides during the 1960's to 1990's.

4.3 SUMMARY of GEOLOGICAL MODEL

- Considering the geomorphology of the site and the surrounding area, the geological model formed implies that the soil profile on site has formed from in-situ weathering of the sandstone bedrock.

- The soil profile is between 1200-1700mm thick, overlying highly weathered sandstone.

- Bedrock structure was observed in the Morley Avenue road cutting east of the property. Bedrock strata dip at 26° toward a dip direction of 90° (Dip/D'Dir: 26°/90°). The dip direction is perpendicular to the slope direction on the western side of the ridge with bedrock strata dipping into the slope. Bedding strike in this location is sub-parallel with the strike of the ridge.

- A large historical landslide scarp cuts through the property near the western boundary. This landslide feature is old and dormant showing signs of dissection although more resent failures have occurred over the scarp slopes.

- The subject site is located north of a medium sized rock-debris slide which has been reactivated numerous times including recorded movement during the 1960's and 1990's.

- The local ground model for landslide hazards involves shallow and deep seated translational earth slides and earth flows, shallow rotational earth/debris slides, local failures in cuttings and regression of existing landslide scarps.

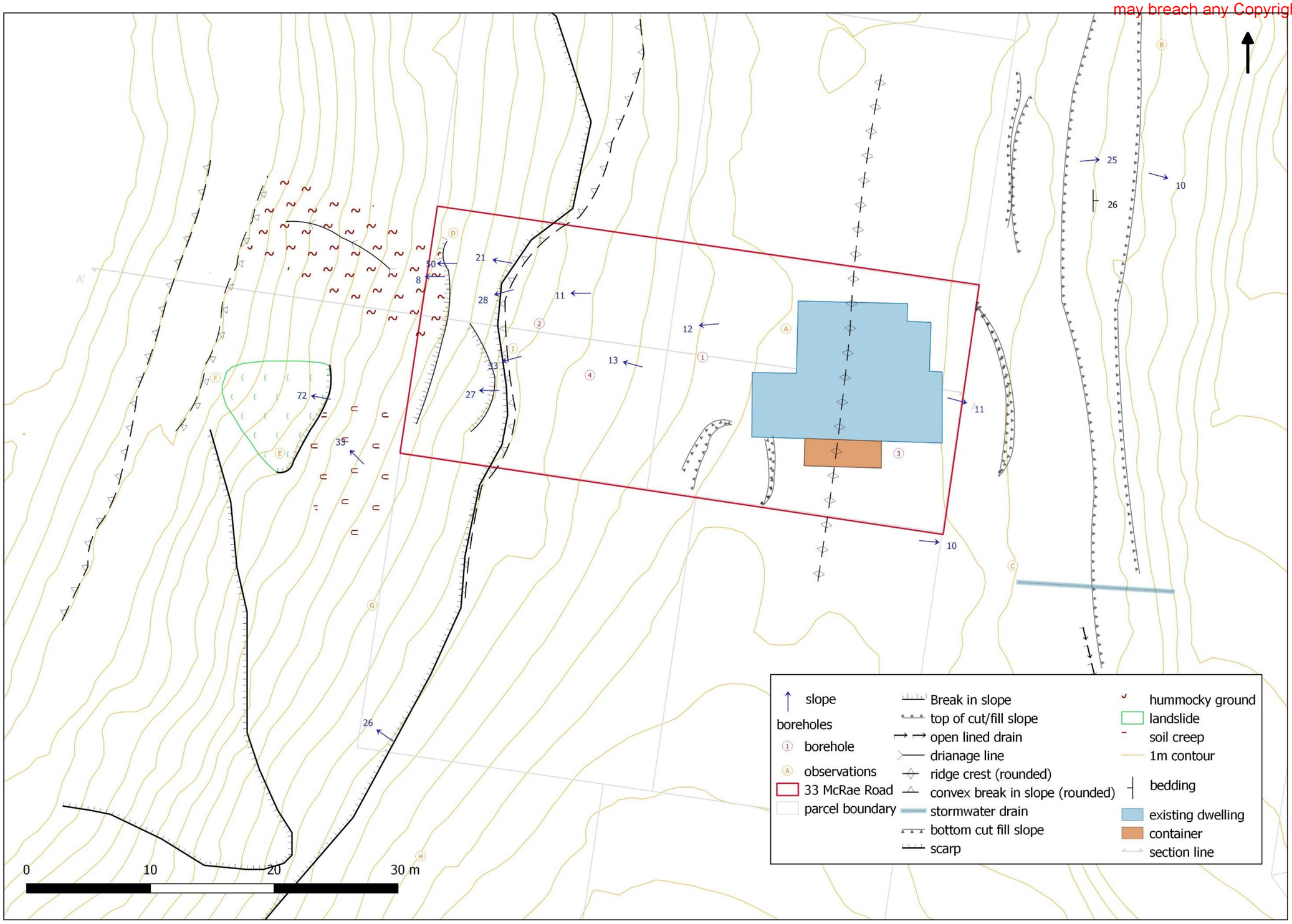

Figure 4: Engineering Geology and Geomorphology of 33 McRae Road Wye River.

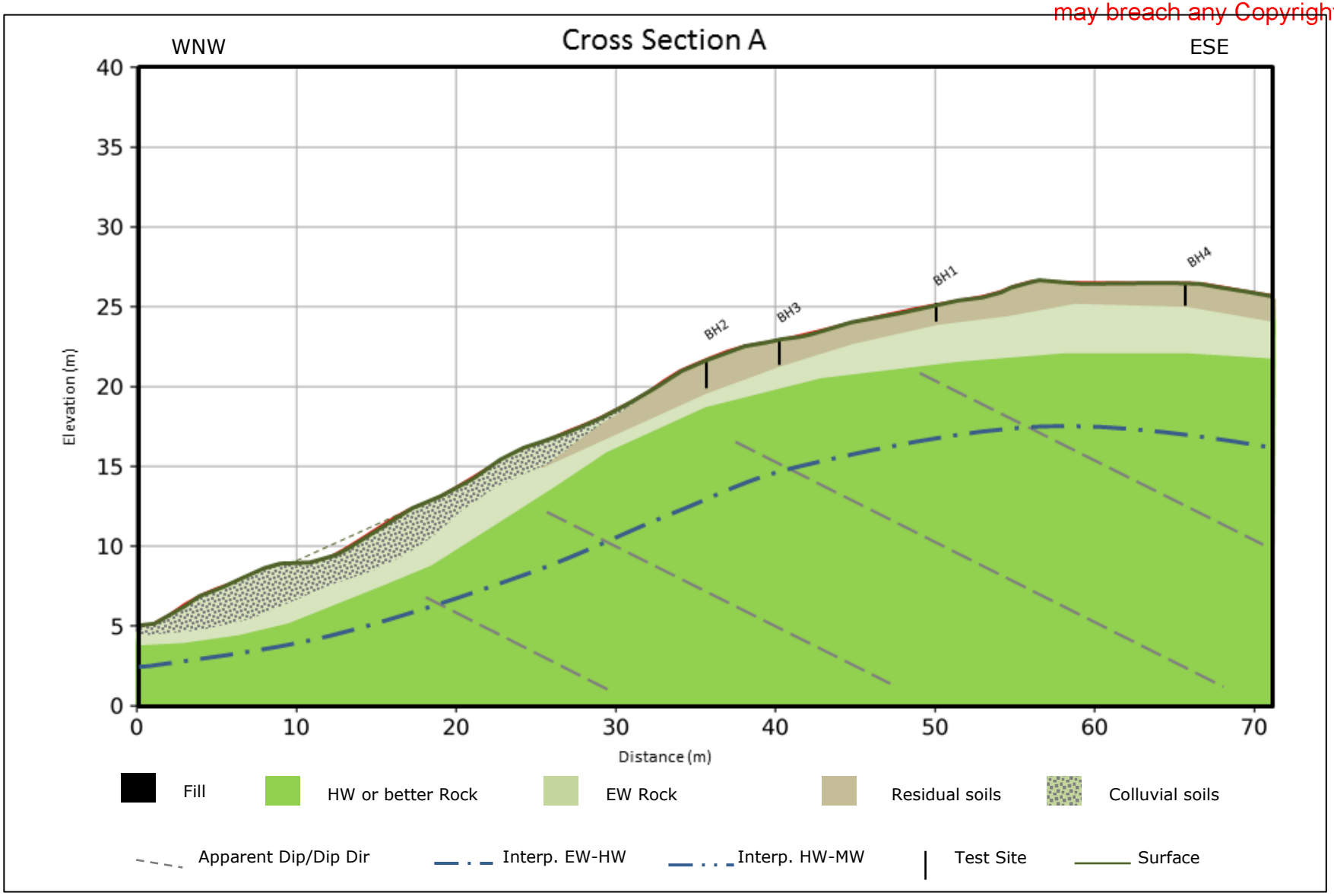

Figure 5: Cross-section A representing the local geological model

4.4 HAZARD IDENTIFICATION

The following **possible** hazards which **may** affect the subject site are:

HAZARD A. LOCALISED FAILURE OF CUTTING ADJACENT TO GARAGE
HAZARD B. ROTATIONAL EARTH SLIDE BELOW DWELLING
HAZARD C. ROTATIONAL DEBRIS SLIDE BELOW PROPERTY BOUNDARY
HAZARD D. TRANSLATIONAL EARTH SLIDE BELOW DWELLING
HAZARD E. TRANSLATIONAL DEBRIS SLIDE BELOW PROPERTY BOUNDARY IN COLLUVIUM

Hazard A. Localised failure of cutting adjacent to garage

- Very small, localized, shallow, slope or toe rotational debris slide or slump (0.5 deep, 2m wide, and 1-1.8m high). Approximately 1m long travel distance. Estimated volume range of sliding mass 1-1.8m^3.
- Fast moving, instantaneous failure.
- Residual soil profile with moderate to low internal friction angles and low drained effective cohesion. Variable undrained shear strength.
- Mechanism for failure: Rotational slumping related internal shearing of poorly cohesive soils within a weakened or fully softened shear plane with low shear strength. Induced by high cut angle exceeding friction angle of soils.
- Triggered: Gravity, high cut angle and heavy to extreme rainfall increasing pore water pressure due to high surface infiltration and concentrated surface run on or seeping groundwater.

Hazard B. Rotational earth slide below dwelling

- Small, rotational debris slide (0.5-1 deep, 5-10m wide, and 5-10 m long). May move up to 1m. Estimated volume range of sliding mass between 12.5m^3 and 100m^3.
- Fast to slow moving with rotation and toe bulge.
- Residual silty CLAY profile with moderate to low friction angles and low drained effective cohesion. Moderate to variable undrained shear strength.
- Mechanism for failure: Rotational sliding related internal shearing of cohesive, unconsolidated, moderate to low shear strength clay.
- Trigger: Increasing pore water pressure due to seeping groundwater and surface water infiltration from prolonged heavy rainfall.

Hazard C. Rotational debris slide below property boundary

- Small, rotational debris slide in colluvial soils. (0.5-1 deep, 5-10m wide, and 5-10 m long). May move up to 1m. Estimated volume range of sliding mass between 12.5m^3 and 100m^3.
- Fast to slow moving, with rotation and toe bulge.
- Residual silty CLAY profile with moderate to low friction angles and low drained effective cohesion. Moderate to variable undrained shear strength.

- Mechanism for failure: Rotational sliding related internal shearing of cohesive, unconsolidated, moderate to low shear strength clay.

- Trigger: Increasing pore water pressure due to seeping groundwater and surface water infiltration from prolonged heavy rainfall.

Hazard D. Translational earth slide below dwelling

- Regression of existing landslide scarp.

- Deeper seated (1.5-2m deep), wide (20-30m wide), translational earth slide of residual soils. Length of area affected 20-25m long. Estimated volume range of sliding mass between 600m^3 and 1500m^3.

- Failure may develop quickly or very slowly. Movement likely to be slow to fast in a single event. Horizontal displacement may be expected up to 1-2m.

- Mechanism for failure: Sliding along a fully softened plane of weakness which may develop where a well-defined competency contrast exists between residual soils and underlying weathered bedrock.

- Trigger: Induced by stress release on the slope and rebound of new cutting in conjunction with prolonged, above average rainfall resulting in groundwater through flow or seepage along soil/rock interface developing a softened plane of weakness and preferential slip surface. May also be triggered by earthquake. May become fluid if trigger is earthquake.

Hazard E. Translational debris slide below property boundary in colluvium

- Shallow (0.5-1m deep), wide (5-10m wide), translational debris slide of colluvial soils. Length of area affected 10m long. Estimated volume range of sliding mass between 25m^3 and 100m^3.

- Failure may develop quickly. Movement fast to rapid in a single event. Has potential to develop into an earth-debris flow. Horizontal displacement may be expected up to 10's of meters with 10-15m run out distance.

- Mechanism for failure: Initial sliding along a fully softened plane of weakness which may develop where a well-defined competency contrast exists between colluvial soils and underlying weathered bedrock. Potential to become fluid and flow down slope after initial sliding failure.

- Trigger: Induced by stress release on the slope and rebound cutting in conjunction with prolonged, above average rainfall resulting increased pore water pressure resultant from groundwater through flow or seepage along soil/rock interface developing a softened plane of weakness and preferential slip surface. May also be triggered by earthquake. May become fluid if trigger is earthquake or if slide is impacted by high volume, high velocity run off and surface flow.

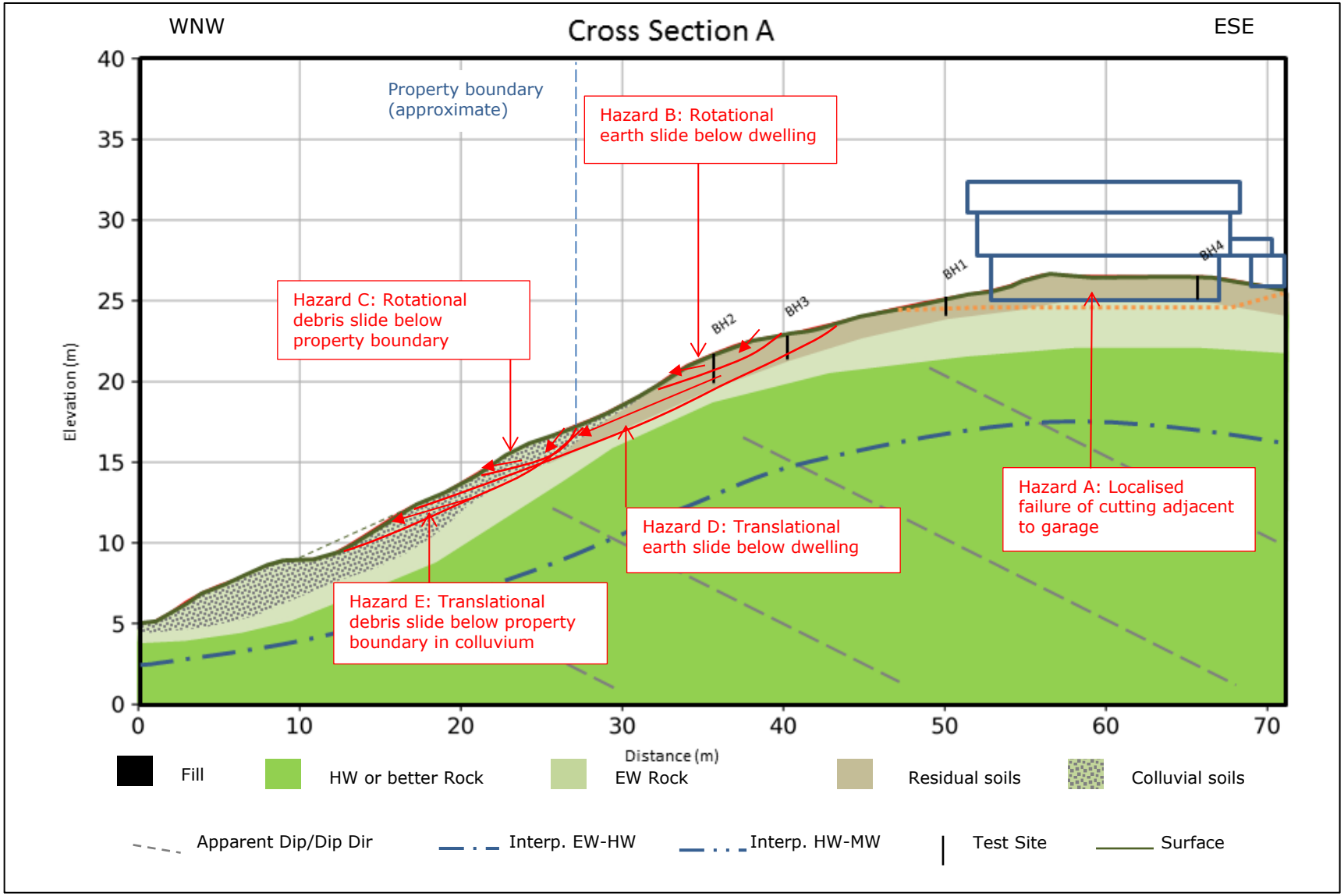

Figure 6: Schematic Cross-section A with possible hazards

5.0 FREQUENCY ANALYSIS

In order to conduct a frequency analysis for each hazard the terminology in Appendix C of the AGS Guidelines (2007) has been adopted to carry out a qualitative assessment as to the *Frequency* or number of hazard events occurring over a given time period This is also referred to as the *Likelihood* which is the qualitative measure of frequency or probability of an event occurring subject to a quantified measure of belief.

Only hazards relating directly to the extent of the alterations and additions pertaining to the permit application as described the Section 3.0 Development Description (the elements at risk) have been considered as part of this analysis.

Hazard A. Localised failure of cutting adjacent to garage

- Residual, silty CLAY soil profile, medium to high plasticity, moderate to low friction angle, low shear strength. Derived from sandstone parent lithology.
- Proposed sub vertical excavation up to 1.8m high.
- Little to no run on expected, gently sloping water shedding slope geometry over crest of ridge.
- Localised ponding surface water possible due to shallow slopes around dwelling.
- Moderately susceptible east and west facing slopes, high annual rainfall area but low elevation.
- Likelihood of occurring during design life: **ALMOST CERTAIN**

Hazard B. Rotational earth slide below dwelling

- Steep natural slopes on existing head scarp (21-33°). Moderate slope angles upslope of existing scarp and potential hazard (11-13°).
- Residual, silty CLAY soil profile, medium to high plasticity, moderate to low friction angle, low shear strength. Derived from sandstone parent lithology.
- Cleared of vegetation.
- Hummocky surface expression and active soil creep present down slope of scarp
- Some run-on expected from up slope.
- No current signs of tension cracks. No signs of recent sumps or rotational failures in this location. No signs of active groundwater seepage at head scarp.
- Rotated slumps and debris flow regressing of scarp interpreted to have occurred historically inferred from curved geometry of scarp and down slope debris.
- Likelihood of occurring during design life: **LIKELY TO POSSIBLE**

Hazard C. Rotational debris slide below property boundary

- Steep natural slopes (21-33°).
- Colluvial soil, low-medium plasticity, moderate to low friction angle, moderate to low shear strength.
- Party vegetated, isolated small to medium trees, no understorey vegetation.
- Run on expected from up slope.
- No current signs of tension cracks. No signs of recent sumps or rotational failures in this location. No signs of active groundwater seepage at head scarp.
- Hummocky surface expression and active soil creep present.
- Evidence of recent/past rotational failures over steep slopes.
- Moderately susceptible east and west facing slopes, high annual rainfall area but low elevation.
- Likelihood of occurring during design life: **LIKELY**

Hazard D. Translational earth slide below dwelling

- Bedrock bedding planes dip around 26° toward the east; dip and dip direction is perpendicular to slope orientation and slope angle. Bedding dips into the slope.
- Open joints, infilled and/or weathered clay seams are possible and have been observed in the Morley Avenue area.
- Moderately susceptible east and west facing slopes, high annual rainfall area but low elevation.
- Regression of existing scarp interpreted to have occurred historically, inferred from curved geometry of scarp and down slope debris.
- Past seismic evidence suggests intraplate earthquakes are infrequent, off shore and of generally low magnitude in the Victorian coastal area. Requires an earthquake of medium to high magnitude to initiate landslide.
- **D1**: Likelihood of 1cm of movement in a single event: **LIKELY**
- **D2**: Likelihood of 1m of movement in a single event: **POSSIBLE**
- **D2**: Likelihood of 10m of movement in a single event: **UNLIKELY**

Hazard E. Translational debris slide below property boundary in colluvium

- Colluvial soil, low-medium plasticity, moderate to low friction angle, moderate to low shear strength.
- Steep slopes (>20°).
- Densely vegetated.
- Surface water run on expected.

- Hummocky surface expression and active soil creep present.
- Evidence of recent/past translational failures over steep slopes.
- Downslope caravan park walking track cutting presents a weakness in the slope; reduction in confining pressure and unloading of slope.
- Moderately susceptible east and west facing slopes, high annual rainfall area but low elevation.
- Likelihood of occurring during design life: **POSSIBLE to LIKELY**

6.0 CONSEQUENCE ANALYSIS

6.1 CONSEQUENCE TO PROPERTY

Consequence to property considers the potential damage and cost of the damage to the element at risk. This is done in relation to characteristics of the hazard such as the volume of the landslide, the position of the element at risk, the magnitude of the displacement of the landslide and the rate of movement of the landslide. Consequence has been evaluated qualitatively using the terminology in Appendix C of the AGS Guidelines (2007) and is summarised in Table 3 and Table 4.

6.2 CONSEQUENCE TO LIFE

Consequence to life is evaluated quantitatively by considering the vulnerability ($V_{(D:T)}$) of the individual impacted by the landslide hazard. The *Vulnerability* of the individual may also be referred to as the likelihood of deaths or injury of the person subjected to the hazard.

Appendix F of the AGS Guidelines (2007) provides vulnerability values derived from data collected from studies of landslide events in Hong Kong, for a person in a building or in a vehicle. The relevant part of the study is reproduced below in Table 2:

Table 2: Hong Kong Vulnerability Recommended Values for Loss of Life

Case	Range in Data	Recommended Value	Comments
Person in a Vehicle If vehicle is buried/crushed	0.9 – 1.0	1.0	Death almost certain
If vehicle is damaged only	0 – 0.3	0.3	High chance of survival
Person in a Building 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

7.0 RISK ASSESSMENT

7.1 RISK ASSESSMENT TO PROPERTY

Based on the measurements and observations that we have made, the conclusions drawn by other researchers and using the procedure and terminology from the AGS Guidelines (2007), the risks to property (over the design life of a building – nominally 50 years) can be summarised for each of the events described above, as shown in Table 3.

For an explanation of terms used and an example of a risk analysis matrix, refer to the attached "Appendix C" of the AGS Guidelines (2007) provided in this report as Appendix VI.

For the purpose of this assessment, only the hazards directly impacting the development description have been considered.

