

NOTICE OF AN APPLICATION FOR PLANNING PERMIT

The land affected by the application is located at:	56B Hazel Road KALIMNA VIC 3909 Lot: 2 PS: 821630
The application is for a permit to:	Buildings and works (dwelling)
A permit is required under the following clauses of the planning scheme:	
Planning Scheme Clause	Matter for which a permit is required
43.02-2 (DDO)	Construct buildings
44.01-2 (EMO)	Buildings and works
The applicant for the permit is:	Crowther & Sadler Pty Ltd
The application reference number is:	5.2026.157.1

You may look at the application and any documents that support the application free of charge at: <https://www.eastgippsland.vic.gov.au/building-and-development/advertised-planning-permit-applications>

You may also call 5153 9500 to arrange a time to look at the application and any documents that support the application at the office of the responsible authority, East Gippsland Shire. This can be done during office hours and is free of charge.

Any person who may be affected by the granting of the permit may object or make other submissions to the responsible authority.

An objection must ♦ **be made to the Responsible Authority in writing,**
♦ **include the reasons for the objection, and**
♦ **state how the objector would be affected.**

The responsible authority must make a copy of every objection available at its office for any person to inspect during office hours free of charge until the end of the period during which an application may be made for review of a decision on the application.

The Responsible Authority will not decide on the application before:	Subject to the applicant giving notice
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If you object, the Responsible Authority will tell you its decision.

Kerry Stow

From: Snapforms Notifications <no-reply@snapforms.com.au>
Sent: Friday, 29 May 2026 12:09 PM
To: Planning Unit Administration
Subject: Planning Permit application
Attachments: 20260511 56B Hazel Road - Town Planning - B.pdf; Geotechnical Investigation.pdf; 21505 BMP V1.pdf; 21505 Report.pdf; 21505 Vol_12209_Fol_222.pdf; Planning_Permit_Application_2026-05-29T12-08-35_34202116_0.pdf; attachment_errors.txt; 21505 BHSA V1.pdf

Planning Permit Application

A "Planning Permit Application" has been submitted via the East Gippsland Shire Council website, the details of this submission are shown below:

Applicant name: Crowther & Sadler Pty Ltd

Email address:

Postal address : Bairnsdale 3875

Preferred phone number

Owner's name: Glenn & Hazel Reimers

Street number:

Street name:

Town: Kalimna

Post code: 3909

Lot