Table 3: Risk Assessment for Property in Unmitigated Conditions

HAZARD		ELEMENT AT RISK	LIKELIHOOD	CONSEQUENCE	RISK TO PROPERTY
A	Localised failure of cutting adjacent to garage	Garage; Dwelling	ALMOST CERTAIN	MINOR	**HIGH**
B	Rotational earth slide below dwelling	Infrastructure	LIKELY to POSSIBLE	MEDIUM	**HIGH**
C	Rotational debris slide below property boundary	Caravan Park	LIKELY	MINOR	**MODERATE**
D_1	Translational earth slide below dwelling with 10cm of movement	Infrastructure; Property	LIKELY	MINOR	**MODERATE**
D_2	Translational earth slide below dwelling with 1m of movement	Infrastructure; Property	POSSIBLE	MEDIUM	**MODERATE**
D_3	Translational earth slide below dwelling with 10m of movement	Infrastructure; Property	UNLIKELY	MAJOR	**MODERATE**
E	Translational debris slide below property boundary in colluvium	Caravan Park	POSSIBLE to LIKELY	MINOR	**MODERATE**

Table 4: Risk Assessment for Property in Mitigated Conditions

HAZARD		ELEMENT AT RISK	MITIGATION MEASURES	LIKELIHOOD	CONSEQUENCE	RISK TO PROPERTY
A	Localised failure of cutting adjacent to garage	Garage; Dwelling	Retain cutting with engineer designed retaining wall.	**RARE**	MINOR	**VERY LOW**
B	Rotational earth slide below dwelling	Infrastructure	Revegetate landslide scarp and slopes below existing scarp with deep rooted trees, shrubs and understorey vegetation; install cut off drainage or surface water diversion berm above the scarp line below; avoid soaking trenches for effluent disposal; reduce effluent loading as much as possible and maintain a minimum 4m buffer from existing scarp line to edge of effluent disposal area; maintain a minimum 10m setback from scarp line to buildings or structures.	**POSSIBLE**	**MINOR**	**MODERATE**
C	Rotational debris slide below property boundary	Caravan Park	**Offsite hazard that is unlikely to have a direct impact on the property** – duty of care to ensure development does not impact the potential hazard. Revegetate landslide scarp and slopes below existing scarp with deep rooted trees, shrubs and understorey vegetation; install cut off drainage or surface water diversion berm above the scarp line to intersect and minimise surface run off; use a spreader for dispersing stormwater at property boundary (if relevant).	**POSSIBLE**	MINOR	**MODERATE**
D_1	Translational earth slide below dwelling with 10cm of movement	Infrastructure; Property	Revegetate landslide scarp and slopes below existing scarp with deep rooted trees, shrubs and understorey vegetation; install cut off drainage or surface water diversion berm above the scarp line below; avoid soaking trenches for effluent disposal; reduce effluent loading as much as possible and maintain a minimum 4m buffer from existing scarp line to edge of effluent disposal area; maintain a minimum	**POSSIBLE**	MINOR	**MODERATE**

HAZARD		ELEMENT AT RISK	MITIGATION MEASURES	LIKELIHOOD	CONSEQUENCE	RISK TO PROPERTY
			10m setback from scarp line to buildings or structures.			
D_2	Translational earth slide below dwelling with 1m of movement	Infrastructure; Property	As above	**UNLIKELY**	**MINOR**	**LOW**
D_3	Translational earth slide below dwelling with 10m of movement	Infrastructure; Property	As above	UNLIKELY	**MEDIUM**	**LOW**
E	Translational debris slide below property boundary in colluvium	Caravan Park	**Offsite hazard that is unlikely to have a direct impact on the property** – duty of care to ensure development does not impact the potential hazard. Revegetate landslide scarp and slopes below existing scarp with deep rooted trees, shrubs and understorey vegetation; install cut off drainage or surface water diversion berm above the scarp line to intersect and minimise surface run off; use a spreader for dispersing stormwater at property boundary (if relevant).	**POSSIBLE**	MINOR	**MODERATE**

7.2 RISK ASSESSMENT TO LIFE

The AGS guidelines (2007) recommend that the risk of loss of life be calculated quantitatively to ensure that the value obtained does not exceed the value of "TOLERABLE RISK" which is defined as "the risk that society can live with" and has a value defined by Schedule 1 to the Otway Ranges Shire EMO as 10^{-5} per annum (a reassurance interval of 1 in 100, 000).

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

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

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. Results of the calculations are documented in Table 5.

For the purpose of this assessment, only the hazards directly impacting the development description have been considered.

7.2.1 Explanation of quantitative risk to life calculations

The values presented in the Table 5 are summed 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.

$P_{(T:S)}$ is calculated with respect to a person in a building as follows:

Annual occupancy of the dwelling: 6/12 months
Daily occupancy of the dwelling 20/24 hours
Building affected by the event: 1 (or 0.5 for part of the building)
Location of individual in the part of the building: 1/4
Location of individual in the residence if the building collapses: 1

Where part of the building is affected by the event, the calculation for $P_{(T:S)}$ is:
$P_{(T:S)}$ = 6/12 x 20/24 x 0.5 x 1/4 = **0.052 or $5.2\ 10^{-2}$**

Where part of the building is affected by the event and that part collapses, $P_{(T:S)}$ is:
$P_{(T:S)}$ = 6/12 x 20/24 x 0.5 x 1 = **0.21 or 2.1×10^{-1}**

Where the whole building is affected by the event but doesn't collapse $P_{(T:S)}$ is:
$P_{(T:S)}$ = 6/12 x 20/24 x 1 x 1/4 = **0.10 or 1.0×10^{-1}**

Where the whole building is affected by the event and the house collapses $P_{(T:S)}$ is:
$P_{(T:S)}$ = 6/12 x 20/24 x 1 x 1= **0.42 or 4.2×10^{-1}**

$P_{(T:S)}$ is calculated with respect to a person in a vehicle belonging to the subject Site as follows:

Annual occupancy of the dwelling: 6/12 months
Daily occupancy of the vehicle (0.16/24) hours (5 min, 2 times a day)

$P_{(T:S)} = 0.5 \times 6.9 \times 10^{-3} =$ **3.45×10^{-3}**

A vulnerability value of 0 (zero) has been adopted for hazards that are not expected to impact any building or vehicle. We have adopted a $P_{(S:H)}$ value of 0.05 for the small or distal hazards, values of 0.1-0.5 for medium scale or intermediate distance failure events and values of 0.5-1.0 for the large scale failure event or a proximal hazard which could result in collapse or destruction of the building.

Table 5: Risk Assessment for Loss of Life in Unmitigated Conditions

Hazard		Element At Risk	Likelihood	P(H) Annual Probability	P(S:H) Spatial Impact Probability	Temporal Considerations	P(T:S) Temporal Probability	Vulnerability Comments	V(D:T) Vulnerability	R Loss To Life Annual Probability
A	Localised failure of cutting adjacent to garage	Dwelling	ALMOST CERTAIN	10^{-1}	0.8	Assume 20 hrs. occupancy per day for person most at risk; part building affected	0.052	Minor damage to the structure	0	0
B	Rotational earth slide below dwelling	Dwelling	LIKELY to POSSIBLE	5×10^{-3}	0	Assume 20 hrs. occupancy per day for person most at risk; part building affected	0.052	No impact with dwelling	0	0
C	Rotational debris slide below property boundary	Holiday Units	LIKELY	10^{-2}	0.05	Assume 20 hrs. occupancy per day for person most at risk; part building affected	0.052	Not expected to impact units	0	0
D_1	Translational earth slide below dwelling with 10cm of movement	Dwelling	LIKELY	10^{-2}	0	Assume 20 hrs. occupancy per day for person most at risk; part building affected	0.052	No impact with dwelling	0	0
D_2	Translational earth slide below dwelling with 1m of movement	Dwelling	POSSIBLE	10^{-3}	0	Assume 20 hrs. occupancy per day for person most at risk; part building affected	0.052	No impact with dwelling	0	0
D_3	Translational earth slide below dwelling with 10m of movement	Holiday Units	UNLIKELY	10^{-4}	0	Assume 20 hrs. occupancy per day for person most at risk; part building affected	0.052	No impact with dwelling	0	0

Hazard		Element At Risk	Likelihood	P(H) Annual Probability	P(S:H) Spatial Impact Probability	Temporal Considerations	P(T:S) Temporal Probability	Vulnerability Comments	V(D:T) Vulnerability	R Loss To Life Annual Probability
E_1	Translational debris slide below property boundary in colluvium with 10cm of movement	Holiday Units	POSSIBLE	5×10^{-3}	0	Assume 20 hrs. occupancy per day for person most at risk; part building affected	0	Not expected to impact units	0	0
E_2	Translational debris slide below property boundary in colluvium with 1m of movement	Holiday Units	POSSIBLE	10^{-3}	0	Assume 20 hrs. occupancy per day for person most at risk; part building affected	0	Not expected to impact units	0	0
E_3	Translational debris slide below property boundary in colluvium with 10m of movement	Holiday Units	UNLIKELY	10^{-4}	0.6	Assume 20 hrs. occupancy per day for person most at risk; part building affected	0.052	Minor damage to the structure	0.1	3.2×10^{-7}

8.0 SUMMARY OF RISKS AND CONCLUSION

Our assessment has found that there are risks to loss of life and to damage of property on the subject site due to conceivable landslide events.

The risks to property associated with developing a residential dwelling on the subject site assuming **existing conditions remain or development is unmitigated,** are considered "HIGH" (for the most at risk element). The risk to life however considered to be negligible and well below the recommended "TOLERABLE" risk limit defined as 1 x 10^{-5} by the AGS Guidelines (2007) and Schedule 1 to the Colac-Otway Shire EMO.

The risks to property can be reduced if recommended mitigation measures are adhered to.

The risks to property associated with developing a residential dwelling on the subject site assuming **risk management conditions are implemented,** can be reduced to "LOW" or "VERY LOW" for most hazards while some hazards will remain at a "MODERATE" risk level.

Some hazards identified during this investigation in accordance with the AGS Guidelines (2007) do not directly impact the development description and may be considered off site hazards. Although they have been considered here, the intension is to ensure the proposed development does not increase the potential likelihood for these hazards occurring or increase the risk to offsite elements. Recommendations for good hill side practice have been made with regard to these hazards however they should also be managed in accordance with the landslip risk assessment relevant to the property for which the elements at risk exist.

Based on our assessments of the risks, we conclude that there are no geotechnical reasons to prevent the issue of a permit to develop on this site, subject to the implementation of the following recommendations, which outline management strategies to reduce or maintain the likelihood and/or consequences of the major risk events.

The following recommendations, outline management strategies that can reduce or maintain the likelihood and/or consequences of the major risk events.

9.0 RECOMMENDATIONS FOR RISK MANAGEMENT

It is not feasible to remove all of the risks of building on the site but the risks can be reduced by good engineering design, by following good hillside construction practices and by regular and frequent site maintenance. The following recommendations outline general good building practice for steep slopes and landslide prone areas.

9.1 SITE RECOMMENDATIONS

Note that an increase in landslide risk may 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.

Careful positioning of the development and related infrastructure is crucial to the long-term stability of this site. As such, we recommend that no structures are to be erected within 10m of the existing landslide scarp and that a minimum 4m buffer is to be enforced between the scarp and any waste water disposal infrastructure.

9.2 SITE CLASSIFICATION

We have generally classified the proposed development site as a **Class P** in accordance with Section 2 of AS2870-2011 (Australian Standard on Residential Slabs and Footings). This classification is due to the potential risk of landslide hazards as defined by Clause 2.1.3(d) of the Standard.

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

9.3 FOOTINGS

Having all footings appropriately designed and founded will reduce the risk of damage due to soil movement or slope failures. As well as founding structures to a stable base, deep footings have the ability to provide similar root-binding effects to that of deep-rooted trees, which contribute to minimising the likelihood of deep-seated soil failures.

We recommend engineer-designed footings designed according to engineering principles. The designer should assume **moderate** soil profile relativity.

Footings must be founded through any fill and/or residual soils and embedded a minimum of 500mm into the **weathered bedrock**. At this depth a maximum Allowable Bearing Pressure of 400kpa may be adopted.

Minimum foundation depths can be expected up to between 1700mm and 20000mm (from the existing surface level) to ensure proper rock socketing. Depths to rock may be shallower in areas where site cuts have been undertaken.

Our investigation revealed that in the three test sites excavated on site proximal to the proposed building envelope, suitable founding depths exist as follows:

Table 6: Suitable Foundation Conditions

Test Site Number	Depth below existing surface to weathered rock	Minimum Founding Depth	Recommended Founding Material	Presumed Maximum Allowable Bearing Capacity	Presumed Maximum Allowable Skin Friction
1	1200mm	1700mm	Weathered bedrock	400 kPa	40kPa
4	1500mm	2000mm	Weathered bedrock	400 kPa	40kPa

The above quoted depth to weathered rock is estimated from our investigation and our previous experience, however the depth to competent rock can vary significantly. Founding depths more than twice the depths quoted above could occur due to natural soil and rock variability. Pile depths of up to 6000mm may be required where depth to less weathered bedrock naturally varies. The depth is measured from surface level at the time of testing and will vary if the site is cut and/or filled.

An experienced geotechnical professional (engineering geologist or geotechnical engineer) should be present **during** all footing excavations to ensure the appropriate foundation has been achieved.

9.4 SITE EXCAVATIONS, CUT AND FILLS AND RETAINING STRUCTURES

It is recommended any new site excavations to accommodate the sloping site should be kept to a minimum and that **all** site excavations should be retained regardless of height unless battered at an appropriate safe shallow angle. **All** excavations equal to or greater than 1000mm must be supported by engineer-designed retaining walls with appropriate drainage features or battered at an appropriate safe shallow angle.

Retaining Walls

Retaining walls should be designed for active earth pressure conditions provided that some wall yield is acceptable. It is recommended that the following Active Earth Pressure Coefficients (Ka) be adopted for the wall design. The following earth pressure coefficients have been calculated without considering geotechnical reduction factors.

Table 7: Active Earth Pressure Coefficients

SOIL TYPE	ACTIVE EARTH PRESSURE COEFFICIENT (Ka)
silty CLAY	0.47

Table 8: Passive Earth Pressure Coefficients

SOIL TYPE	PASSIVE EARTH PRESSURE COEFFICIENT (Kp)
silty CLAY	2.12

If the retaining wall is to form part of the building structure restrained from movement above and below by the integral structure of the building, then the following At Rest Earth Pressure Coefficients (Ko) may be used.

Table 9: At Rest Earth Pressure Coefficients

SOIL TYPE	AT REST EARTH PRESSURE COEFFICIENT (Ko)
silty CLAY	0.64

The recommended parameters assume a vertical wall and a horizontal backslope with granular backfill behind the wall as well as a horizontal foreslope in front of the wall of at least 2.5m wide. Wall friction between soldier piles and soil/rock is based on the assumption that piles will be founded in rock. If retaining wall conditions differ from those described, then a change in design parameters will be required.

Any retention system should be designed so that the soil behind the retaining wall is completely and permanently drained. If this cannot be achieved, hydrostatic pressure must be included in the design. Retaining wall backfill should be comprised of free draining granular material. Under no circumstances should backfill comprise of poorly compacted non-granular material. It is recommended that a non-woven geotextile filter be installed in subsurface drains to minimize silting and erosion of backfill.

Specific Retaining Wall Design

Specific retaining wall design parameters should be determined by the application of an accepted design theory (e.g.: Rankin Earth Pressure Theory or Coulomb Earth Pressure Theory). The following geotechnical parameters are judged to be typical values for the types of ground materials present on site.

Table 10: Typical Geotechnical Parameters

	silty CLAY	HW Rock[1]
Wet or total unit Weight (γ_w)	19 kN/m^3	25 kN/m^3
Effective Friction angle (Φ')	21-24^o	35-39^o
Effective Cohesion (c')	3kPa	25kPa
Undrained shear strength (c_u or S_u)[2]	25 -100kPa	400kPa
Unconfined compressive strength (q_u)		800kPa

Additional testing may be required to determine more site specific design parameters such as wet density, suction, cohesion and angle of internal friction, before the design of the retaining walls or the determination of a safe batter angle can be finalised.

Slope Stability – Short Term

In order to ensure adequate stability of filled or excavated slopes in the short term (i.e. 2 consecutive days, in fine weather) the following maximum batters should be adopted.

Table 11: Temporary Batter Angles

SOIL TYPE	MAXIMUM TEMPORARY SLOPE (To Horizontal)
Topsoil (clayey silts, silty sands, clayey sands)	45^o or 1(V):1(H)
Subsoils (clay, sandy clay, silty clay)	45^o or 1(V):1(H)
New or existing fill	45^o or 1(V):1(H)
Highly weathered to fresh rock[3]	60^o or 2(V):1(H)

All excavations should be inspected to ensure that stability is adequate and to identify any possible zone of instability e.g. unfavourable jointing, fault zones. The stability of vertically excavated slopes, e.g. for the insertion of precast panels, cannot be guaranteed.

If poor weather conditions are encountered (i.e. heavy rain, etc.) at the time of excavation or panel insertion, immediate shoring of the batters should be carried out.

Permeable soils that become inundated may lose form. If excavations are undertaken during wet periods a shoulder to shoulder pile system may be required **or** a proven diversion drainage system may need to be installed prior to site works.

Permanent Earthworks

[1] These strength parameters apply to failure through the rock mass and do not take into account failures controlled by geological structures such as along clay filled bedding planes, joints or faults.
[2] Not to be used for long term stability
[3] Steeper angles maybe possible in some less weathered rock depending on the nature of the geological structure, but would require site specific assessment during excavation by an experienced geotechnical professional.

Any fill introduced to the site should contain little or no organics and be placed in layers up to 200mm thick with each layer being well compacted at the appropriate moisture content. All permanent fill batters or cuts in natural soils must not exceed slope angels 27° or 1(V):2(H) or alternatively be retained by engineer designed retaining walls with appropriate footings and drainage works.

In order to ensure adequate stability of filled or excavated slopes in the long term the following maximum batters should be adopted.

Table 12: Permanent Batter Angles

SOIL TYPE	MAXIMUM PERMANENT SLOPE (To Horizontal)
Topsoil (clayey silts, silty sands, clayey sands)	27° or 1(V):2(H)
Subsoils (clay, sandy clay, silty clay)	27° or 1(V):2(H)
New or existing fill	27° or 1(V):2(H)
Highly weathered to fresh rock[4]	45° or 1(V):1(H)

All cut and fill batters should be revegetated with fast growing deep rooted plants as soon after construction as possible to protect the batter face.

Care must also be taken to ensure that any levelled areas have a slight fall to prevent surface water from ponding or seeping into the ground 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.

9.5 VEHICLE PARKING AND ACCESS

It is recommended that suitably designed drainage accompany any design of access ways to minimise surface water run-off and overland flow. It is recommended that some consideration be given to a drainage system which may include the use of a spoon drain and culvert system as part of the overall drainage design for the site to ensure surface water is discharged away from any buildings and dispersed so that surface water cannot accumulate and infiltrate to the soil profile or run-off down slope and over any steep embankments.

9.6 SITE DRAINAGE

Many researchers identify intense rainfall and/or poor site drainage as a common trigger of landslide events. Whilst nothing can be done to reduce the likelihood of intense rainfall in the Wye River area, steps can be taken to improve site drainage and minimise saturation of the soil layers which often triggers soil movement. Careful attention to drainage is essential to reduce the landslide risk and surface water must therefore be prevented from ponding anywhere on the site.

We recommend that the drainage system for the site be fully engineer designed. We expect that the roof run-off will be collected in tanks and that overflows should be connected to the site drainage system and discharge excess water in a non-destructive way to an approved point of discharge such as curb side storm water drain or municipal drainage infrastructure. Discharge must be made well

[4] Steeper angles maybe possible in some less weathered rock depending on the nature of the geological structure, but would require site specific assessment during excavation by an experienced geotechnical professional.

away from any buildings to an area where the water can be dispersed without causing erosion or accumulating in a concentrated area. It is very important that roof run-off is not allowed to run onto the ground near the buildings or be allowed to discharge freely over the natural slopes.

Surface drainage (catch drains or diversion berms) are recommended above the crest of all cut and fill embankments and within all levelled or benched areas to ensure surface water does not concentrate and pond anywhere on site or be allowed to run-off over the face of any cut or fill batters.

Either a catch drain, cut off drain or diversion berm is to be installed above the existing scarp and down slope of the proposed effluent disposal area. Surface drainage must be installed so as to capture and prevent surface run off from discharging over the scarp line. Any surface drainage or storm water discharged to the western property boundary must be dispersed using a spreader to avoid concentrated discharge.

Where the soil surface is altered to construct vehicle parking bays, recreation areas etc., precautions must be taken to ensure excess surface water cannot pond or soak into the ground but is diverted away from the buildings.

Careful attention to site drainage will reduce the risk of slope failures or soil movements.

9.7 SITE VEGETATION

Suitable vegetation contributes greatly to the stability of a site by reducing the soil moisture content, minimizing soil erosion and binding the soil structure together. Existing trees should remain unless they interfere with the building or the minimum defendable space for fire protection in which case they should be cut off at ground level and the root structures left intact.

We recommend revegetation over and below the existing scarp. Suitable deep-rooted trees, shrubs and grasses should be established an appropriate distance from the building with regard to fire risk to assist the overall slope stability.

Revegetation of the site, especially over and below the existing scarp and will provide root-binding effects, help mitigate excess moisture building up in the soil profile, increase suction, assist with rainfall and surface flow interception and reduce the velocity of overland flow in turn reducing the risk of slope failures.

9.8 EFFLUENT DISPOSAL

Effluent should be disposed of offsite where reticulated mains sewer is available.

If onsite waste water treatment is required then it should, where possible, be widely dispersed by subsurface irrigation well away from the development area to minimise the likelihood of wastewater concentrating in the soil profile. Suitable vegetation will assist with evapotranspiration.

We recommend reducing the potential waste water loading as much as possible to minimise the required land application area. This could be achieved in a number of ways such as ensuring a minimum of three star water saving fixtures are installed throughout the dwelling, utilising a split blackwater/greywater treatment with minimum advanced secondary treatment, incorporating a third pipe for recycling advanced secondary treated greywater for use in toilets and laundry's or utilising incinerating toilets to reduce daily loading rates.

If an irrigation disposal field is to be constructed behind (up-slope of) the development then a cut-off drain **must** be constructed between the irrigation field and the dwelling. The cut-off drain should be a minimum of 1m deep (but may be shallower where bedrock is encountered) and contain a sub-

surface drain wrapped in geofabric to minimise clogging. Inspection openings should be provided to enable periodic flushing. The drain should have sufficient fall to discharge completely to an area well away from the house.

On this site wastewater disposal is to be excluded within a 4m of the existing scarp line.

9.9 EROSION

Re-vegetation of bare surface slopes is critical to minimising the effect of sheet, tunnel and rill erosion. Vegetation adds organic material back into the soil, improving soil structure and binding the topsoil layers. Surface vegetation and low shrubs also intercept surface water runoff and slow the rate of surface flow thus minimising the physical impact of surface water runoff across sloping sites.

Additional measures to help prevent erosion caused by surface water include implementing good drainage design to capture surface water runoff and using surface berms, vertical drops and energy dissipaters within the landscape design to reduce the velocity of runoff down slope.

9.10 GENERAL RECOMMENDATIONS

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

a) the design of an appropriate development for the site;

b) the provision of adequate retaining structures and drainage for all cut faces (or batter at an appropriate angle);

c) adequate site drainage is essential, surface water and excess roof water must not be allowed to pond or seep into the ground near buildings.

d) regular maintenance of open drains.

Refer also to the attached Appendices for more general advice.

DAVID J HORWOOD
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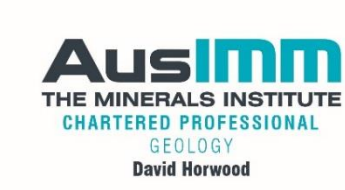
SENIOR ENGINEERING GEOLOGIST



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Appendix I: Aerial Photograph

Appendix II: Site Plan

Appendix III: Site Photographs

Photo 1: View of existing dwelling from McRae Rd.

Photo 2: Overview of the proposed development area.

Photo 3: Moderate to steep slopes west fo the existing dwelling.

Photo 4: Landslide escarpment and steep break in slope.

Photo 5: Sparsely vegetated steep slope showing signs of soil creep (curved/bowed trees).

Photo 6: Breaks in slope and hummocky ground below the existing scarp line.

Appendix IV: Borehole Logs

Client:	Richard van der Mewre	Bore Hole	No. 1	Drilling Medthod:	
Project Address:	33 McRae Rd, Wye River	Field Work Completed By:	DH	Hand Auger	
Reference No:	19A341LRA	Field Work Date:	1/30/2019	Fron 0	To 1200

Depth mm	Graphic Log	Group Symbol	Material Description		Shade	Colour	Moisture	Consistency/ Density	Field Test
100		ML	clayey SILT	low plasticity	Dk	Gy	D	H	
200			trace sand						
300									
400		CH	silty CLAY	med-high plasticity	Pl	Gy/ Br, mott Or	D	VSt	
500									
600									
700			with HW Sandstone Rock Fragments	gravel to pebble sized	Pl	Or/ Br, mott Gy	D	VSt	
800				sub angular to sub round					
900					Pl	Yl/ Gy, mott Or	SM	VSt	
1000									
1100			Grading Sandy						
1200									
1300			Refusal with hand auger						
1400									
1500									
1600									
1700									
1800									
1900									
2000									
2100									
2200									
2300									
2400									
2500									
2600									
2700									
2800									
2900									
3000									
3100									
3200									
3300									
3400									
3500									

Comment:

Graphic Log Granular A Horison | Cohesive A Horizon | Cohesive B Horizon | Granular B Horizon | EW Rock/C Horizon | Rock | Fill

Field Test and Sampling	Moisture:	Relative Density:	Consistency:
SPT Standard Penetration Test (Relative density N - blows/300mm)	D Dry	VL	VS Very Soft
PP Pocket Penetrometer (Force kgf/cm^2 - Unconfined Compressive Strength q_u)	SM Slightly Moist	L	S Soft
VS Vane Shear (Undrained cohesive (shear) strength Cu/Su kPa)	M Moist	MD	F Firm
DCP Dynamic Cone Penetrometer (Penetration resistance N_p - blows/100mm)	VM Very Moist	D	St Stiff
Disturbed Sample D Undisturbed Sample U	W Wet	VD	VSt Very Stiff

Compaction: PC Poorly Compacted MC Moderately Compacted WC Well Compacted VC Variably Compacted

Groundwater ▼

Colour: Dk Dark Lt Light Bk Black Br Brown Gy Grey Or Orange Yl Yellow Re Red Bl Blue Gn Green Pk Pink Wh White

H Hard

Client:	Richard van der Mewre	Bore Hole	No. 2	Drilling Medthod:	
Project Address:	33 McRae Rd, Wye River	Field Work Completed By:	DH	Hand Auger	
Reference No:	19A341LRA	Field Work Date:	1/30/2019	From 0	To 1700

Depth mm	Graphic Log	Group Symbol	Material Description	Shade	Colour	Moisture	Consistency/ Density	Field Test
100			Fill silty clay with sand	Dk	Or/ Br	D	MC	
200		ML	clayey SILT low plasticity	Dk	Gy	D	H	
300		CH	silty CLAY med-high plasticity	Pl	Gy/ Br, mott Or	D	VSt	
400								
500								
600								
700				Pl	Gy, mott Or	SM	VSt	
800								
900								
1000								
1100								
1200								
1300								
1400								
1500								
1600								
1700								
1800			Refusal with hand auger					
1900								
2000								
2100								
2200								
2300								
2400								
2500								
2600								
2700								
2800								
2900								
3000								
3100								
3200								
3300								
3400								
3500								

Comment:

Graphic Log Granular A Horison; Cohesive A Horizon; Cohesive B Horizon; Granular B Horizon; EW Rock/C Horizon; Rock; Fill

Field Test and Sampling	Moisture:	Relative Density:	Consistency:
SPT Standard Penetration Test (Relative density N - blows/300mm)	D Dry	VL	VS Very Soft
PP Pocket Penetrometer (Force kgf/cm^2 - Unconfined Compressive Strength q_u)	SM Slightly Moist	L	S Soft
VS Vane Shear (Undrained cohesive (shear) strength Cu/Su kPa)	M Moist	MD	F Firm
DCP Dynamic Cone Penetrometer (Penetration resistance N_p - blows/100mm)	VM Very Moist	D	St Stiff
Disturbed Sample D Undisturbed Sample U	W Wet	VD	VSt Very Stiff
			H Hard

Compaction: PC Poorly Compacted MC Moderately Compacted WC Well Compacted VC Variably Compacted

Colour: Dk Dark Lt Light Bk Black Br Brown Gy Grey Or Orange Yl Yellow Re Red Bl Blue Gn Green Pk Pink Wh White

Groundwater ▼

Client:	Richard van der Mewre	Bore Hole	No. 3	Drilling Medthod:	
Project Address:	33 McRae Rd, Wye River	Field Work Completed By:	DH	Hand Auger	
Reference No:	19A341LRA	Field Work Date:	1/30/2019	Fron 0	To 1500

Depth mm	Graphic Log	Group Symbol	Material Description		Shade	Colour	Moisture	Consistency/ Density	Field Test
100		ML	clayey SILT	low plasticity	Dk	Gy/ Br	D	St	
200			trace sand						
300		CH	silty CLAY	med-high plasticity		Or/ Br	SM	VSt	
400									
500									
600									
700									
800									
900						Or/ Gy	M	VSt	
1000									
1100			with HW Sandstone Rock Fragments	gravel to pebble sized					
1200				sub angular to sub round					
1300									
1400									
1500									
1600			Refusal with hand auger						
1700									
1800									
1900									
2000									
2100									
2200									
2300									
2400									
2500									
2600									
2700									
2800									
2900									
3000									
3100									
3200									
3300									
3400									
3500									

Comment:

Graphic Log Granular A Horison | Cohesive A Horizon | Cohesive B Horizon | Granular B Horizon | EW Rock/C Horizon | Rock | Fill

Field Test and Sampling	Moisture:	Relative Density:	Consistency:
SPT Standard Penetration Test (Relative density N - blows/300mm)	D Dry	VL	VS Very Soft
PP Pocket Penetrometer (Force kgf/cm^2 - Unconfined Compressive Strength q_u)	SM Slightly Moist	L	S Soft
VS Vane Shear (Undrained cohesive (shear) strength Cu/Su kPa)	M Moist	MD	F Firm
DCP Dynamic Cone Penetrometer (Penetration resistance N_p - blows/100mm)	VM Very Moist	D	St Stiff
Disturbed Sample D Undisturbed Sample U	W Wet	VD	VSt Very Stiff
			H Hard

Compaction: PC Poorly Compacted MC Moderately Compacted WC Well Compacted VC Variably Compacted

Colour: Dk Dark Lt Light Bk Black Br Brown Gy Grey Or Orange Yl Yellow Re Red Bl Blue Gn Green Pk Pink Wh White

Groundwater ▼

Client:	Richard van der Mewre	Bore Hole	No. 4	Drilling Medthod:	
Project Address:	33 McRae Rd, Wye River	Field Work Completed By:	DH	Hand Auger	
Reference No:	19A341LRA	Field Work Date:	1/30/2019	Fron 0	To 1500

Depth mm	Graphic Log	Group Symbol	Material Description		Shade	Colour	Moisture	Consistency/ Density	Field Test
100		ML		clayey SILT	Dk	Gy/ Br	D	St	
200			trace	sand					
300		CH		silty CLAY	Pl	Gy/ Br, mott Or	D	VSt	
400									
500									
600									
700					Pl	Or/ Br, mott Gy	D	VSt	
800									
900									
1000									
1100			with	HW Sandstone Rock Fragments		gravel to pebble sized			
1200						round to sub angular			
1300			Grading	Sandy					
1400									
1500									
1600			Refusal	with hand auger					
1700									
1800									
1900									
2000									
2100									
2200									
2300									
2400									
2500									
2600									
2700									
2800									
2900									
3000									
3100									
3200									
3300									
3400									
3500									

Comment:

Graphic Log Granular A Horison | Cohesive A Horizon | Cohesive B Horizon | Granular B Horizon | EW Rock/C Horizon | Rock | Fill

Field Test and Sampling	Moisture:	Relative Density:	Consistency:
SPT Standard Penetration Test (Relative density N - blows/300mm)	D Dry	VL	VS Very Soft
PP Pocket Penetrometer (Force kgf/cm^2 - Unconfined Compressive Strength q_u)	SM Slightly Moist	L	S Soft
VS Vane Shear (Undrained cohesive (shear) strength Cu/Su kPa)	M Moist	MD	F Firm
DCP Dynamic Cone Penetrometer (Penetration resistance N_p - blows/100mm)	VM Very Moist	D	St Stiff
Disturbed Sample D Undisturbed Sample U	W Wet	VD	VSt Very Stiff
Compaction: PC Poorly Compacted MC Moderately Compacted WC Well Compacted VC Variably Compacted		Groundwater	H Hard
Colour: Dk Dark Lt Light Bk Black Br Brown Gy Grey Or Orange Yl Yellow Re Red Bl Blue Gn Green Pk Pink Wh White		▼	

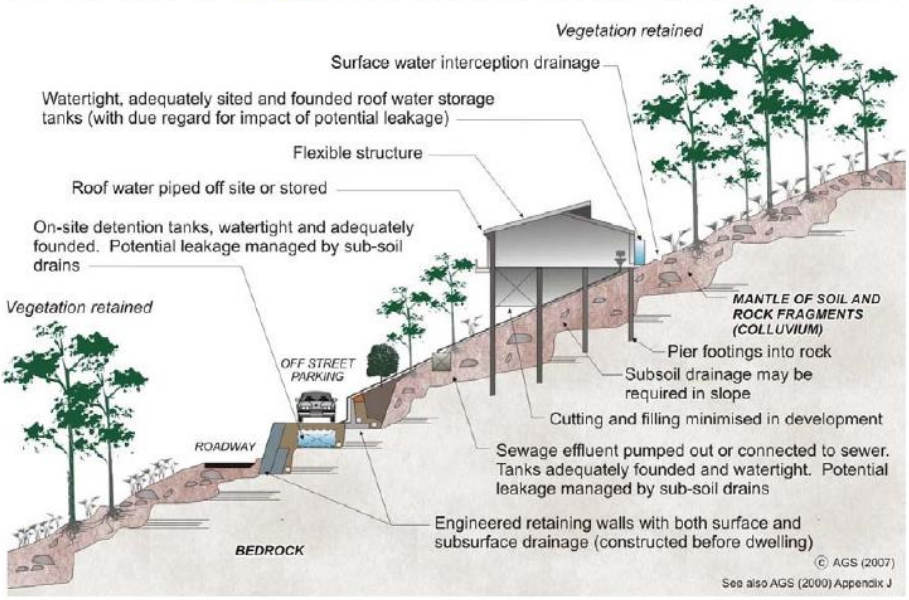
Appendix V: Hillside Construction Practice

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

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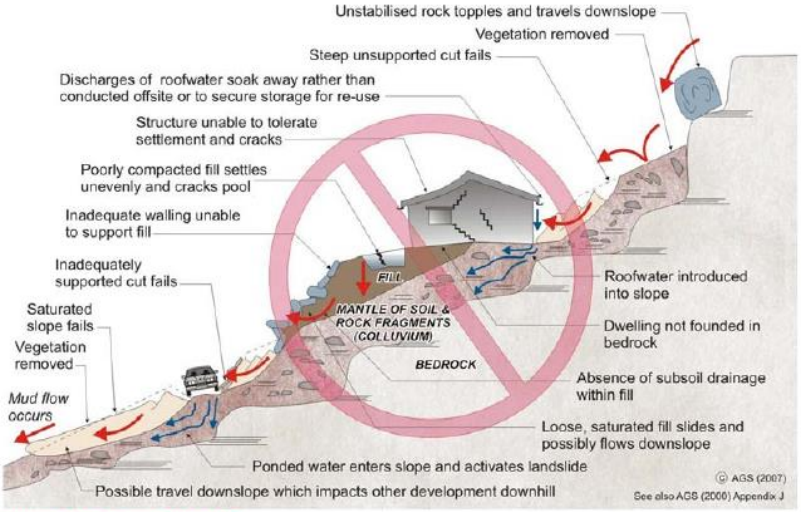
AUSTRALIAN GEOGUIDE LR8 (CONSTRUCTION PRACTICE)

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.

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Appendix VI: Qualitative Terminology for use in Assessing Risk to Property

PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT 2007

APPENDIX C: LANDSLIDE RISK ASSESSMENT

QUALITATIVE TERMINOLOGY FOR USE IN ASSESSING RISK TO PROPERTY

QUALITATIVE MEASURES OF LIKELIHOOD

Approximate Annual Probability		Implied Indicative Landslide Recurrence Interval		Description	Descriptor	Level
Indicative Value	Notional Boundary					
10^{-1}	$5x10^{-2}$	10 years	20 years	The event is expected to occur over the design life.	ALMOST CERTAIN	A
10^{-2}	$5x10^{-3}$	100 years	200 years	The event will probably occur under adverse conditions over the design life.	LIKELY	B
10^{-3}	$5x10^{-4}$	1000 years	2000 years	The event could occur under adverse conditions over the design life.	POSSIBLE	C
10^{-4}	$5x10^{-5}$	10,000 years	20,000 years	The event might occur under very adverse circumstances over the design life.	UNLIKELY	D
10^{-5}	$5x10^{-6}$	100,000 years	200,000 years	The event is conceivable but only under exceptional circumstances over the design life.	RARE	E
10^{-6}		1,000,000 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%	40%	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%	10%	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%	1%	Limited damage to part of structure, and/or part of site requiring some reinstatement stabilisation works.	MINOR	4
0.5%		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)

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.

Appendix VII: Geotechnical Declaration

FORM **A**

Geotechnical Declaration and Verification Development Application

Office Use Only		Regulator: COLAC-OTWAY SHIRE

To be submitted with a development application. If this form is not submitted with the geotechnical report the report will be refused.
This form is essential to verify that the geotechnical report has been prepared in accordance with Schedule 1 to the Erosion Management Overlay and that the author of the geotechnical report is a geotechnical engineer or engineering geologist as defined by Schedule 1 to the Erosion Management Overlay. Alternatively, where a geotechnical report has been prepared for subdivision or is greater than two years old or by a professional person not recognized by Schedule 1 to the Erosion Management Overlay, then this form may be used as technical verification of the geotechnical report if signed by a geotechnical engineer or engineering geologist as defined by Schedule 1 to the Erosion Management Overlay.

Section 1 Related Application

Reference	
DA Site Address	33 McRae Road Wye River VIC
DA Applicant	Richard van der Merwe

Section 2 Geotechnical Report

Details	Title: Landslip Risk Assessment for Container Store and Balcony Additions at 33 McRae Road Wye River	
	Author's Company/Organization Name: AGR Geosciences Pty Ltd	Report Reference No: 19A341LRA
	Author: David J Horwood	Dated: 20 /03 / 2019

Section 3 Checklist

The following checklist covers the minimum requirements to be addressed in a geotechnical report. This checklist is to accompany the report. Each item is to be cross-referenced to the section or page of the geotechnical report which addresses that item.

Yes	No	Geotechnical Requirements (Tick as appropriate, either Yes or No)
☒	☐	A review of readily available history of slope instability in the site or related land as per *section 4.1; 4.1.2; 4.1.3*
☒	☐	An assessment of the risk posed by all reasonably identifiable geotechnical hazards as per *Sections 4.4, 5.0, 6.0, 7.0*
☒	☐	Plans and sections of the site and related land as per *Figures 1-6, Section 4.0*
☒	☐	Presentation of a geological model as per *Figures 1-6, Section 4.1.1; Section 4.2 & Section 4.3*
☒	☐	Photographs and/or drawings of the site as per *Appendices ii-iii*
☒	☐	A conclusion as to whether the site is suitable for the development proposed to be carried out either conditionally or unconditionally as per *Section 8.0*
☐	☐	If any items above are ticked No, an explanation is to be included in the report to justify why. <*Add reference*>

Subject to recommendations and conditions relevant to:

Yes	No	
☒	☐	selection and construction of footing systems,
☒	☐	earthworks,
☒	☐	surface and sub-surface drainage,
☒	☐	recommendations for the selection of structural systems consistent with the geotechnical assessment of the risk,
☒	☐	any conditions that may be required for the ongoing mitigation and maintenance of the site and the proposal, from a geotechnical viewpoint,
☒	☐	highlighting and detailing the inspection regime to provide the Colac-Otway Shire and builder with adequate notification for all necessary inspections.
☒	☐	State Design life adopted: 50 Years

FORM **A**

Geotechnical Declaration and Verification Development Application

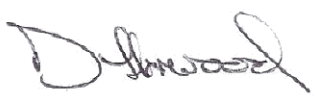
Section 4 List of Drawings referenced in Geotechnical Report

Design Documents	Description	Plan or Document No.	Revision or Version No.	Date	Author
	Existing Conditions	01		25/2/2019	Josh Crosbie Architects
	Site Plan	02		25/2/2019	Josh Crosbie Architects
	Ground Floor Plan	03		25/2/2019	Josh Crosbie Architects
	First Floor Plan	04		25/2/2019	Josh Crosbie Architects
	Roof Plan	05		25/2/2019	Josh Crosbie Architects
	Elevations	06-07		25/2/2019	Josh Crosbie Architects
	Section A	08		25/2/2019	Josh Crosbie Architects

Section 5 Declaration

Declaration (Tick all that apply) Yes		
☒	No ☐	**I am a geotechnical engineer or engineering geologist as defined by the** Schedule 1 to the Erosion Management Overlay **and on behalf of the company below, I:**
☒	N/A ☐	am aware that the geotechnical report I have either prepared or am technically verifying (referenced above) is to be submitted in a support of a development application for the proposed development site (referenced above) and its findings will be relied upon by Colac-Otway Shire in determining the development application.
☒	N/A ☐	prepared the geotechnical report referenced above in accordance with the AGS (2007c) as amended and Schedule 1 to the Erosion Management Overlay.
☒	No ☐	am willing to technically verify that the Geotechnical Report referenced above has been prepared in accordance with the AGS (2007c) as amended and Schedule 1 to the Erosion Management Overlay.
☐	N/A ☒	am willing to technically verify that the landslip risk assessment prepared for the development application for the site confirms the land will achieve the level of <*tolerable risk*> of slope instability as a result of the considerations described in Section 2.0 of Schedule 1 to the Erosion Management Overlay taking into account the total development and site disturbances proposed.
☒	No ☐	am willing to technically verify that the landslip risk assessment prepared for the site and related land being greater than two years old confirms the land will achieve the level of <*tolerable risk*> of slope instability as a result of the considerations described Section 2.0 of Schedule 1 to the Erosion Management Overlay *taking into account the total development and site disturbances proposed.*
☒	No ☐	have professional indemnity insurance in accordance with and Schedule 1 to the Erosion Management Overlay of not less than $1.0 million, being in force for the year in which the report is dated, with retroactive cover under this insurance policy extending back to the engineer's first submission to Colac-Otway Shire.

Section 6 Geotechnical Engineer or Engineering Geologist Details

Company/ Organization Name	AGR Geosciences Pty Ltd	
Name (Company Representative)	Surname: Horwood	Mr /Mrs /Other: Mr
	Given Names: David John	
	Chartered Professional Status: **CP (Geo)**	Registration No: **321719**
Signature		Dated: 04 / 04 / 2019

AGR ASSESSING GEOLOGICAL RISK

AGR GEOSCIENCES PTY LTD

LAND CAPABILITY ASSESSMENT REPORT

FOR

33 MCRAE RD, WYE RIVER

Prepared for:	Richard Van Der Merwe
Prepared by:	Nerida Harrison Graduate Engineering Geologist *BSc (Geology)*
Approved by:	David J Horwood Senior Engineering Geologist *BAppSc (Geology); MAusIMM CP(Geo); MAIG*
Reference No.	19A342LCA
Date:	15th February 2019
Revised:	4th April 2019

AGR GeoSciences Pty Ltd
ABN: 32 601 372 632
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1. INTRODUCTION

AGR Geosciences Pty Ltd (AGR) was engaged by Josh Crosbie Architects on behalf of Richard van der Merwe (the Client) to undertake a Land Capability Assessment (LCA) for the 1151m² site at No. 33 McRae Rd, Wye River. Due to the high landslide risk in the Wye River area, AGR were engaged to provide specific advice regarding on-site wastewater management to conform to appropriate landslide risk management.

This report is a risk assessment for on-site waste water management undertaken in accordance with EPA Vic Publication 891.4 *Code of Practice Onsite Waste Water Management* (2016) and AS/NZ 1547:2012 *On-site Domestic Wastewater management* (2012).

The field investigation and report which accompany this review have been undertaken and prepared by suitably experienced staff. AGR has appropriate professional indemnity insurance for work of this type.

1.1. REPORT SUMMARY

This report will accompany an Application to Install a Septic Tank submitted to the Colac-Otway Shire Council for an onsite wastewater management system for a private residence. This document provides information about the site and soil conditions. It also provides a detailed LCA for the 1151m² lot, and includes a conceptual design for a suitable onsite wastewater management system, including recommendations for monitoring and management requirements.

A number of options have been considered for both the treatment system and land application area (LAA). However, our recommendation is that wastewater should be treated to a secondary standard by a suitable EPA-approved treatment system and in our opinion the effluent is best applied to the land via pressure compensated sub surface drip irrigation.

Secondary level treatment options may include an AWTS, single-pass sand filter, membrane bioreactor, with disinfection or any other suitable EPA approved alternative.

1.2. SITE OVERVIEW

Allotment	New double storey, 4 bedroom dwelling to replace existing single storey dwelling
Ground cover	Grass covered area located close to the rear of the dwelling with well established native forest occupying the rear of the property.
Trees	A row of hedging trees is located along the northern property boundary and well established native forest covers 25% of the property on the western side.
Topography	Mid-level west facing slopes below the crest of a north/south trending ridge line with up to 9m local relief. A north/south oriented landslide scarp runs through the property on the western side.
Surface drainage	Generally fair drainage conditions over the majority of the site. Possible tunnel erosion and low levels of sheet, rill and gully erosion.
Ground condition	Dry, patchy grass and some exposed soils indicate dry surface soil condtions at the time of investigation. Lush patches of grass around exisiting effluent system.
Adjacent properties	Well established exisiting dwellings occupy the adjacent properties to the north and south. The western edge of the property backs onto the Big4 Wye River Holiday Park. To the East lies a road reserve that has experienced an easterly moving land slip.
Aspect	Located on the crest that runs along McRae Road. The allotment has a westerly facing aspect and slope orientation.
Exposure to sun and wind	Part of the property is open with full sun, no shade and moderate wind protection. Whilst other areas experience dappled light and a high degree of wind protection.
Slope / form / gradient	The upper areas of the site exhibits predominately straight sided slope shape with a gradient of 12° to the west. The lower areas consists of a mixture of convex and concave shapes slopes with gradients increasing to >20°. Major breaks in slope relate to historical landslips.
Other features	

2. DESCRIPTION OF THE DEVELOPMENT

Site Address:	33 McRae Rd, Wye River, Victoria.
Owner/Developer:	**Mr Richard Van Der Merwe**
Postal Address:	
Contact:	Josh Crosbie Architects
Council Area:	Colac-Otway Shire Council.
Zoning:	Township Zone (TZ)
Overlays:	Bushfire Management Overlay (BMO) Design and Development Overlay (DDO) Erosion Management Overlay (EMO) Neighbourhood Character Overlay (NCO) Significant Landscape Overlay (SLO)
Allotment Size:	1151 m².
Domestic Water Supply:	Tank water only.
Availability of Sewer:	The area is unsewered and highly unlikely to be sewered within the next 10-20 years, due to low development density in the area and the considerable distance from existing wastewater services.
Proposed Development:	4 bedroom, Double storey new dwelling with decking replacing existing single storey dwelling.
Anticipated Wastewater Load:	A 4 bedroom residence with full water-reduction fixtures @ 5 people per maximum occupancy will have a wastewater generation of 150/person/day (full water saving fixtures) for a total design load = **750L/day** (Table 4 EPA Code of Practice).

3. SITE AND SOIL ASSESSMENT

David Horwood and Nerida Harrison undertook a site investigation on the 30 January 2019.

3.1. SITE KEY FEATURES

Table 1 summarises the key features of the site in relation to effluent management proposed for the site.

NOTE:

- The site is not within a special water supply catchment area.
- The site does not experience high stormwater run-on.
- There is no evidence of a shallow water table.
- The risk of effluent transport offsite is moderate.

An aerial photograph is appended to provide recent and current site context (Appendix I).

A site plan describing the location of the proposed building envelope and other development works, wastewater management system components and physical site features is appended (Appendix II).

Table 1: Risk Assessment of Site Characteristics

Feature	Description	Level of Constraint	Mitigation Measures
Buffer Distances	Relevant buffer distances in Table 5 of the Code (2016) are achievable for nominated effluent fields.	Moderate	Utilise an advanced secondary treatment system to allow smaller setbacks from property boundaries Maximise the setback distance between effluent field and landslide scarp. Reduce application rate to minimise through flow.
Climate	70th percentile average annual rainfall 981mm (SILO data), max. average 128 mm in August, min. average 44 mm in January. Average annual pan evaporation is 897mm.	Moderate to Major	Use water balance to size effluent fields. Utilize sub surface drip irrigation.
Soil Drainage	Both rapid to moderate drainage. Rapid drainage likely caused by tree roots and fissured clays	Minor to Moderate	Upgrade on site drainage. Install cut-off drain up slope of the proposed effluent area to minimise surface water run on.
Erosion	Possible tunnel erosion, low levels of sheet , rill and gully erosion	Moderate	Reduce water loading as much as possible by utilising mandatory 3 star rated or better water efficient fixtures. Revegetate slopes and embankments. Remediate erosion affected areas and upgrade site drainage. Install erosion protection in effected areas.

Feature	Description	Level of Constraint	Mitigation Measures
Landslip	High susceptibility and inventory records on the east and west of the property	Major	Disperse effluent as widely as possible. Avoid landslide scarp where possible.
Exposure	Full sun, good sea breeze exposure	Minor	Treat effluent to a minimum secondary treatment standard.
Aspect	Westerly aspect	Moderate	Maximise the setback distance between effluent field and down slope property boundary. Reduce application rate to minimise through flow. Increase treatment level to account for reduced solar radiation
Flood frequency (ARI)	<1:100 year flood.	Nil	NN
Groundwater bores	No bores within 50m of site	Minor	NN
Fill	Minimal, <100mm of isolated fill	Minor	NN
Land area available for LAA	Land Area meets requirements for effluent field and any required buffers	Moderate	Use water balance and nitrogen balance. Configure disposal field to comply with building and site boundary setbacks and buffer zones. Increase level of treatment.
Slope Form	Convex slope with straight sides. Minor depressions from local cut and fill and removed trees	Minor	Fill in and level out depressions with good quality top soil
Rock outcrops	No rock outcrops visible on site	Nil	NN
Run-on and Run-off	House on crest, run-off to the East	Minor	Determine appropriate run off coefficient for use in water balance. Increase catchment size. Install catch drain above the effluent field to minimise run-on
Slope gradient (%)	11-13° Straight sided and convex slopes steepening to >20° below clearing	Major	Increase effluent application area by 20% to allow for slope and/or install terracing to eliminate slope. Minimise application rate where possible. Install drainage above effluent disposal area.
Soil Drainage	Lush grass patches around existing effluent system	Moderate	Upgrade on site drainage. Install cut-off drain up slope of the proposed effluent area to minimise surface water run on.
Surface waters	>60m from Wye River and Ocean	Minor	NN
Feature	**Description**	**Level of Constraint**	**Mitigation Measures**

Vegetation coverage over the site	Patchy grass over clearing. Dying off due to summer conditions	Moderate	Site will require complete revegetation following irrigation installation. Recommend dense native ground cover, low shrubs, native grasses and lawn for the effluent area. Other areas on site also require revegetation with deep rooted native trees and shrubs.

NN: not needed

3.2. SITE ASSESSMENT RESULTS

The site is moderately constrained due constraining site features such as climate, slope, exposure and aspect, erosion and landslip risk. However, the most containing site features is the lack of available land for practical disposal installation.

The risk of erosion and landslip may be addressed by installing a catch drain or alternative surface drainage above the proposed effluent field on the eastern side of the rear yard to intercept any surface run on from the catchment area above the LAA and also below the proposed effluent field to divert any runoff away from the landslip scarp.

Whilst the vegetation coverage within the proposed effluent field is sufficient, this vegetation will need to be removed to facilitate installation. It is recommended that the LAA requires re-vegetation with deep rooted and high transpiration trees, shrubs and grasses, especially over the proposed disposal area, upon completion of the installation works.

There is insufficient available land to manage effluent on-site at a normal daily flow/loading rate for a standard 4 bedroom house. The available land for wastewater disposal covers a historical landslide scarp line. As such, the slope angles in some areas are extremely steep (between 21-33^{o} and up to 50^{o} below the scarp line. The practicalities of terracing this area would be extremely challenging and cost prohibitive. Therefore, we propose that the daily water loading (flow rate) should be reduced by at least 30% from 750L/day to 525L/day in order to maximise the available area above the scarp line. The reduction in the loading rate minimises the risk of surface run off and sub-surface through flow off site in accordance with AS1547:2012.

Daily flow rate reduction can be achieved in several ways:

- Installing a split greywater treatment system so that advanced secondary treated wastewater may be recycled in house for use in the toilets thus reducing the minimum required disposal field and daily wastewater loading. **Or;**

- Utilising waterless toilet systems such as incinerating or dry composting toilets. This removes a percentage of daily water use from the overall water loading (nominally 20-30%).

An existing escarpment associated with a historical landslip is located below the proposed effluent disposal area. The EPA Code of Practice (2013) requires a minimum 15m setback to any cuttings or escarpments located on site. Maintaining this setback distance would limit the area available for waste water disposal to the point where the minimum area required for zero wet weather storage and complete nutrient uptake would be unachievable.

In the EPA Code of Practice (document 891.4, 2016) Section 3.9 states that council may reduce a setback distance in a non-potable water supply catchment where it considers that the risk to public health and the environment is negligible. In order for waste water to be successfully managed on site as close to regulatory conditions as possible, the available space must be maximised. We can achieve a 4m setback from the cutting with reduced application rate of 2.9mm/day, which will result

in reduced deep seepage and minimal through flow and therefore the risk to public health can be minimised. Seeing as the site is neither in a potable water catchment nor is it environmentally sensitive, we suggest that minimum set back conditions can be reduced to enable maximum available space for effluent disposal.

Utilising an advanced secondary treatment system will allow reduction in the property boundary setbacks to 0.5m from upslope boundaries, this would in turn, allow maximising of the setback from the landslide scarp.

As already discussed, the moderately steep slopes pose a very high constraint on the methods of effluent disposal available for use on this site for reasons such as construction difficulty, risk of effluent run off and uniform waste water dispersal. Methods of disposal which require soil absorption such as trenches and modified ETA beds/trenches are not suitable for steep slopes. They require near flat ground surfaces for satisfactory construction. Absorption trenches are also inappropriate for high landslide risk areas where it is critical to avoid high volumes of water from accumulating in a concentrated way within the soil profile. Drip irrigation, surface or subsurface is generally the most appropriate way to disperse waste water in high landslide risk areas because it utilises evapotranspiration as well as absorption over a wide surface area within the near surface soil profile. The slopes of this site are too steep however for surface irrigation which poses a significant risk of effluent run off well beyond the minimum irrigation area and the site boundaries.

Sub-surface drip irrigation is therefore the best solution for waste water disposal either wholly in raised terraces or using a combination of irrigation lines in raised terraces constructed along the natural contour and the application of irrigation lines installed directly to the slope.

Existing erosion hazards including tunnel and rill erosion are evident in low levels on this site. Tunnel erosion is caused by concentrated run off and subsurface groundwater seepage eroding dispersive soils in the upper sub-surface soil horizons. Rill erosion is a product of concentrated and excessive run off and surface flow.

Existing tunnel erosion may require deep cross ripping of tunnels and soil amelioration with gypsum. Remediated tunnel areas should be re-vegetated with deep rooted trees and shrubs and dense native ground cover vegetation. Up to 100mm of non-dispersive topsoil should be introduced to the remediation site for revegetation. Vegetation should not be planted directly into the pre-existing dispersive soil. Existing gullies and drainage lines should be lined with an impervious material such as rock. A rock lining acts as an energy dissipater protecting the soil surface from physical erosion.

The proposed development includes the installation of an outdoor spa. Due to the highly chlorinated or salted nature of outdoor spa water, outdoor spas are to be treated in line with swimming pools when it comes to the disposal waste water, in accordance with EPA Code of Practice, section 3.3.2 (2016). Effluent treatment systems work through the use of bacteria to break down the solids within wastewater. Highly chemically treated water from swimming pools and spas can damage this bacteria causing the system to fail. Disposal of wastewater from the spa must be in accordance with council regulations, but cannot be diverted to the effluent treatment system.

After consideration of all constraints, we consider the overall land capability of the site to sustainably manage all effluent onsite is satisfactory providing recommended mitigation measures discussed above and in Table 1 are implemented.

3.3. SOIL KEY FEATURES

Soils on site have been assessed for their suitability for onsite wastewater management by a combination of soil survey and desktop review of published soil survey information.

A soil survey was carried out at the site to determine suitability for application of treated effluent. Soil investigations were conducted at two (2) locations in the vicinity of the proposed effluent field as shown in the Test Site and LAA Location Plan (Appendix III).

The two (2) bore holes were established to a minimum depth of 1.5m or to effective refusal using manual hand augers. Seven (7) boreholes were established to a minimum depth of 150mm into the limiting layer for permeameter installation. This was sufficient to adequately characterise the soils as only minor variation would be expected throughout the area of interest. Permeameters were inserted to a minimum depth of 150mm or 50mm into the limiting layer, and constant head draw down was monitored over a period of at least 60 minutes in order to calculate saturated hydraulic conductivity for the limiting soil layer.

Samples of all discrete soil layers for each soil type were collected for subsequent laboratory analysis of pH, Electrical Conductivity, Sodicity, Cation Exchange Capacity, Sodium Absorption Ratio and Emerson Aggregate Classification.

Two soil types were encountered during this investigation. Full profile descriptions are provided in the Borelogs (Appendix IV). Soil descriptions may be summarised as follow:

- A residual topsoil (A-horizon) layer of dark grey, dry, clayey SILT (Category 4 CLAY LOAM), containing <10% coarse fragments; overlying,

- A residual subsoil (B-horizon) layer of dark grey brown, slightly moist slightly silty CLAY (Category 5 LIGHT CLAYS), with 10%-20% orange mottle

Table 2 below provides an assessment of the physical and chemical characteristics of each soil type.

Table 2: Risk Assessment of Soil Characteristics

Feature	Assessment	Level of Constraint	Mitigation Measures
Cation Exchange Capacity (CEC)	Topsoil: **12.1MEQ%** Soil structural stability is considered unsatisfactory.	Major	Recommend adding organic matter (compost/humus) to soil profile to increase CEC and nutrient availability and ameliorate soil structure. Typically >15 MEQ% is recommended for land application areas. Typically >15 MEQ% is recommended for land application areas.
	Subsoil: **13.2MEQ%** Soil structural stability is considered unsatisfactory.	Major	Recommend adding organic matter (compost/humus) to soil profile to increase CEC and nutrient availability and ameliorate soil structure. Typically >15 MEQ% is recommended for land application areas. Typically >15 MEQ% is recommended for land application areas.
Electrical Conductivity	Topsoil: **0.057 dS/m** Soil conditions do/do not appear to be restricting plant growth.	Minor	NN
	Subsoil: **0.045 dS/m** Soil conditions do/do not appear to be restricting plant growth.	Minor	NN
Emerson Aggregate Class	Topsoil: **Class 2** Slaking and some dispersion, excepting the remoulded ped with showed no dipersion at the 2 hour mark	Major	Soil amelioration required. Application of gypsum to improve soil structure and dispersity.
	Subsoil: **Class 1-2** Slaking and some dispersion at 2 hours, becoming full dispersion after 20 hours	Major	Soil amelioration required. Application of gypsum to improve soil structure and dispersity.

Feature	Assessment		Level of Constraint	Mitigation Measures
pH	Topsoil:	**6.6**	Minor	Optimum range for most plants.
	Subsoil:	**5.4**	Minor	Suitable range for many acid-loving plants.
Rock Fragments	Topsoil:	**<10% coarse fragments in the A Horizon.**	Minor	NN
	Subsoil:	**<10% coarse fragments in the B Horizon.**	Minor	NN
Sodicity (ESP)	Topsoil:	**1.1 % Non Sodic**	Minor	Soil amelioration recommended. Application of gypsum to improve soil structure and dispersity
	Subsoil:	**21.8% Strongly Sodic**	Major	Soil amelioration recommended. Application of gypsum to improve soil structure and dispersity
Sodium Absorption Ratio (SAR)	Topsoil: Low Ratios	**0.04**	Minor	Recommend use of low sodium domestic products to reduce the SAR ratio
	Subsoil: Moderate ratios	**0.91**	Moderate	Recommend use of low sodium domestic products to reduce the SAR ratio. Soil amelioration recommended.
Soil Depth to rock or other impermeable layer	Depth Overall soil profile depth is between 1.2m and 1.5m below surface.	**1.2 - 1.5**	Moderate	Suitable for subsurface irrigation
Feature	**Assessment**		**Level of Constraint**	**Mitigation Measures**
	Topsoil:	Soil Type (Category 4a);	Minor	

Soil Permeability & Design Loading/ Irrigation Rates	**Indicative** Ksat permeability is **0.5-1.5m/day.** **3.5mm**/day Design Irrigation Rate (DIR) for subsurface irrigation (EPA, 2016). This is **7**% of lowest indicative Ksat for soil. Recommended application rate is <10% of measured Ksat (TVA, 2004)		Use measured Ksat for limiting layer as seepage rate in water balance. Use up to 10% of Ksat value as comparison to maximum application rate.
Soil Permeability & Design Loading/ Irrigation Rates	Subsoil: Soil Type (Category 5a); **Indicative** Ksat permeability is **0.12 – 0.5m/d**; **Measured** Ksat permeability is **1.22m/d**; **3.0mm**/day Design Irrigation Rate (DIR) for subsurface irrigation (EPA, 2016). This is **<1%** of measured Ksat for the soil. Recommended application rate is <10% of measured Ksat (TVA, 2004)		Use up to 10% of Ksat value as deep seepage rate in water balance. Maximum application rate to approximate **3.0mm**/day relative to soil category where measured Ksat is reflective of inferred Ksat in Table 9 EPA (2016)
Soil Texture & Structure	Topsoil: Soil Type (Category 4, CLAY LOAMS) EPA (2016) and AS/NZS 1547:2012. Topsoil is inferred to have a high to moderate structure.	Minor	Soil amelioration recommended. Increasing organic content and apply gypsum to improve soil structure.
	Subsoil: Soil Type (Category 5, LIGHT CLAYS) EPA (2016) and AS/NZS 1547:2012. Subsoil is inferred to have a weak to moderate structure.	Moderate	Use up to 10% of Ksat value as deep seepage rate in water balance. Use measured Ksat to determine maximum application rate.
Gleying	Topsoil: Nil No evidence of gleying witnessed in soil samples	Minor	Install drainage measures to limit surface run on and subsurface through flow to the irrigation area.
Feature	**Assessment**	**Level of Constraint**	**Mitigation Measures**

Gleying	Subsoil: Nil No evidence of gleying witnessed in soil samples	Minor	Install drainage measures to limit surface run on and subsurface through flow to the irrigation area.
Mottling	Topsoil: Nil Uniform grey brown soil colour	Minor	Soil amelioration recommended. Increasing organic content and apply gypsum to improve soil structure.
	Subsoil: 10% - 20%, Orange mottle Grey brown soil colour with orange mottle	Moderate - Major	Soil amelioration recommended. Increasing organic content and apply gypsum to improve soil structure.
Water table Depth	Depth >2m	Minor	Dispose of effluent via sub surface drip irrigation.

NN: not needed

3.4. SOIL ASSESSMENT RESULTS

For the soils in the proposed land application area (light clays), several features present a moderate or major constraint. Primary constraints relate to sodicity, soil structure, soil drainage, CEC, Emmerson Aggregate Class.

Soil chemistry elements such as CEC are a major constraint on this site. The cation exchange capacity is also a measure of plant nutrient availability. Adding organic compost and humus to the soil profile can help improve nutrient availability.

Soil characteristics relating to poor soil structure, soil drainage and dispersity can be mitigated or improved with the addition of gypsum. Gypsum adds bi-charged calcium ions to the soil which acts as a flocculating agent helping soil particles to clump together and aggregate, displacing singularly charged sodium ions which influence soil dispersity and potential soil erosion.

Based on the cation exchange capacity (CEC) and soil sodicity (ESP), a gypsum requirement of **16.68t/ha** (1.67kg/m^2) been calculated in order to ameliorate the soil profile to a desired level of 6% ESP to 600mm below surface. The application of gypsum requires removal to the A Horizon and where practical to do so, deep ripping to a minimum depth of 600mm. As this is not always practical in areas of steep terrain with limited access and where deep soil disturbance can create slope instability problems, we recommend the application dry ground gypsum without ripping. Gypsum should be applied to the base of the irrigation channels prior to line installation and lightly watered in to dissolve the gypsum and encourage infiltration into the soil profile.

Long term soil amelioration may take several years and as such we recommend the application of liquid gypsum as an ongoing maintenance process. Liquid gypsum can be added to the pump well of the irrigation system and mixed with treated waste water ready for direct application to the

subsurface soil profile. We propose that the application of **2L** of concentrated liquid gypsum added to the pump well of the irrigation system on a **Quarterly** basis should provide adequate ongoing sodic soil amelioration. Gypsum requirement computations are provided in Appendix VII.

The soil texture for the limiting layer soil is slightly silty clay which equates to a Category 5 Light Clay with an indicative permeability ranging from <0.06m/day to 0.5m/day (the later for a strongly structured soil) and results in a design application rate of 3.0mm/day. In comparison, a moderately structured Category 4 Clay Loam has an indicative permeability of 0.5 – 1.5m/day, which results in a 3.5mm/day design application rate. Measured Ksat for the limiting slightly silty clay on this site is 1.22m/day which is very highly permeable. This figure is greater than that expected for a typical light clay found in the Wye River area and does not reflect the indicative permeability's presented for a strongly structured Light Clay according to Table 9, EPA 891.4.

The higher measured permeability in this location can be attributed to the drier soil, higher elevation and the influence of the surrounding established trees and infers a strongly structured soil with probable deep shrinkage cracking which is unlikely to change seasonally due to tree effects.

The overall capability of the soil to sustainably manage effluent onsite is considered satisfactory providing recommended mitigation measures discussed above and in Table 2 are implemented.

3.5. OVERALL LAND CAPABILITY RATING

Based on the results of the site and soil assessment tabled above, the overall land capability of the proposed effluent management area is **moderately to highly constrained**. Subject to implementation of the mitigation measures recommended in Tables 1 and 2, it is possible to dispose treated wastewater on site.

It is therefore our recommendation that considering the site's physiographic constraints and soil characteristics, 'All Waste' effluent should be secondary treated and disposed on-site via pressure compensating sub-surface drip irrigation.

4. WASTEWATER MANAGEMENT SYSTEM

The following sections provide an overview of a suitable on-site wastewater management system, with sizing and design considerations and justification for its selection. Detailed design for the system should be undertaken at the time of the building application and submitted to Council.

4.1. EFFLUENT DISPOSAL SYSTEM

A range of possible land application systems have been considered for part on-site disposal, such as absorption trenches, evapotranspiration/absorption (ETA) beds, wick trench and bed systems, subsurface irrigation and mounds.

The preferred system is a **pressure compensated sub surface drip irrigation**. Subsurface irrigation will provide even and widespread dispersal of the treated effluent within the root-zone of plants, does not require a reserve area and can be installed on slopes up to 30% (17°) before requiring a specialised irrigation design. This system will provide beneficial reuse of effluent, which is desirable given that the site is not serviced by town water. It will also ensure that the risk of effluent being transported off-site will be negligible and is the most accepted method of onsite waste disposal for minimising the risk of slope instability.

4.2. DESCRIPTION OF THE IRRIGATION SYSTEM

A detailed irrigation system design is beyond the scope of this report, however a general description of subsurface irrigation is provided here for the information of the client and Council.

Subsurface irrigation comprises a network of drip-irrigation lines that is specially designed for use with wastewater. The pipe contains pressure compensating emitters (drippers) that employ a biocide to prevent build-up of slimes and inhibit root penetration.

The lateral pipes are usually 1.5-2m apart for a LIGHT CLAY, installed parallel along the contour. Installation depth is a minimum of 100mm into at least 250mm of good quality topsoil in accordance with AS/NZS 1547:2012. It is critical that the irrigation pump be sized properly to ensure adequate pressure and delivery rate to the irrigation network.

A filter is installed in the main line to remove fine particulates that could block the emitters. This must be cleaned regularly (typically monthly) following manufacturer's instructions. Vacuum breakers should be installed at the high point/s in the system to prevent air and soil being sucked back into the drippers when the pump shuts off. Flushing valves are an important component and allow periodic flushing of the lines, which should be done at six monthly intervals. Flush water should be returned to the treatment system via a return line.

All trenching used to install the pipes must be backfilled properly to prevent preferential subsurface flows along trench lines. Irrigation areas must not be subject to high foot traffic movement, and vehicles and livestock must not have access to the area otherwise compaction around emitters can lead to premature system failure.

4.3. SIZING THE IRRIGATION SYSTEM

To determine the necessary size of the irrigation area water balance modelling has been considered based on the water balance method outlined in AS1547:2012 and Victorian Land Capability Assessment Framework (2014). Final sizing of the irrigation system has been undertaken adopting a justifiable deep seepage rate based on the measured saturated hydraulic conductivity (Ksat) and comparing the minimum area for zero storage with the maximum allowable application rate or DIR from Table 9 of the EPA (2016). The Tennessee Valley Authority (2004) in their peer reviewed guidelines for drip irrigation recommends that the seepage or percolation rate used in water balance modelling may be 10-14% of measured Ksat and that the final application rate (DIR) should be less than 10% of measured Ksat.

The water balance presenting in this assessment adopts a trial land application area methodology to find the most suitably sized effluent field according to the justifiable deep seepage rate and the maximum allowable application rate.

The retained rainfall factor used in the water balance has been derived using a formula to calculate a weighted run off coefficient based on published run off coefficients for different land uses and surfaces and total catchment size. Professional judgement has been used where selected coefficients vary from published coefficients in the calculations and justification for the variation is provided with the computations attached to this report.

Crop factors used in the water balance may vary depending on the type of vegetation or degree of shading expected in the proposed effluent disposal area. Crop Nitrogen uptake rates used in the mass balance calculation may also vary and are selected with reference to either the type of vegetation growing on the subject area, or a particular vegetation type proposed for use in the effluent area. Published crop Nitrogen uptake rates are sourced from EPA Publication 168 (1991).

4.3.1 Water Balance

The water balance can be expressed by the following equation:

Precipitation + Effluent Applied = Evapotranspiration + Percolation

Data used in the water balance includes:

- Mean monthly rainfall and mean monthly pan evaporation;
- Design daily flow rate for a 4 bedroom dwelling with full water-reduction fixtures– 750L/day (from Table 4 of the Code and Table H2 of the Standard);
- Deep seepage Rate – 5.5mm/day[1]; (based on measured Ksat of 1.22m/day)
- Crop factor –0.8; and
- Retained rainfall – 56% for steeply sloping, forested areas through to 75% for horizontal terraced surfaces with 25% impervious coverage over a local catchment of 1151m^2

The results of the water balance are compared against the basic irrigation formula **A = Q/DIR** to ensure the final application rate for the disposal field (DIR) approximates that for the appropriate soil category in the EPA Code of Practice (2016) and AS1547:2012.

The water balance method is used to calculate the minimum area required to balance all inputs and outputs to the water balance. As a result of these calculations at least **212m^2** is required for on-site wastewater disposal based on hydraulic loading not taking into account the minimum required buffers and offsets.

This yields an application rate of **3.5mm/day** which is greater than the maximum 3.0mm/day from the EPA Code of Practice (2016) for application to a strongly structured light clay and <1% of measured Ksat[2]. The application rate is consistent with that for Category 5 soils with indicative permeability's similar to measured Ksat.

A full water balance is provided as Appendix V.

4.3.2 Nutrient Balance

A nutrient balance is considered to check that the Land Application Area is of sufficient size to ensure nutrients are assimilated by the soils and vegetation. It is acknowledged that a proportion of nitrogen will be retained in the soil through processes such as mineralisation and volatilisation. Typically, only sensitive sites with limiting site or soil constraints require nutrient considerations.

NOTE: Soil has a high PRI (phosphorus retention index) in clayey soils. Phosphorus is readily removed under these circumstances from wastewater fixation in clayey soil by the action of adsorption. Phosphate in dispersed effluent is lost within a few centimetres of the soil.

This leaves nitrogen (N) as the limiting factor in this proposed development.

The nutrient balance can be expressed by the following Mass Balance equation:

Land Application Area (m^2) = (C x Q)/L$_x$

Data used in the nutrient balance includes:

[1] This rate is significantly less than the recommended permeability rate of 10-14% of measured Ksat (TVA, 2004) and has been selected considering reccomended rate reducitons for sloping sites in accordance with AS1547:2012.

[2] The reccomended application rate is <10% of measured Ksat (TVA, 2004).

- C = Concentration of nutrient - 25mg/L (from EPA Publication 464.2);
- Q = Design daily flow rate – 525L (from Table 4 of the Code and Table H2 of the Standard);
- L_x = Critical loading rate of nutrients – 60.27 mg/m^2/day (from EPA Publication 464.2).
- Nutrient loss to soil processes – 20% (Geary & Gardner 1996)
- Crop N uptake rate – 220 kg/ha/yr

As a result of the Mass Balance calculations, the minimum **Land Application Area** required for complete nutrient (nitrogen) uptake is **249m^2** for on-site disposal.

A Full nutrient balance is provided in Appendix V.

4.3.3 Minimum Disposal Field and Land Application Area

The nitrogen uptake is the most limiting factor here and as such nutrient loading and the mass balance would normally be used to nominate the minimum area required to balance both nutrient and hydraulic loading including all inputs and outputs.

Although water balance indicates that approximately 212m^2 is required as the minimum effluent disposal area required to achieve zero storage and complete nutrient uptake, this does not make any allowance for the hydraulic gradient of the site. As a result, effluent would need to be applied to the land via raised terraces (over the entire effluent area) so as to provide near horizontal application areas.

The construction of raised terracing can be a very costly addition to a waste water project and given the concern around slope stability on this site, it is our preference to avoid adding additional loading to the steep, susceptible slopes. In order to eliminate the need for raised terracing, the application rate based on hydraulic loading should be reduced by at least 20% at a minimum. This is effectively achieved by increasing the disposal area to **255m^2**, which results in the design application rate to 2.9mm/day, which is less than the maximum 3.0mm/day from the EPA Code of Practice (2016) for Category 5 soils.

The maximum available useable land for effluent disposal is 273m^2 (taking into account all required property boundary buffers), marginally more than the minimum required area based on nutrient or hydraulic loading, however, this site is hindered by steep slopes and potential landslide risk. As such, a reduction in the daily loading is required to allow disposal of effluent on site within the area available.

In order to manage wastewater onsite within the more stable available space, a 30% loading reduction in the daily flow rate is required as discussed in Section 3.2. A 30% loading reduction would result in a daily flow rate of 525L/day providing a minimum hydraulic effluent area of **148m^2** with an application rate of **3.5mm/day** for a horizontal surface. The gentler sloping area on the upper parts of the rear yard has an 11° slope. As such, a 20% reduction in application rate is required to eliminate the need for terracing. This is achieved by increasing the disposal area to **178m2**, resulting in an application rate of **2.9mm/day**. A Site Investigation Plan display's the envelope of land that is suitable for this type of effluent management, (Appendix III).

Reduced daily flow rates will also reduce nitrogen and phosphorous output to a level which is contained within the property boundaries. With respect to phosphorous, the maximum available wastewater area would be able to achieve a 60 year life cycle with reduced loading rates.

It is therefore recommended that a minimum of **178m²** with an application rate of **2.9mm/day** be adopted as the minimum disposal area for this site utilising low rise terraced beds installed along the contour.

4.4. SITING AND CONFIGURATION OF THE IRRIGATION SYSTEM

The preferred area for siting the irrigation field is to the west of the proposed dwelling. The Site Investigation Plan display's the envelope of land that is suitable for effluent management, (Appendix III).

Final placement and configuration of the irrigation system will be determined by the client and/or system installer, provided it complies with the mandatory setback and buffers. The minimum area required according to the water balance is shown to scale (Appendix III). The recommended location for the effluent disposal shown in Appendix III has been selected on the basis that the available area with the greatest lateral width will encourage lateral hydraulic flow and minimise surface run off.

It is important that appropriate buffer distances to neighbouring properties, buildings and the drainage easement be maintained. It is also important to note that buffers are measured as the overland flow path for run-off water from the effluent irrigation area.

Site Investigation Plans indicate site contours and flow path directions on the property (Appendix III).

It is highly recommended that the owner consults an irrigation expert familiar with effluent irrigation equipment and steeply sloping sites to design the system, and an appropriately registered plumbing/drainage practitioner to install the system. The irrigation plan must ensure even application of effluent throughout the entire irrigation area and that final configuration ensures an application rate or dosage to the irrigation field no greater the rates described in Section 4.3.3.

4.5. BUFFER DISTANCES

Setback buffer distances from effluent land application areas and treatment systems are required to help prevent human contact, maintain public amenity and protect sensitive environments. The relevant buffer distances for this site, taken from Table 5 of the Code (2016) are:

- 20 metres upslope from potable or non-potable groundwater bores;
- 100 metres upslope from watercourses in a potable water supply catchment.
- 30 metres upslope from surface waters and waterways (non-potable)
- 3 metres if area upslope and 1.5 metres if area downslope of property boundaries, swimming pools and buildings.
- For advanced secondary treatment: 1 metre if application area upslope and 0.5 metres if area downslope of property boundaries.
- 15 metres upslope from escarpments or cuttings.

Not all required buffer distances are achievable on this site. The appended site plan shows the location of the proposed wastewater management system components, recommended setback distances and other relevant features such as the recommended location of cut off drains (Appendix III).

4.6. INSTALLATION OF THE IRRIGATION SYSTEM

Installation of the irrigation system must be carried out by a suitably qualified, licensed plumber or drainer experienced with effluent irrigation systems.

To ensure even distribution of effluent, it is essential that the pump capacity is adequate for the size and configuration of the irrigation system, taking into account head and friction losses due to changes in elevation, pipes, valves, fittings etc. To achieve even coverage, irrigation areas should be dosed alternately using an automatic indexing or sequencing valve and line spacing's should be progressively increased down slope.

The irrigation area and surrounding areas must be vegetated or revegetated immediately following installation of the system, preferably with turf or dense ground covering shrubs and grasses with high transpiration rates. The area should be fenced or otherwise isolated (such as by landscaping), to prevent vehicle and stock access; and signs should be erected to inform householders and visitors of the extent of the effluent irrigation area and to limit their access and impact on the area.

Stormwater run-on is expected to pose a moderate amount of concern for the proposed disposal areas. Upslope diversion berms and surface drainage should be constructed during installation of the disposal system and connected to the site drainage system and diverted to the legal point of discharge. Stormwater from roofs and other impervious surfaces must not be disposed of into the wastewater treatment system or onto the effluent management system.

Due to the sloping nature of the terrain on site the irrigation system should be designed by an irrigation specialist experienced with steeply sloping terrain to ensure an even distribution of effluent over the irrigation field.

4.7. TREATMENT SYSTEM

The minimum advanced secondary (tertiary) effluent quality required is:

- BOD < 10 mg/L
- TSS < 10 mg/L
- E.Coli < 10 cfu/100mg

Refer to the EPA website for the list of approved options that are available[3]. Many of the secondary or advanced secondary treatment system options are capable of achieving the desired level of performance. The property owner has the responsibility for the final selection of the secondary treatment system and will include the details of it in the Septic Tank Permit to Install application form for Council approval.

As a guide, the two types of treatment methods which are able to produce high quality waste water are Membrane Bioreactor or MBR systems and Trickling Filters. MBR's combine treatment technologies such as aerated water treatment systems (AWTS) and membrane filtration. They typically use a pre-treatment settling tank, followed by aerobic bioreactor (AWTS) and finally a filter membrane followed by disinfection with UV for higher quality waste water. Trickling Filters such as generic sand filters use aerobic biological processes and mechanical filtration to treat effluent. They incorporate a settling or septic tank (which may be generic or alternative such as a worm farm) for primary treatment after which effluent is applied to the filter and then may be disinfected with either by chlorine or UV. Other methods of secondary treatment system such as Aerated Wastewater Treatment System's (AWTS) are also acceptable utilising disinfection to achieve advanced secondary standard.

[3] http://www.epa.vic.gov.au/en/your-environment/water/onsite-wastewater

If the proposed dwelling is to be used intermittently for short stay and holiday rental, consideration should be given to passive systems which are less reliant on power and regular maintenance. In this situation we recommend the application of Trickling Filters with disinfection so long as the system can achieve 20/30/10 standard effluent for greywater recycling.

Further consideration should be given to selecting a system that includes a suitably sized storage or balancing tank to moderate flow into the wastewater treatment system or a system that integrally uses multiple chambers where intermittent or periodic surge flows are expected. Where an AWTS is to be considered in this situation, selection of a system which includes recirculation or some other technology to accommodate intermittent flow is recommended.

Alternative methods of waste management to provide a reduction in daily flow rates may include the use of dry compositing or incinerating toilets. Dry composting or incinerating toilets would effectively remove a portion of the daily water loading for the fixture from the water balance, thus reducing the required effluent disposal footprint. Recycling of advanced secondary treated greywater in house to toilets will also provide a similar outcome.

5. MONITORING, OPERATION AND MAINTENANCE

Maintenance is to be carried out in accordance with the EPA Certificate of Approval of the selected secondary treatment system and Council's permit conditions. The treatment system will only function adequately if appropriately and regularly maintained. We highly recommend the client enters into an ongoing service agreement with a service contractor approved by the treatment system manufacture.

To ensure the **treatment** system functions adequately, residents must:

- Have a suitably qualified maintenance contractor service the secondary or advanced secondary treatment system at the frequency required by Council under the permit to use;
- Use household cleaning products that are suitable for septic tanks;
- Keep as much fat and oil out of the system as possible;
- Installation and frequent maintenance of grease trap where grey water system only is used if waterless toilets are installed.
- Conserve water (3 star or better rating fixtures and appliances are recommended).
- Not dispose of chlorinated or salted spa water into the treatment system, as the chemicals in the spa water will damage the bacteria within the system, causing the system to fail.

To ensure the **land application** system functions adequately, residents must:

- Regularly harvest (mow) vegetation within the LAA and remove this to maximise uptake of water and nutrients;
- Monitor and maintain the subsurface irrigation system following the manufacturer's recommendations, including flushing the irrigation lines;
- Regularly clean in-line filters;
- Not erect any structures and paths over the LAA;
- Avoid vehicle and livestock access to the LAA, to prevent compaction and damage;
- Ensure that the LAA is kept level by filling any depressions with good quality topsoil (not clay);
- Apply dry ground gypsum into irrigation channels during installation of the effluent system;
- Add 2L of concentrated liquid gypsum to the site via the irrigation system pump well upon commissioning of the irrigation system and thereafter at least quarterly. The regular addition of liquid gypsum will provide an ongoing soil remediation measure designed to improve soil structure and permeability, and mitigate dispersion and erosion properties from developing;

6. CONCLUSIONS

As a result of our investigations we conclude that sustainable onsite wastewater management is feasible for the 4 bedroom development at 33 McRae Rd, Wye River with the implementation of appropriate mitigation measures as outlined.

Specifically, we recommend the following:

- An advanced secondary treatment system that treats wastewater to a 10/10/10 standard.
- Implementation of a 30% reduction in the daily flow rate through the use of a split system grey water treatment system with in house recycling to toilets **or** waterless toilets.
- Specialist design of the irrigation system by an irrigation expert experienced with steeply sloping terrain based on the maximum available space for effluent disposal as depicted in Appendix III;
- Dripper directly to the natural contour over an area of **178m²** as indicated in Appendix III applied at a maximum rate of **2.9mm/day (525L/day).**
- Detailed documentation of the as built irrigation design, including the filter, manifold, irrigation line location and diameter, number and length of dripper lines, number and location of vacuum breaker(s), sequencing valve(s), location of flush valve(s) and the location of the return line returning flush water back to the treatment system.
- Installation of 3 star or better water saving fixtures and appliances in the residence to conserve water and reduce the effluent load;
- Use of low phosphorus and low sodium (liquid) detergents to improve effluent quality and maintain soil properties for growing plants; and
- Chlorinated or salted spa water is not to be discharged into the treatment system. Dispose of spa water in accordance with council regulations.
- Operation and management of the treatment and disposal system in accordance with manufacturer's recommendations, the EPA Certificate of Approval, the EPA Code of Practice (2016) and the recommendations made in this report.

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BAppSc (Geology); AusIMM CP (Geo)

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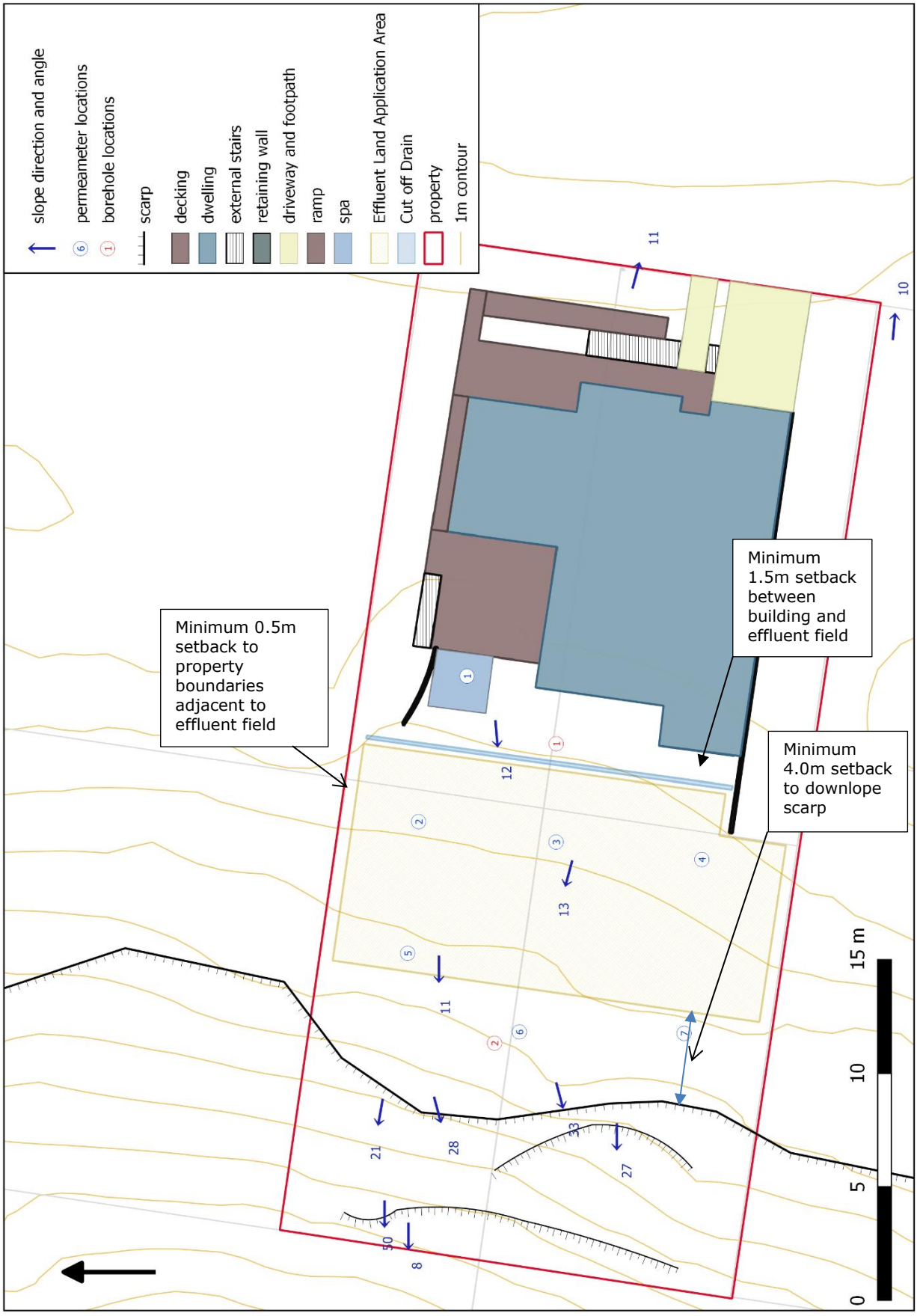
Appendix I: Aerial Photo

Appendix II: Site Plan

Appendix III: Site Investigation Plan



Appendix IV: Borehole Descriptions

AGR GeoSciences

Client: 18A342LCA | Bore Hole No. 1

Project Address: 33 McRae Rd, Wye River | Field work Completed By: David Horwood

Reference No: | Field Work Date: 1/30/2019

Depth	Excavatoin Method	Graphic Log	Horizon	Material Description	Texture	Structure	Shade	Colour	Mottles	Moisture	Coarse Fragments	Boundary Type	Sample
100	Hand Auger		A1	Clayey Silt	SCL		Dk	Gy		D	nil		1
200				Category 4 Clay loams									
300												Clear	
400			B2	Slightly Silty Clay	LC		Lt	Gy / Br	Or <5%	D			
500				Category 5 Light clays									
600									Or 5-10%				
700			C	With HW Sandstone Rock Fragments			Lt	Or / Br	Gy <5%	D	<10%		2
800													
900				Silty Clay			Lt	Yl / Gy	Or	SM			
1000				With HW Siltstone Rock Fragments									
1100				Grading Sandy									
1200				Refusal									
1300													
1400													
1500													
1600													
1700													
1800													
1900													
2000													
2100													
2200													
2300													
2400													
2500													

Comment:

Texture:

S	Sand	ZL	Silty Loam	SiC	Silty Clay
LS	Loamy Sand	SCL	Sandy Clay Loam	LC	Light Clay
CS	Clayey Sand	CL	Clay Loam	LMC	light Med Clay
SL	Sandy Loam	ZCL	Silty Clay Loam	MC	Medium Clay
FSL	Fine Sandy Loan	FSCL	Fine Sandy Clay Loam	HC	Heavy Clay
L	Loam	SC	Sandy Clay		

Moisture:

D	Dry
SM	Slightly Moist
M	Moist
VM	Very Moist
W	Wet

Structure:

Gr	(Single) Grained
Mas	Massive
Wk	Weakly Structured
Md	Mod Structured
St	Strongly Structure

Colour: Dk Dark Lt Light Bk Black Br Brown Gy Grey Or Orange Yl Yellow Re Red Bl Blue Gn Green

Groundwater ▼

Sample: 1

Boundary Type: Sharp <5mm | Abrut 5-20mm | Clear 20-50mm | Gradual 50-100mm | Diffues >100mm

AGR GeoSciences

Client: 18A342LCA | Bore Hole No. 2

Project Address: 33 McRae Rd, Wye River | Field work Completed By: David Horwood

Reference No: | Field Work Date: 1/30/2019

Depth	Excavatoin Method	Graphic Log	Horizon	Material Description		Texture	Structure	Shade	Colour	Mottles	Moisture	Coarse Fragments	Boundary type	Sample
100	Hand Auger	Fill		Fill	Silty Clay / Sand mix									
200			A1		Clayey Silt			Dk	Gy / Br		D			
300			B2		Slightly Silty Clay			Dk	Gy / Br	Or 10-20%	SM		Clear	
400														
500														
600														
700				Colour	Colour Lightening	LC		Lt	Gy	Or 10-20%	SM			
800														
900														
1000														
1100														
1200														
1300														
1400														
1500														
1600				EOH										
1700														
1800														
1900														
2000														
2100														
2200														
2300														
2400														
2500														

Comment:

Texture:						**Moisture:**		**Structure:**	
S	Sand	ZL	Silty Loam	SiC	Silty Clay	D	Dry	Gr	(Single) Grained
LS	Loamy Sand	SCL	Sandy Clay Loam	LC	Light Clay	SM	Slightly Moist	Mas	Massive
CS	Clayey Sand	CL	Clay Loam	LMC	light Med Clay	M	Moist	Wk	Weakly Structured
SL	Sandy Loam	ZCL	Silty Clay Loam	MC	Medium Clay	VM	Very Moist	Md	Mod Structured
FSL	Fine Sandy Loan	FSCL	Fine Sandy Clay Loam	HC	Heavy Clay	W	Wet	St	Strongly Structure
L	Loam	SC	Sandy Clay						

Colour: Dk Dark Lt Light Bk Black Br Brown Gy Grey Or Orange Yl Yellow Re Red Bl Blue Gn Green

Groundwater ▼

Sample: 1

Boundary Type: Sharp <5mm | Abrut 5-20mm | Clear 20-50mm | Gradual 50-100mm | Diffues >100mm

Appendix V: Ksat, Water and Nutrient Balance Computation

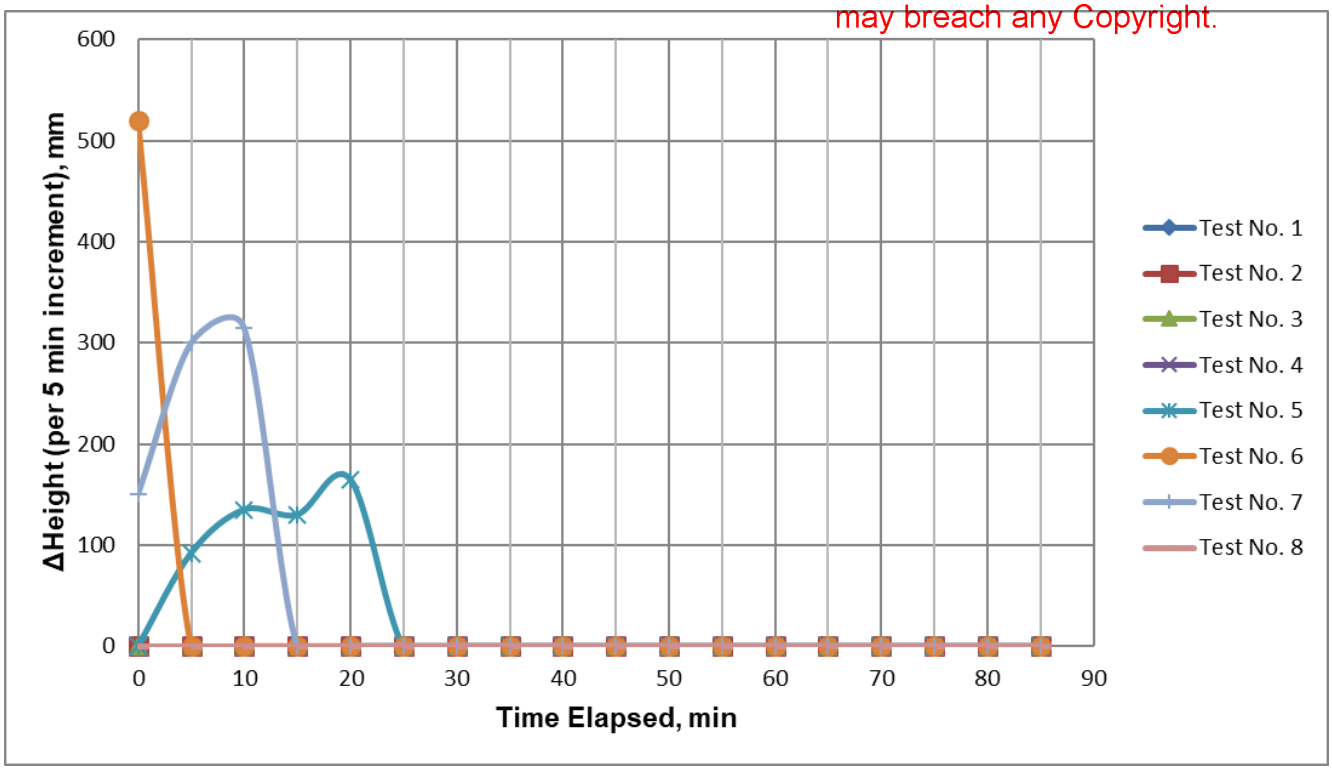
Project:	33 McRae Rd Wye River	**Job No.:**	19A342LCA
		Comp:	27/02/2019
		Date:	30/01/2019
Client:	Richard Van Der Merwe	**Attendee:**	NH
Subject:	Soil Permeability Calculations	**Review:**	0

AGR ASSESSING GEOLOGICAL RISK

SOIL PERMEABILITY CALCULATIONS

Refer Site Investigation Plan for locations of test sites
Refer Borehole Profiles for soil types and depths encountered

Test Number:		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Time Step (min):		5	5	5	5	5	5	5	
Hole Depth(mm):		450	450	450	450	480	450	420	
Hole Dia. (mm)		75	75	75	75	75	75	75	75
Tube Inside Dia. (mm):		40	40	40	40	40	40	40	40/50
Lim. Layer Depth(mm):		300	300	300	300	300	300	250	
Lim. Layer Material:		LC	LC	LC	LC	LC	LC	LC	
Tube Insert. Depth:		300	300	300	300	300	300	300	
Tube Number:		1	2	3	4	5	6	7	
Test Liquid:		Tap Water	Tap Water	Tap Water	Tap Water	Tap Water	Tap Water	Tap Water	Tap Water
Soil Moisture:		D	D	D	D	D	D	D	
	Time								
Time	0	100				208	20	35	
Reading:	5	100				208	540	185	
Drop:		0				0	520	150	
Reading:	10	100				300		485	
Drop:		0				92		300	
Reading:	15	100				435		800	
Drop:		0				135		315	
Reading:	20	100				565			
Drop:		0				130			
Reading:	25	100				730			
Drop:		0				165			
Reading:	30	100							
Drop:		0							
Reading:	35	100							
Drop:		0							
Reading:	40	100							
Drop:		0							
Reading:	45	100							
Drop:		0							
Reading:	50	100							
Drop:		0							
Reading:	55	100							
Drop:		0							
Reading:	60	100							
Drop:		0							
Reading:	65								
Drop:									
Reading:	70								
Drop:									
Reading:	75								
Drop:									
Reading:	80								
Drop:									
Reading:	85								
Drop:									
Reading:	90								
Drop:									



	1	2	3	4	5	6	7	8
Starts uniform drop	5				15	0	10	
Stops uniform drop	60				25	5	15	
Time elapsed(min)	55				10	5	5	
Total Drop (cm)	0.0				29.5	52.0	31.5	
z	2.0				2.4	2.0	1.6	
Flow, Q (cm^3/min)	0.0				37.1	130.7	79.2	
K_{sat} (cm/min)	0.0000				0.0378	0.1679	0.1337	
K_{sat} (m/day)	0.000				0.544	2.418	1.926	
							Average K_{sat} (m/day)	**1.2219**

Project: 33 McRae Rd
Wye River

Client: Richard Van Der Merwe

Subject: Land Application Area Sizing Using Water Balance - Standard Irrigation

Job No.: 19A342LCA
Comp: 27/02/2019
Date: 30/01/2019
Attendee NH
Review: 0

AGR ASSESSING GEOLOGICAL RISK

INPUT DATA

Design Wastewater Flow	Q	750	L/day
Design Seepage Rate	DSR	5.5	mm/day
Trial Land Application Area	LAA	255	m^2
Crop Factor	C	Fescue	unitless
Rainfall Runoff Factor	RF	0.75	untiless
Effective Void Ratio	N	0.3	unitless
Minimum Freeboard Topsoil Layer	F	100	mm
Mean Monthly Pan Evaporation Data	Wye/Kennett River 70th percentile SILO		
Mean Monthly Rainfall Data	Wye/Kennett River 70th percentile SILO		

Parameter	Symbol	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days in month	D		days	31	28	31	30	31	30	31	31	30	31	30	31	**365**
Evaporation	E		mm/month	129	106	90	58	39	28	32	44	61	87	102	121	897.0
Rainfall	R		mm/month	43	45	57	71	99	105	112	128	108	94	65	54	981.0
Crop Factor	C		unitless	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	
OUTPUTS																
Evapotranspiration	ET	E x C	mm/month	103.2	84.8	72.0	46.4	31.2	22.4	25.6	35.2	48.8	69.6	81.6	96.8	**718**
Seepage	S	DSR x D	mm/month	170.5	154.0	170.5	165.0	170.5	165.0	170.5	170.5	165.0	170.5	165.0	170.5	**2007.5**
Total Outputs		ET+S	mm/month	273.7	238.8	242.5	211.4	201.7	187.4	196.1	205.7	213.8	240.1	246.6	267.3	**2725.1**
INPUTS																
Retained Rainfall	RR	R x RF	mm/month	32.3	33.8	42.8	53.3	74.3	78.8	84.0	96.0	81.0	70.5	48.8	40.5	**735.8**
Applied Effluent	W	QxD	L/month	23250	21000	23250	22500	23250	22500	23250	23250	22500	23250	22500	23250	**273750**
Total Inputs		RR+W	mm/month	55.5	54.8	66.0	75.8	97.5	101.3	107.3	119.3	103.5	93.8	71.3	63.8	**1009.5**
DISPOSAL RATE																
Disposal Rate	DR	(ET+S)-RR	mm/month	241.5	205.1	199.8	158.2	127.5	108.7	112.1	109.7	132.8	169.6	197.9	226.8	
LAND AREA REQUIRED FOR ZERO STORAGE			m^2	96	102	116	142	182	207	207	212	169	137	114	103	

MINIMUM AREA REQUIRED FOR ZERO STORAGE: 212 m^2
ADOPTED LAND APPLICATION AREA: 255 m^2
DESIGN APPLICATION RATE: 2.9 mm/day

STORAGE CALCULATION

Application Rate	AR	Q/LAA	mm/month	91.2	82.4	91.2	88.2	91.2	88.2	91.2	91.2	88.2	91.2	88.2	91.2
Storage For The Month	ST	AR-DR	mm/month	-150.3	-122.7	-108.6	-69.9	-36.3	-20.4	-20.9	-18.5	-44.6	-78.4	-109.6	-135.6
Increase In Depth Of Stored Effluent	ΔH	ST/N	mm/month	-500.9	-409.0	-361.9	-233.0	-120.9	-68.0	-69.7	-61.7	-148.5	-261.4	-365.4	-452.1
Storage Remaining From Previous Month			mm/month	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cumulative Storage At End Of Month	CS		mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cumulative Storage From Previous Year	CS		mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Maximum Storage Depth for Nominated Area MS: 0 mm

DESIGN DIMENSIONS SUMMARY

Land Application Area	LAA	212	m^2
Maximum Storage Height	MS	0	mm
Minimum Freeboard Topsoil Layer	F	100	mm
Min Depth Of Land Application System	Z		mm

Project: 33 McRae Rd
Wye River

Client: Richard Van Der Merwe

Subject: Land Application Area Sizing Using Water Balance - Standard Irrigation

Job No.: 19A342LCA
Comp: 27/02/2019
Date: 30/01/2019
Attendee NH
Review: 0

AGR ASSESSING GEOLOGICAL RISK

INPUT DATA

Design Wastewater Flow	Q	525	L/day
Design Seepage Rate	DSR	5.5	mm/day
Trial Land Application Area	LAA	178	m^2
Crop Factor	C	Fescue	unitless
Rainfall Runoff Factor	RF	0.75	untiless
Effective Void Ratio	N	0.3	unitless
Minimum Freeboard Topsoil Layer	F	100	mm
Mean Monthly Pan Evaporation Data	Wye/Kennett River 70th percentile SILO		
Mean Monthly Rainfall Data	Wye/Kennett River 70th percentile SILO		

Parameter	Symbol	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days in month	D		days	31	28	31	30	31	30	31	31	30	31	30	31	**365**
Evaporation	E		mm/month	129	106	90	58	39	28	32	44	61	87	102	121	897.0
Rainfall	R		mm/month	43	45	57	71	99	105	112	128	108	94	65	54	981.0
Crop Factor	C		unitless	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	
OUTPUTS																
Evapotranspiration	ET	E x C	mm/month	103.2	84.8	72.0	46.4	31.2	22.4	25.6	35.2	48.8	69.6	81.6	96.8	**718**
Seepage	S	DSR x D	mm/month	170.5	154.0	170.5	165.0	170.5	165.0	170.5	170.5	165.0	170.5	165.0	170.5	**2007.5**
Total Outputs		ET+S	mm/month	273.7	238.8	242.5	211.4	201.7	187.4	196.1	205.7	213.8	240.1	246.6	267.3	**2725.1**
INPUTS																
Retained Rainfall	RR	R x RF	mm/month	32.3	33.8	42.8	53.3	74.3	78.8	84.0	96.0	81.0	70.5	48.8	40.5	**735.8**
Applied Effluent	W	QxD	L/month	16275	14700	16275	15750	16275	15750	16275	16275	15750	16275	15750	16275	**191625**
Total Inputs		RR+W	mm/month	48.5	48.5	59.0	69.0	90.5	94.5	100.3	112.3	96.8	86.8	64.5	56.8	**927.4**
DISPOSAL RATE																
Disposal Rate	DR	(ET+S)-RR	mm/month	241.5	205.1	199.8	158.2	127.5	108.7	112.1	109.7	132.8	169.6	197.9	226.8	
LAND AREA REQUIRED FOR ZERO STORAGE			m^2	67	72	81	100	128	145	145	148	119	96	80	72	

MINIMUM AREA REQUIRED FOR ZERO STORAGE: 148 m^2
ADOPTED LAND APPLICATION AREA: 178 m^2
DESIGN APPLICATION RATE: 2.9 mm/day

STORAGE CALCULATION

Application Rate	AR	Q/LAA	mm/month	91.4	82.6	91.4	88.5	91.4	88.5	91.4	91.4	88.5	91.4	88.5	91.4	
Storage For The Month	ST	AR-DR	mm/month	-150.0	-122.5	-108.3	-69.7	-36.0	-20.2	-20.7	-18.3	-44.3	-78.2	-109.4	-135.4	
Increase In Depth Of Stored Effluent	ΔH	ST/N	mm/month	-500.1	-408.2	-361.1	-232.2	-120.1	-67.2	-68.9	-60.9	-147.7	-260.6	-364.6	-451.2	
Storage Remaining From Previous Month			mm/month	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Cumulative Storage At End Of Month	CS		mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Cumulative Storage From Previous Year	CS		mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Maximum Storage Depth for Nominated Area	MS			0	mm											

DESIGN DIMENSIONS SUMMARY

Land Application Area	LAA	148	m^2
Maximum Storage Height	MS	0	mm
Minimum Freeboard Topsoil Layer	F	100	mm
Min Depth Of Land Application System	Z		mm

Nitrogen Balance

Site Address:	33 McRae Rd Wye River

SUMMARY - LAND APPLICATION AREA REQUIRED BASED NITROGEN BALANCE	249	m^2

INPUT DATA[1]

Wastewater Loading			
Hydraulic Load		750	L/day
Effluent N Concentration		25	mg/L
% N Lost to Soil Processes (Geary & Gardner 1996)		0.2	Decimal
Total N Loss to Soil		3750	mg/day
Remaining N Load after soil loss		15000	mg/day

Nutrient Crop Uptake					
Crop N Uptake	220	kg/ha/yr	which equals	60.27	$mg/m^2/day$

NITROGEN BALANCE BASED ON ANNUAL CROP UPTAKE RATES

Minimum Area required with zero buffer		
Nitrogen	249	m^2

Determination of Buffer Zone Size for a Nominated Land Application Area (LAA)		
Nominated LAA Size	249	m^2
Predicted N Export from LAA	-0.003	kg/year
Minimum Buffer Required for excess nutrient	0	m^2

CELLS

	Please enter data in blue cells
XX	Red cells are automatically populated by the spreadsheet
XX	Data in yellow cells is calculated by the spreadsheet, DO NOT ALTER THESE CELLS

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*

Nitrogen Balance

Site Address:	33 McRae Rd Wye River

SUMMARY - LAND APPLICATION AREA REQUIRED BASED NITROGEN BALANCE	174	m^2

INPUT DATA[1]

Wastewater Loading			
Hydraulic Load		525	L/day
Effluent N Concentration		25	mg/L
% N Lost to Soil Processes (Geary & Gardner 1996)		0.2	Decimal
Total N Loss to Soil		2625	mg/day
Remaining N Load after soil loss		10500	mg/day

Nutrient Crop Uptake					
Crop N Uptake	220	kg/ha/yr	which equals	60.27	$mg/m^2/day$

NITROGEN BALANCE BASED ON ANNUAL CROP UPTAKE RATES

Minimum Area required with zero buffer		
Nitrogen	174	m^2

Determination of Buffer Zone Size for a Nominated Land Application Area (LAA)		
Nominated LAA Size	178	m^2
Predicted N Export from LAA	-0.0835	kg/year
Minimum Buffer Required for excess nutrient	0	m^2

CELLS

	Please enter data in blue cells
XX	Red cells are automatically populated by the spreadsheet
XX	Data in yellow cells is calculated by the spreadsheet, DO NOT ALTER THESE CELLS

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*

Appendix VI: Gypsum Requirement

Project: 33 McRae Rd
Wye River

Client: Richard Van Der Merwe
Subject: Gypsum Requirement

Job No.: 19A342LCA
Comp: 27/02/2019
Date: 30/01/2019
Attendee: NH
Review: 0

AGR ASSESSING GEOLOGICAL RISK

Calculation $CEC \times 1.6 \times (ESP - ESP_D)$

Sample 1

	meq/100g	%
Exchangeable Calcium	9.7	80.2
Exchangeable Magnesium	2	16.5
Exchangeable Potassium	0.3	2.5
Exchangeable Sodium	0.1	0.8
Exchangeable Hydrogen		0.0

Sample Depth (mm)	200
Depth of soil (mm)	300
Gypsum factor (tons)[1]	1.6
t/ha to kg/m^2 conversion	0.1

Cation Exchange Capacity (CEC)	MEQ%	12.1
Excangable Sodium Percentage (ESP)	%	1.1
Desirable Exchangable Sodium Percentage (ESP_D)	%	6.0
Calcium Replacement ($ESP - ESP_D$)	%	0.0

Gypsum Requirement	t/ha	0.00
	kg/m^2	0.00

[1]US Department of Agriculture (1954) Agrigulture Handbook No. 60; Davis *et al* (2012)

Project: 33 McRae Rd
Wye River

Client: Richard Van Der Merwe
Subject: Gypsum Requirement

Job No.: 19A342LCA
Comp: 27/02/2019
Date: 30/01/2019
Attendee: NH
Review: 0

AGR ASSESSING GEOLOGICAL RISK

Calculation CEC x 1.6 x (ESP - ESP_D)

Sample 2

	meq/100g	%
Exchangeable Calcium	2	15.2
Exchangeable Magnesium	8	60.6
Exchangeable Potassium	0.3	2.3
Exchangeable Sodium	2.9	22.0
Exchangeable Hydrogen		0.0

Sample Depth (mm)	700
Depth of soil (mm)	500
Gypsum factor (tons)[1]	1.6
t/ha to kg/m^2 conversion	0.1

Cation Exchange Capacity (CEC)	MEQ%	13.2
Excangable Sodium Percentage (ESP)	%	21.8
Desirable Exchangable Sodium Percentage (ESP_D)	%	6.0
Calcium Replacement (ESP - ESP_D)	%	15.8

Gypsum Requirement	t/ha	16.68
	kg/m^2	1.67

[1]US Department of Agriculture (1954) Agrigulture Handbook No. 60; Davis *et al* (2012)

Appendix VII: Runoff Coefficient Computation

Project:	33 McRae Rd Wye River	**Job No.:** **Comp:** **Date:**	19A342LCA 27/02/2019 30/01/2019
Client:	Richard Van Der Merwe	**Attendee:**	NH
Subject:	Run off Coefficient	**Review:**	0

AGR ASSESSING GEOLOGICAL RISK

Proportional Land Use Zones areas of Total Catchment Area

Total area [ ] km^2 1151 m^2

Land Use	Prop. Of Land A_i	C_i
House, Roof	0.24	0.95
Driveway, road	0.026	0.3
Very Steep Forrested	0.2	0.25
Steep Heavy Soil Lawn	0.36	0.3
Moderately sloping heavy soil lawn	0.17	0.25
		0.3
A_{total}	1.0	
Runoff coefficient for total area (Weighted C)	**0.438**	

Weighted C = $\sum C_i A_i / A_{total}$

NOTE: Runoff Factor used in LCA water balance calculations is the inverse of the Runoff Coefficient. Ie the proportion of water retained or that infiltrates the soil as apposed to water runs off. If C = 0.3 then RF = 0.7

AGR ASSESSING GEOLOGICAL RISK

AGR GEOSCIENCES PTY LTD

16th July 2019

Roservear Planning Associates
Att: Phil Rosevear

RE: PP132/2019-1, 33 McRae Road, Wye River

Dear Phil,

I refer to the Request for Further Information (RFI) dated 11/7/2019, provided by Colac Otway Shire (COS) in reference to the Landslip Risk Assessment (LRA), 19A341LRA dated 20/3/2019.

The RFI states that *"The LRA does not appear to provide for the risk to property a TOLERABLE risk or lower limit.".*

Schedule 1 to the Erosion Management Overlay (EMO) indicates that COS define TOLERABLE RISK for new developments or changes to existing developments in accordance with the AGS Guidelines (2007) *"Practice Note Guidelines for Landslip Risk Management"*. Regarding risk to PROPERTY, the AGS Guidelines (2007) define TOLERABLE RISK as MODERATE for a structure with a level 2 importance such as a residential dwelling.

Table 4 in the LRA "*Risk Assessment for Property in Mitigated Conditions*" indicates a risk to property no greater than MODERATE is achievable for all hazards while the concluding statement in Section 9.0 states *"The risks to property associated with developing a residential dwelling on the subject site assuming risk management conditions are implemented, can be reduced to "LOW" or "VERY LOW" for most hazards while some hazards will remain at a "MODERATE" risk level*.".

The assessed risk to property for 33 McRae Road Wye River is therefore TOLERABLE.

I trust this information is satisfactory to your requirements.

Yours Sincerely,

DAVID J HORWOOD
BAppSc (Geology); AusIMM CP (Geo)

AGR GeoSciences Pty Ltd **P** PO Box 178 Mount Clear VIC 3350 **Ph** 03 5332 2917 **E** office@agrgeo.com.au **W** agrgeo.com.au
ABN: 32 601 372 632
ACN: 601 372 632

BUSHFIRE MANAGEMENT STATEMENT– 33 MCRAE ROAD, WYE RIVER

REF: 2018-299

21st October 2019

South Coast Bushfire Consultants

South Coast Bushfire Consultants

P.O. Box 721, Torquay, Vic 3228

Phone: 0401 328 757 Email: kylie@scbconsult.com.au

Principal Consultant – Kylie Steel

Qualifications / Accreditations:

- Accredited Bushfire Consultant (BPAD level 2) with the Fire Protection Association Australia (FPA) (2014)
- Preparing and assessing an application under the Bushfire Management Overlay – Planet (Department of Planning and Community Development) (2013)
- Postgraduate Diploma in Bushfire Planning and Management – The University of Melbourne (2015)
- Postgraduate Certificate in Business – The University of Notre Dame, Broome (2002)
- Bachelor of Science, Honours – The University of Melbourne (1998)
- Native Vegetation Planning Permit Applications – Planet (Department of Planning and Community Development) Training Seminar (2013)

Disclaimer

This report has been made with careful consideration and with the best information available to South Coast Bushfire Consultants at the time of writing. Before relying on information in this report, users should evaluate the accuracy, completeness and relevance of the information provided for their purposes. South Coast Bushfire Consultants do not guarantee that it is without flaw or omission of any kind and therefore disclaim all liability for any error, loss or other consequence that may arise from you relying on any information in this report.

Requirements detailed in this document do not guarantee survival of the buildings or the occupants. The client is strongly encouraged to develop and practice a bushfire survival plan.

Information and assistance including a template for a Bushfire Survival Plan is provided as part of the 'Fire Ready Kit' available through the CFA website at http://www.cfa.vic.gov.au or through your local CFA Regional office.

Conditions of Use

Version Control

	Name	Date Completed	Comments
Report Version	Kylie Steel	8/2/19 9/4/19 1/10/19 21/10/19	Version 1 Version 2 Version 3 Version 4
Field Assessment	Kylie Steel	5/2/19	
Report	Kylie Steel	5/2/19	
Mapping	Kylie Steel	5/2/19	

Contents

DEFINITIONS, ABBREVIATIONS AND ACRONYMS

AS 3959-2009 – Australian Standard AS 3959 -2009 Construction of buildings in bushfire-prone areas.

CFA – Country Fire Authority

Clause – A clause relates to a specific piece within the planning scheme.

Clause 44.06 – Bushfire Management Overlay

Clause 53.02 – Planning for Bushfire

DEPI – Department of Environment Planning and Infrastructure (now DELWP)

DELWP – Department of Environment, Land, Water and Planning

BAL – Bushfire Attack Level

BPA – Bushfire Prone Area

BMO – Bushfire Management Overlay

BMS – Bushfire Management Statement

Method 1 – refers to methodology in AS 3959-2009 for determining a BAL with a number of predetermined inputs.

Method 2 – refers to methodology in AS 3959-2009 for determining a site specific BAL

Pathway 1 – refers to an application pathway in Clause 53.02 of the planning scheme.

Pathway 2 – refers to an application pathway in Clause 53.02 of the planning scheme.

Planning Practice Note – a guide for using various sections of the planning scheme prepared by DTPI

RA – Responsible Authority

SCBC – South Coast Bushfire Consultants

Total Fire Ban Day – is declared by CFA on days when fires are likely to spread rapidly and could be difficult to control.

Bushfire Management Statement– 33 McRae Road, Wye River

1. SUMMARY

This document analyses the bushfire hazards to 33 McRae Road, Wye River (referred to as 'the site' throughout this document). This document includes a Bushfire Hazard Landscape and Site assessment, Bushfire Attack Level (BAL), Bushfire Management Plan and a response to the legislative requirements of the Bushfire Management Overlay (Clause 44.06 and 53.02).

Like many of the small townships along the Great Ocean Road, Wye River is built on the side of a hill that looks out over the Ocean to the east. Beyond the small township zone are large extensive areas of forest vegetation that extend back for tens of kilometers. The volume of fuel for a bushfire and the complex terrain in this landscape has the potential for extreme bushfires to develop and impact the township.

The landscape risk is high due to the high fuel loads in the surrounding forests, the potential for long fire runs and the complex topography.

The site is in a small residential hamlet in the center of Wye River. There are residential properties surrounding the proposed development site that have a combination of managed and modified fuels throughout their gardens.

Based on a conservative assessment the vegetation within the residential areas have been classified as modified vegetation in accordance with Clause 53.02.

The Bushfire Attack Level (BAL) was determined using the tables within Clause 53.02 and a method 2 assessment from AS 3959-2009 to the south. The BAL has been determined to BAL 29 to all aspects. A method 2 assessment has been used to calculate an accurate radiant heat exposure from the south.

Access to the site will be via a short driveway (less than 30m).

The dwelling will provide 10,000 litres of water in a non-combustible tank, solely for the purposes of fire fighting. The tank will be accessed via a remote access line.

2. INTRODUCTION

This document has been prepared to respond to the requirements of Clause 44.06 *Bushfire Management Overlay* (known from this point on as Clause 44.06), and associated Clause 53.02 *Bushfire Protection: Planning Requirements* (known from this point on as Clause 53.02) for a new dwelling at 33 McRae Road, Wye River.

The site is located in the Bushfire Management Overlay (BMO) and as such requires a Bushfire Management Statement (BMS) to accompany a planning permit application.

3. METHODOLOGY

The methodology used to satisfy the requirements of the BMO include the following:

- Bushfire Hazard Landscape Assessment
- Bushfire Hazard Site Assessment
- A method 2 BAL Assessment
- Bushfire Management Plan
- Bushfire Management Statement – response to Clause 53.02

4. PLANNING AND BUILDING CONTROLS

4.1 Planning and building controls

Clause Number	Name
32.05	Township Zone (TZ)
	Schedule
44.06	Bushfire Management Overlay
43.02	Design and Development Overlay (DDO)
	Schedule 4
44.01	Erosion Management Overlay (EMO)
	Schedule 1
43.05	Neighbourhood Character Overlay (NCO)
	Schedule 1
42.03	Significant Landscape Overlay (SLO)
	Schedule 2

5. BUSHFIRE HAZARD SITE ASSESSMENT

The Bushfire Hazard Site Assessment includes a plan that describes the bushfire hazard within 150 meters of the proposed development. The description of the hazard is prepared in accordance with AS 3959-2009 Construction of buildings in bushfire prone areas (Standards Australia) excluding paragraph (a) of section 2.2.3.2 (Vegetation Exclusions).

5.1 Site Details

Address:	33 McRae Road, Wye River 3234
Lot / Plan:	Lot 2 PS742250
Municipality:	Colac Otway
BMO Schedule:	N/A
Existing Dwellings:	Existing dwelling
Private Bushfire Shelter:	N/A
Application Pathway:	Clause 53.02-1
Directory Reference:	VicRoads 519 R6
Site Area:	Approximately 893m^2

Map 1 – Bushfire Hazard Site Assessment

5.2 Vegetation

The vegetation within the 150 metre assessment area was classified according to method 1 in AS 3959-2009 for the purposes of this preliminary assessment. The assumed forest fuel loads have the potential to increase with a detailed assessment.

The AS 3959-2009 approach uses a generalised description of vegetation based on the AUSLIG (Australian Natural Resources Atlas: No.7 Native Vegetation) classification system. According to this method, vegetation can be classified into seven categories. Each category indicates a particular type of fire behavior and these categories or classifications are then used to determine bushfire intensity.

Table 1 – Vegetation Assessment

Forest	**AS 3959-2009 Description** ***Trees 10-30m high: 30-70% foliage cover (may include understorey of sclerophyllous low trees and tall scrubs or grass). Typically dominated by eucalypts.*** ***The assumed fuel load for forest in AS 3959 is 25 t/ha ground fuel and 35 t/ha overall fuel. An independent fuel assessment has not been undertaken. The fuel assumptions are considered within an appropriate range.*** **Ecological Vegetation Classes (EVC)** Ecological Vegetation Classes (EVC) are the standard unit used by DELWP for classifying vegetation types in Victoria. The EVC's surrounding a site can give an indication of the likely fuels affecting a bushfire run within the landscape. The EVC's give contain a 'typical' but not comprehensive list of species and species composition for each EVC in a certain bioregion. The EVC's identified surrounding this comprises a number of different types of forest including Cool Temperate Rainforest (EVC 31), Shrubby Wet Forest (EVC 201), Wet Forest (EVC 30), Shrubby Foothill Forest (45) and Riparian Forest (EVC 18). The most dominant forest type was Shrubby Foothill Forest and one of the dominant eucalypt species within this EVC is *Eucalyptus oblique* or Messmate Stringybark. The occurrence of this species within the landscape significantly contributes to the ability to suppress a bushfire as they produce massive quantities of embers and short distance spotting. Mapping of the EVC's surrounding the site and their general composition and description can be found in appendix 1 of this document. **Site Description** There is a large area of forest to the south west corner of the 150m assessment zone. This area of forest is part of a long band of forest vegetation that come into the town from the south west. The majority of the forest to the south west was burnt in the 2015 Wye River bushfires and is currently in a state of regeneration.

Low Threat	**AS 3959-2009 Description** ***e) Non-vegetated areas, including waterways, roads, footpaths, buildings and rocky outcrops.*** ***f) Low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses, maintained public reserves and parklands, vineyards, orchards, cultivated gardens, commercial nurseries, nature strips and windbreaks.*** **Site Description** The vegetation within the Wye River Big 4 Caravan Park is well managed and is considered to be low threat vegetation. The park is predominantly lawn and the lawn is managed to a low threat condition and irrigated. The area to the north east around the Wye River General Store, the Great Ocean Road and the Wye River Hotel is considered to be low threat vegetation as it is dominated by built form and sealed roads and carparks. Figure 1 – Low threat Vegetation within the property boundary (to be defendable space) 

	Figure 2 – Low threat vegetation around the Wye River Hotel to the south. 
Modified Vegetation	**<u>Modified Vegetation as described in *Clause 53.02 and Technical Guide 2017 DELWP.*</u>** ***Modified vegetation refers to vegetation that is different from other vegetation types shown in AS 3959-2009 and Table 1 and Table 2 of Clause 53.02-3. Modified vegetation arises in parts of Victoria where fuel loads are high but the vegetation is modified because of urban development, gardens, the way the vegetation is configured (for example, limited or no understorey vegetation), or because the fuel loads are different from the fuel loads assumed in AS 3959-2009.*** **<u>Site Description</u>** The vegetation throughout the township of Wye River is considered to be modified. Residential properties have modified the vegetation for the purposes of bushfire mitigation and for garden aesthetics, however, the vegetation would still enable spot fires to develop within the residential areas. **<u>Site Description</u>** The fuel loads within the gardens of the surrounding residential development are largely managed, however there are a number of existing trees within the gardens, particularly to the south.

Figure 2 – Modified Vegetation within the assessment zone.

Figure 4 – Modified Vegetation within the assessment zone.

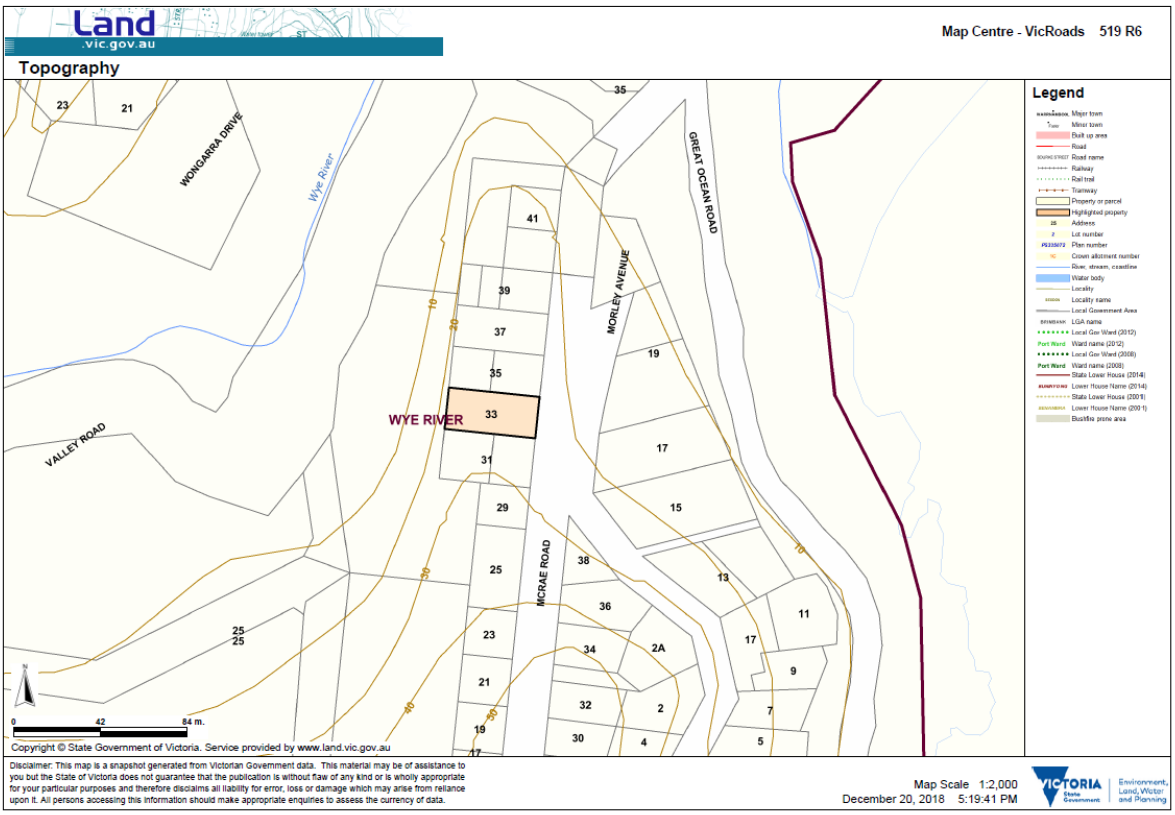
5.3 Topography

The proposed development site is located on an east facing slope and there is a steep downslope to the carvan part to the west. The site is in a low lying area of Wye River, close to the river mouth and the surrounding landscape is dominated by steep upslopes beyond the township to the north and to the south west. The short downslope runs in the surrounding landscape will not make a significant impact on the intensity of a landscape bushfire impacting this site.

The surrounding topography would enable embers to be dumped into the township from the surrounding ridges.

The wider topography is very hilly with steep ridgelines and deep gullies that would enable extreme bushfire behavior as was seen in the 2015 Wye River / Separation Creek bushfires.

Map 2 – Topography of the surrounding area.



5.4 Bushfire Attack Level (BAL) for the proposed development

The bushfire attack level (BAL) is a means of measuring the severity of a building's potential exposure to ember attack, radiant heat and direct flame contact, using increments of radiant heat expressed in kilowatts per meter squared, and the basis for establishing the requirements for construction to improve protection of building elements from attack by bushfire.

The highest BAL determines the construction requirements for the dwelling. A reduction of one BAL level may be applied if facades of the house are shielded from the bushfire hazard. Shielding is not appropriate for this site due to the extreme landscape hazard.

South of the site is an existing residential property with a managed yard. The forest vegetation is located over 33m from the proposed dwelling to the forest and the land in between the new development and the forest has been classified as modified vegetation. A method 2 BAL assessment has been undertaken (table 3) to determine the radiant heat exposure from the forest and it was found to be 27.8 k/Wm^2 which would enable construction to a BAL of 29.

Table 2 – BAL based on distance to the highest threat vegetation.

Orientation	Highest threat vegetation	Slope under classifiable vegetation	Defendable Space	Bushfire Attack Level (BAL)
North	Modified Vegetation	5-10° Downslope	Property Boundary	29
East	Modified Vegetation	5-10° Downslope	Property Boundary	29
South	Modified Vegetation	5° Downslope	Property Boundary	29
South	Forest	5° Downslope	33m	29
West	Modified Vegetation	10-15° Downslope	Property Boundary	29

Table 3 – CSIRO BAL calculator to determine the radiant heat exposure from the forest to the south.

Forest, Woodlands & Rainforest					
FDI	100				
Vegetation classification	Forest				
Surface Fuel Load (t/ha)	25	*1			
Overall Fuel Load (t/ha)	35	*1			
Effective slope under the classified vegetation (degrees)	5	Downslope			
Slope between the site and classified vegetation (degrees)	3				
Distance of the site from classified vegetation (m)	33		Rate of spread	3	(km/h)
Flame Width (m)	100	*2	Slope ROS	4.23597	(km/h)
Flame Temperature (K)	1090	*3	Flame length	31.7338	(m)
Flame Emissivity	0.95	*4	Flame angle	61	
Ambient Temperature (K)	308	*4	View Factor	0.44822	
Relative humidity (%)	25%	*4	Height of Receiver	12.14805	(m)
Direction	S		Path length	25.30757	(m)
Assessment date	8/03/2019		Atmospheric Transmissivity	0.816378	
Assessment performed by	Kylie Steel		Radiant heat flux	27.82	(kW/m^2)
Site Location	33 McRae St, Wye River		BUSHFIRE ATTACK LEVEL	BAL -29	

6. BUSHFIRE HAZARD LANDSCAPE ASSESSMENT

The Bushfire Hazard Landscape Assessment includes a plan that describes the bushfire hazard of the general locality surrounding the site (Map 1).

6.1 Vegetation extent in the broader landscape

The site is surrounded by extensive areas of forest vegetation in the Great Otway National Park. Fire runs have the potential to be in excess of 30km from the north and 40km from the west.

There are no features in the landscape to mitigate a large landscape bushfire. Townships along the Great Ocean Road, such as Wye River, are at an increased risk as they are close to large areas of unmanaged vegetation on complex topography. Steep slopes allow for prolific ember storm and the development of convection columns in the event of a large landscape bushfire.

6.2 Surrounding Road Network

The site is located in close proximity to McRae Rd which joins Morley Avenue and allows good access to the beach and the Great Ocean Road.

The characteristics of the Great Ocean Road are hazardous, the hazards are enhanced during a time of panic or distress particularly during a bushfire. It is for this reason early evacuation is recommended.

6.3 Bushfire History of the Area

The Barwon South West Regional Strategic Fire Management Plan: Environmental Scan lists bushfire events in the Otway Ranges. The 1939 Black Friday Fires, the 1983 Ash Wednesday fires and the 2015 Wye River and Separation Creek bushfires are the most significant bushfire events in the South West region of Victoria in recent history.

The bushfires on Christmas day in 2015 showed how devastating a bushfire can be under relatively mild weather conditions in a sea side community with aging infrastructure. These bushfires have significantly lowered the fuel loads within the Wye River township and surrounding forests. These fuel loads will take a number of years to establish loads that were present pre the 2015 Bushfires.

The bushfire history maps in appendix 11.2 show the extent of bushfire in the surrounding landscape since 1970.

6.4 Landscape Type

The determination of landscape type is a requirement of Clause 53.02 as a simplified method to establish landscape context.

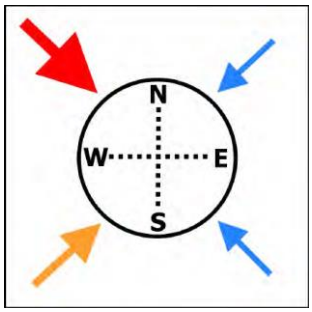
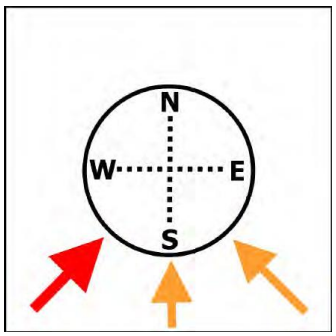
The surrounding landscape is characteristic of the 'Broader Landscape Type Four' as per *The Technical Guide 2018 (DELWP)*

Table 4 – Broader Landscape Type Justification

Broader Landscape Type Four Description	**Sites Response**
The broader landscape presents an extreme risk	There are heavily forested areas to the north, and west of Wye River. The topography of the surrounding landscape is characteristic of steep slopes and is very hilly. This landscape would contribute to a bushfires severity.
Evacuation options are limited or not available.	The only evacuation point is to the beach. The township is located on the Great Ocean Road and evacuation along this road is only recommended prior to a day that is predicted to be of a high bushfire risk. Evacuation along the Great Ocean Road once a fire is established is not an option.

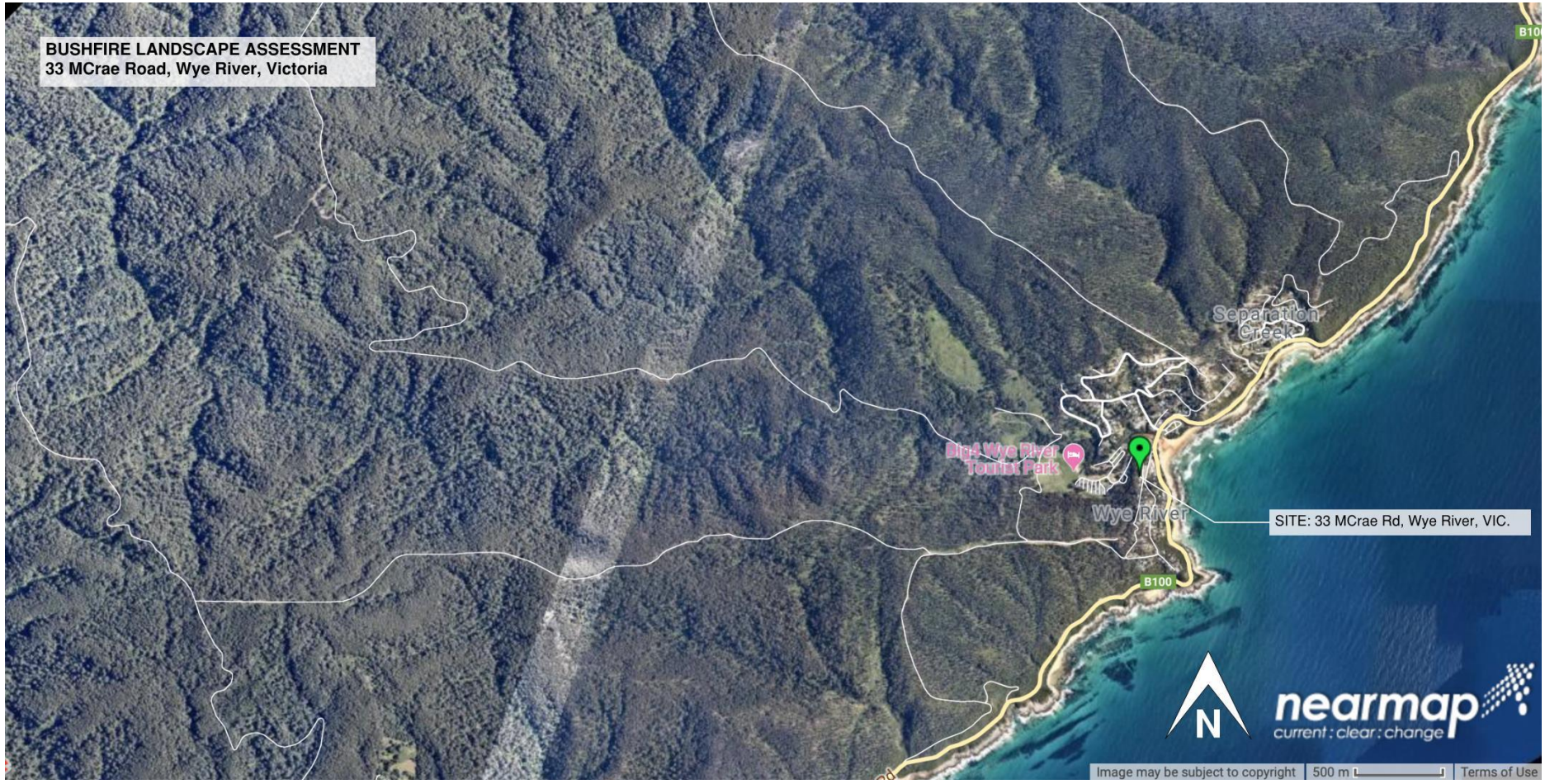
6.5 Bushfire Risk

Table 5 – Bushfire Scenarios

Bushfire Scenario	Description	Site Response
North 	North of the development site are a number of existing dwellings, the caravan park reception building, the Wye River general store and the crown land reserve that runs along the river. North of the river is forest vegetation. The land north of the river was affected by the 2015 Wye River / Separation Creek bushfires and the number of trees within the landscape has significantly reduced. The trees outside of the township zone will return at pre-bushfire conditions, however the density of trees within the residential areas to the north will likely be maintained to a low threat condition.	Localised ignitions to the north would likely be mitigated by the existing development. The site will manage defendable space to the property boundary to the north and construction will be to a BAL of 29.
East	East of the site is the Wye River Hotel and the ocean. This aspect does not present as a large bushfire hazard as spot fires within this area would likely be contained.	The site will manage the garden to the east as per defendable space conditions to the property boundary.
South 	South of the site are large areas of forest vegetation within the Otway National Park. The Great Otway National Park has high fuel loads and has topography that would significantly influence the severity of a landscape bushfire. To the south is a narrow band of forest vegetation that impacts the township area. This forest area is over 33m from the site and there is another dwelling between the forest to the south and the proposed development.	A method 2 BAL assessment using the CSIRO BAL calculator has determined the radiant heat exposure of the forest to the south and it was determined to be at BAL 29. The dwelling will manage defendable space to the property boundary to the south.
West	West of the site is a modified strip of vegetation that contains a number of trees with a cleared and managed understorey. West of this strip of vegetation is the existing caravan park development with permanent onsite cabins, cabins and large open areas of grassland for camping. The wye river	The vegetation to the west within the caravan park is low threat. The site will manage the garden to the west as per defendable space conditions to the property boundary.

	meanders through the caravan part to the west along the creekline.	

Map 4 – Bushfire Hazard Landscape Assessment



7. DEFENDABLE SPACE AND VEGETATION MANAGEMENT OBJECTIVES

Vegetation Management Requirements	**Sites Response**
Grass must be short cropped and maintained during the declared fire danger period.	All lawn areas within the site will be cropped to a low threat condition of less than 100mm during the bushfire danger period.
All leaves and vegetation debris must be removed at regular intervals during the declared fire danger period.	Regular debris removal will be undertaken during and prior to 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.	The location of flammable objects such as; wood heaps, additional plastic water tanks and treated pine retaining walls will not be located within 10m of a vulnerable part of the building (including glazing and external doors).
Plants greater than 10 centimetres in height must not be placed within 3 metres of a window or glass feature of the building.	The landscape plan will ensure that plantings are located over 3m from a window or glass feature.
Shrubs must not be located under the canopy of trees.	Shrubs will not be located under the canopy of trees.
Individual and clumps of shrubs must not exceed 5 square metres in area and must be separated by at least 5 metres.	Any further planting of shrubs will ensure that they are not planted in densities greater than $5m^2$.
Trees must not overhang or touch any elements of the building.	Trees will not overhang or touch any elements of the building.
The canopy of trees must be separated by at least 5 meters.	Existing trees and any further trees planted within the property will ensure a 5m canopy separation.
There must be a clearance of at least 2 metres between the lowest tree branches and ground level.	Trees will be managed to ensure at least 2 metres between the lowest tree branches and ground level.

8. BUSHFIRE MANAGEMENT PLAN AND STANDARD PERMIT CONDITIONS

Bushfire Management Plan – 33 McRae Road, Wye River
(Prepared By – SCB Consultants 21st October 2019)

Bushfire Mitigation Measures

Construction - the dwelling will be constructed to a minimum **BAL-29** from AS 3959-2009.

Defendable space - An area of defendable space for the designated BAL around the proposed building / or to the property boundary where vegetation (and other flammable materials) will be modified and managed in accordance with the following distances from Table 2 Clause 53.02:

- North – Property Boundary
- East – Property Boundary
- South– Property Boundary
- West – Property Boundary

Vegetation Management requirements include:

- 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 3 metres 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 square 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.

Water Supply and Access

The site is required to have 10,000 Litres of water supply for fire fighting purposes which meets the following requirements:

- Is stored in an above ground water tank constructed of concrete or metal.
- The static water supply must include a separate outlet for the private use of the owner/occupier of the land that incorporates a ball or gate valve.
- The static water supply must be provided with a separate outlet for the CFA (CFA outlet) that includes a 64 mm CFA 3 thread per inch male coupling.
- The CFA outlet must be:

a) easily accessible by a fire-fighter in the event of a bushfire
b) Clear of all vegetation for a distance of 1.5 metres
c) Setback from flammable objects (including timber fences and timber retaining walls) for a minimum distance of 1.5 metres
d) Located a minimum distance of 10 metres (unless approved heat shielding is provided) and no more than 60 metres from the dwelling and oriented horizontally.

- The material of manufacture of the remote outlet piping will be HDPE pipe of a diameter of 90mm.
- The internal diameter of the CFA outlet at the tank to the pipeline must be greater than the internal diameter of the pipeline between the tank and the fire authority outlet.
- The centreline of the CFA outlet must be:

a) A minimum of 300mm and maximum 600mm in height above the finished ground level.
b) Located below the level of the outlet on the tank.

- The riser for the CFA outlet must be supported by a galvanised steel post at least 50mm x 50mm or equivalent which is concreted in the ground to a depth of at least 450mm.
- A 65mm British Standard Pipe (BSP) ball or gate valve must be provided at the CFA outlet to control the flow of water to the CFA coupling. Any other valves between the CFA outlet and the tank must be locked in the open postion.
- The CFA outlet must be easily identifiable from the entrance to the property or signage must be provided that meets the following requirements:
- Has an arrow pointing to the location of the fire authority outlet.
- Has dimensions of not less than 310mm high and 400mm long.
- Is red in colour, with a blue reflective marker attached.
- Is labelled with a 'W' that is not less than 15cm high and 3cm thick.
- The CFA outlet must include a fade-resistant or engraved sign that:
- Is to be fixed to the post supporting the fire authority outlet riser.
- Has a minimum height of at least 1.5m from the ground surface level.
- Includes the words "FIRE WATER TANK OUTLET" in lettering that is a minimum of 50mm in height and written in a colour contrasting with that of the background.
- A blue reflective disc at least 50mm in diameter must be attached to the post holding the sign. The blue reflective disk must be located immediately below the sign.
- All below-ground water pipes must be installed to provide at least the following cover below the finished surface; 300 mm for pipes subject to vehicle traffic; 75 mm for pipes under dwellings or concrete slabs; and 225 mm for all other locations.
- Fire authorities are required to be able to get within 4m of the water supply.
- The material of manufacture of the remote outlet piping will be HDPE pipe of a diameter of 90mm.

9. BUSHFIRE MANAGEMENT STATEMENT – SITES RESPONSE TO APPLICABLE SUB CLAUSES OF 53.02

Clause 53.02 contains a range of sub clauses with objectives, approved measures (AM), alternative measures (AltM) and decision guidelines. The table below details which clauses are relevant to this application. The following section demonstrates how the requirements have been met for the relevant standards.

Table 6 - Relevant clauses and measures applicable to the proposed development.

Clause	Approved Measure	Achieved	Justification
Clause 53.02-3 – Dwellings in existing settlements – Bushfire protection objective	AM 1.1	Not Applicable	
	AM 1.2	Not Applicable	
	AM 1.3	Not Applicable	
Clause 53.02-4.1 Landscape, siting and design objectives	AM 2.1	Applicable	
	AM 2.2	Applicable	
	AM 2.3	Applicable	
Clause 53.02-4.2 Defendable space and construction objective	AM 3.1	Applicable	
	AM 3.2	Not Applicable	
	AltM 3.3	Applicable	
	AltM 3.4	Applicable	
	AltM 3.5	Not Applicable	
	AltM 3.6	Not Applicable	
Clause 53.02-4.3 Water supply and access objectives	AM 4.1	Applicable	
	AM 4.2	Applicable	
Clause 53.02-4.4 Subdivision objectives	AM 5.1	Not Applicable	
	AM 5.2	Not Applicable	
	AM 5.3	Not Applicable	
	AM 5.4	Not Applicable	
	AltM 5.5	Not Applicable	

9.1 53.02-4.1 Landscape, siting and design objectives

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.

Development is sited to provide safe access for vehicles, including emergency vehicles.

Building design minimises vulnerability to bushfire attack.

Approved Measure	Requirement
AM 2.1	**The bushfire risk to the development from the landscape beyond the site can be mitigated to an acceptable level.** **Response:** This report provides a comprehensive assessment of the bushfire hazards associated with the development site at 33 McRae Rd, Wye River. If the reference to 'acceptable level' refers to the state based appropriate risk parameters set by the Minister for Planning. The site can mitigate the risks to an acceptable level. The BAL of 29 can be met to all aspects by using the following inputs; • 'Forest Fire Danger Index'(FFDI) of 100 and • Flame Temperature of 1090K. There are features within the surrounding landscape including; the highly managed areas surrounding the Wye River Hotel and the Wye River Big 4 Caravan Park to the west, that would mitigate the impacts of a landscape bushfire on the proposed development. The development is able to meet the approval measures and alternative measures in Clause 53.02 and thus it is deemed that the development presents as an acceptable risk given the surrounding landscape.
AM 2.2	**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.** **Response:** The dwelling has been located in accordance with the existing building. The development site is a small residential allotment and there is limited availability for siting.

	The greatest local hazard is to the south where there are extensive forested areas. The forest is located over 33m from the forest to south and the CSIRO BAL calculator (table 3) has been used to determine the radiant heat exposure. An appropriate BAL to mitigate the effects of this forest vegetation was determined to be BAL 29. The building has good access to a quality public road and the Great Ocean Road to the south. Access can be provided for emergency services.
AM 2.3	**A building is designed to be responsive to the landscape risk and reduce the impact of bushfire on the building.** **Response:** The proposed dwelling will be constructed in accordance with AS 3959-2009 for a BAL of 29 and the design will minimise the ability for ember accumation.

9.2 53.02-4.2 Defendable space and construction objective

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

AM 3.1	**A building used for a dwelling (including an extension or alteration to a dwelling), a dependant person's unit, industry, office or retail premises is provided with defendable space in accordance with:** • **Column A, B or C of Table 2 to Clause 53.02-3 wholly within the title boundaries of the land; or** • **If there are significant siting constraints, Column D of Table 2 to Clause 53.02-3.** **The building is constructed to the bushfire attack level that corresponds to the defendable space provided in accordance with Table 2 to Clause 53.02-3.** **Response:** The vegetation in the surrounding township area and along the embankment to the west has been classified as 'modified vegetation' in accordance with Clause 53.02. Where vegetation is classified as 'modified' the lowest construction standard is BAL 29 and defendable space must be managed to the property boundary. There is forest vegetation within the assessment zone to the south and a method 2 BAL assessment using the CSIRO BAL calculator has been used to determine the radiant heat exposure from the is aspect.

AltM 3.3	**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.** **Response:** Adjoining land is not used as defendable space. Defendable space is contained within the property boundary.
AltM 3.4	**Defendable space and the bushfire attack level is determined using Method 2 of *AS3959:2009 Construction of buildings in bushfire prone areas* (Standards Australia) subject to any guidance published by the relevant fire authority.** **Response:** A method 2 BAL assessment using the CSIRO BAL calculator has been used to determine the BAL to the south due to the inability to share defendable space across property boundaries. The vegetation between the proposed dwelling and the forest is maintained to a low threat condition, however, based on a precautionary principle has been classified as modified vegetation for this assessment. The detailed working of the CSIRO BAL assessment are detailed in table 3 of this document.

9.3 53.02-4.3 Water supply and access objectives

A static water supply is provided to assist in protecting property.

Vehicle access is designed and constructed to enhance safety in the event of a bushfire.

AM 4.1	**A building used for a dwelling (including an extension or alteration to a dwelling), a dependent person's unit, industry, office or retail premises is provided with:** • **A static water supply for fire fighting and property protection purposes specified in Table 4 to Clause 53.02-5.** • **Vehicle access that is designed and constructed as specified in Table 5 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 fire fighting water supplies.** **Response:** The development site will provide a static water supply of 10,000L for CFA purposes. The water will be accessed by a remote access line from McRae Road (as per Bushfire Management Plan and the architectural plans inserted in appendix 2).

10.REFERENCES

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Standards Australia (2009). AS 39359-2009 Construction of Buildings in Bushfire Prone Areas. Standards Australia, North Sydney, New South Wales.

11.APPENDICES

11.1 Appendix 1 – Bushfire History and Prescribed Burns in the Area

(DEPI – Biodiversity Interactive Map – showing bushfire history).

The maps below show the extent of bushfire footprints surrounding Apollo Bay. Figure 2 below demonstrates the areas where prescribed burns have been undertaken, as indicated in grey. Prescribed burns are undertaken with a strategic intent to minimise the impact of a large landscape bushfire. As figure 2 indicates, there have been a limited number of prescribed burns surrounding the Apollo Bay township.

Figure 1 – Natural Bushfires in the area since 1970. Pink areas on the map indicate wildfires.

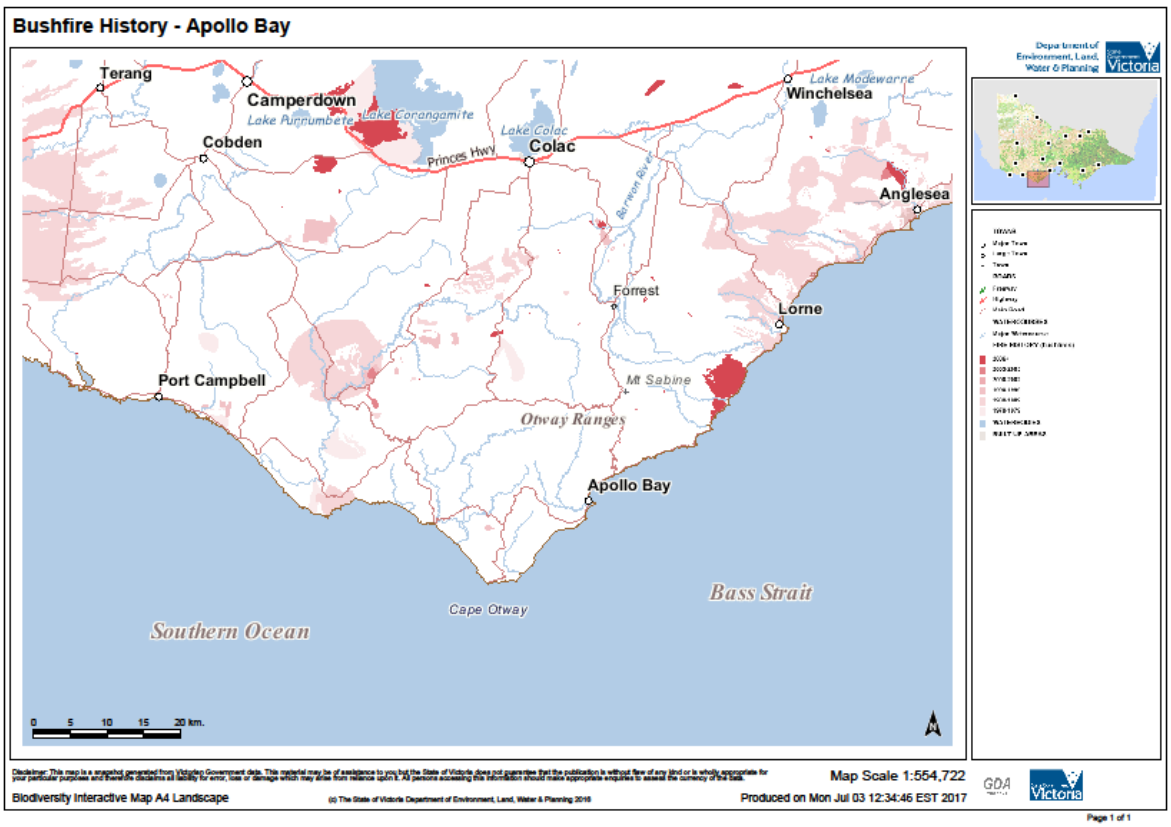
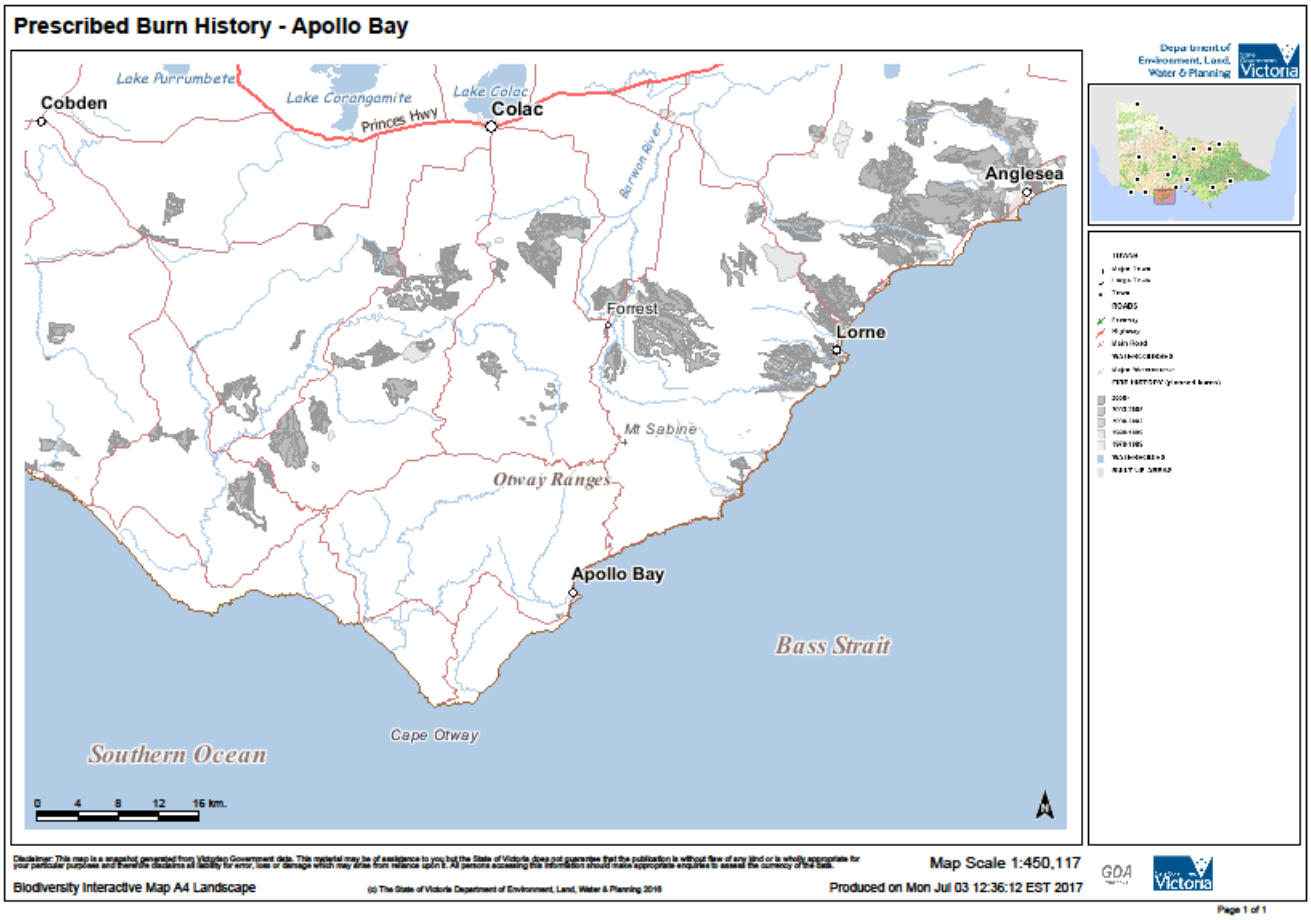


Figure 2 – Prescribed Burns in the area since 1970. Most of the prescribed burns indicated on the map shaded as areas of grey have occurred since the 2008 Black Saturday bushfires.



11.2 Appendix 2 – Static Water Supply

Images associated with the static water supply have been taken from the architectural plans dated the 17/10/19.

Figure 1 – Fall from the water tank to the CFA outlet.

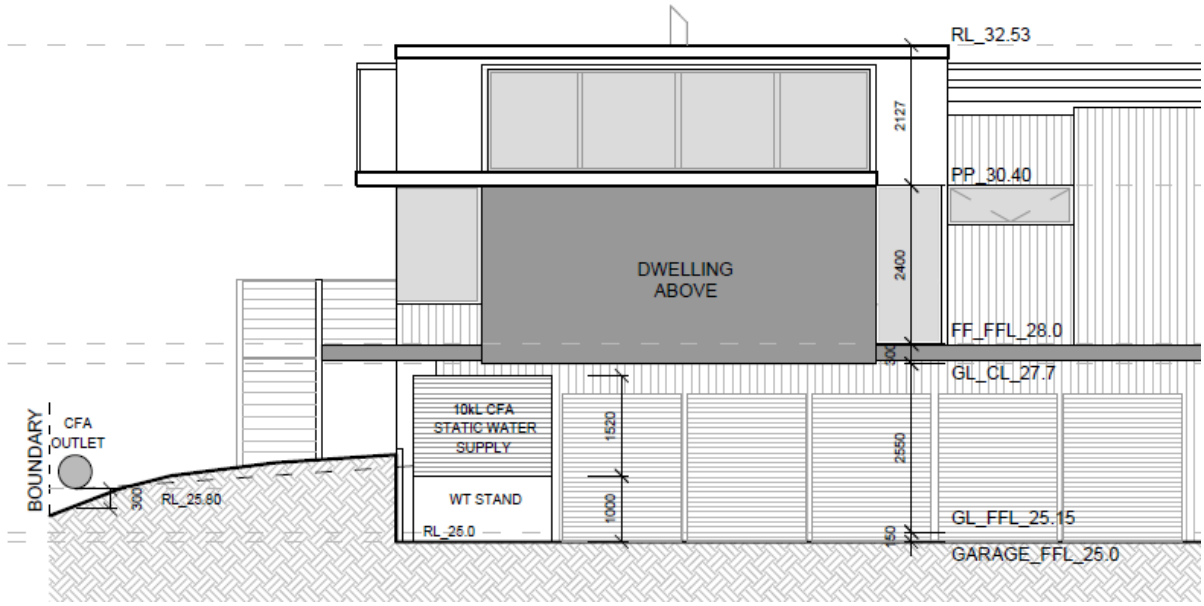
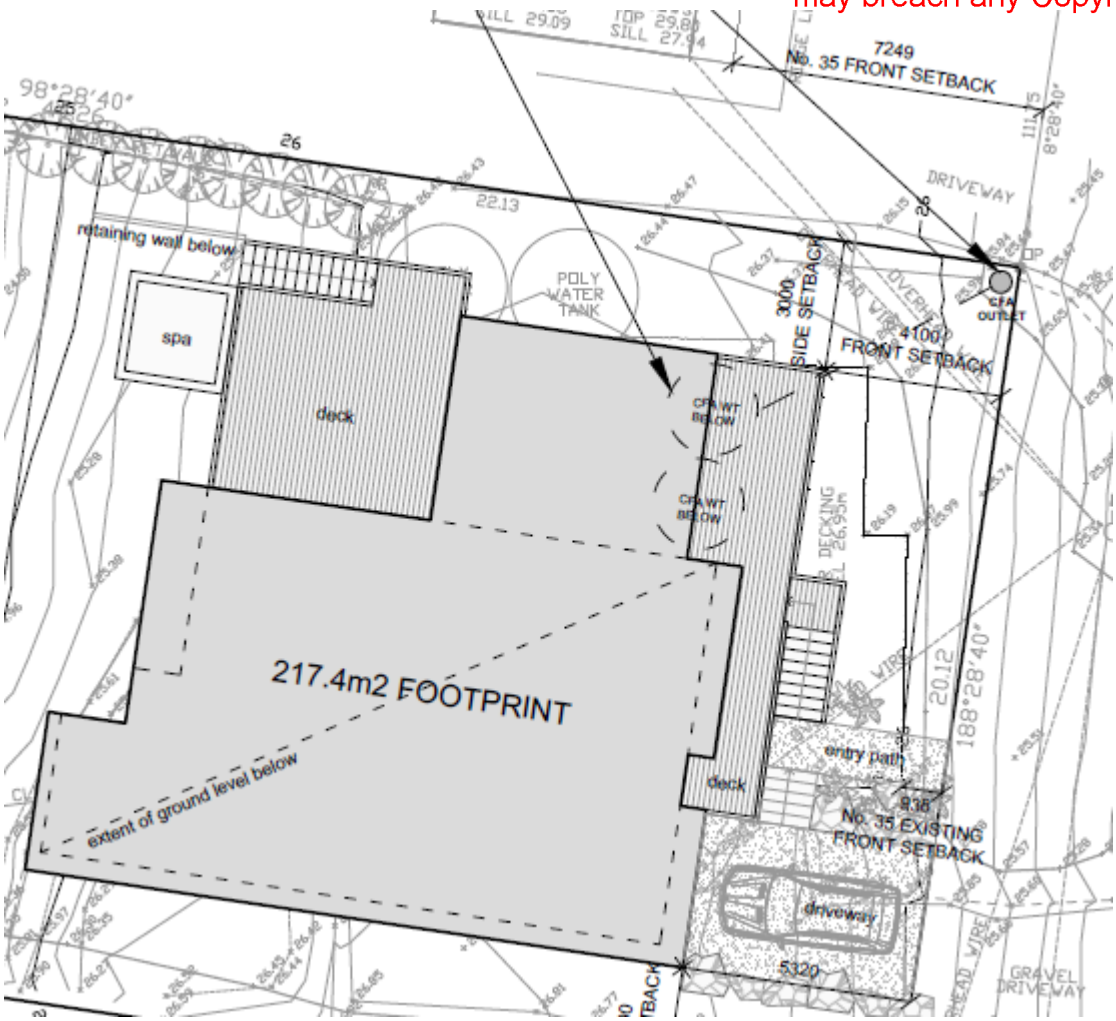


Figure 2 – Location of the water tanks and the CFA outlet.



Rosevear Planning Associates

ABN: 97 429 778 841

18 July 2019

Helen Evans
Statutory Planning Department
Colac Otway Shire
2-6 Rae Street
Colac Vic 3250

Received 18/07/2019

By email to: inq@colacotway.vic.gov.au

Planning Application: PP132/2019-1
Subject Land: 33 McRae Road WYE RIVER
PROPOSAL: Construction of a double storey Dwelling, Removal of Easements E1 & E2 and associated Earthworks

Dear Helen,

I refer to Council's request for further information dated 11 July 2019 and note the change to the proposal description to include the proposed Earthworks,

The specific issues raised in your letter are include in itallics below with our response following and provide the following:

1. *The decision guidelines for removal of an easement requires the responsible authority consider the interests of affected people. It is noted E2 on PS742250M related to the subject land nominates the land benefiting from the easement as that described in Instrument 2155252. Please provide a copy of Instrument 2155252 to enable the benefiting land to be identified and to be consulted as part of the processing of the application.*

A copy of Instrument 2155252 is attached as requested.

2. *It is noted that the application indicates that a maximum site coverage proposed is 24.1%. it appears that this does not take into account the decks/verandahs. Taking this coverage as well into account, the site coverage appears to be around 27-28%. Please provide comment/justification for the increased coverage.*

The development plans lodged with the application clearly show that the ground floor is contained within the footprint of the upper level and can therefore be disregarded for the purpose of calculating site coverage as follows:

Upper floor area - 161.1sqm. + Deck area - 53.6sqm + Spa - 6.25sqm = 220.95sqm (24.81%) site coverage. This is an increase of 0.71% or the area of the spa, which was erroneously omitted from the previous calculation. Given the minor nature of this variation, the justification provided in the planning report lodged with the application is still relevant.

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3. *Please provide written clarification from the Geotechnical Engineer that the proposed development responds to the risk to property at a risk rate of TOLERABLE risk or lower or otherwise.*

Confirmation from the Geotechnical Engineer, that the proposed development responds to the risk to property at a risk rate of TOLERABLE has been provided as requested.

If there are any questions or if you would like to discuss the application, please do not hesitate to contact me.

Yours faithfully

Philip Rosevear
Rosevear Planning Associates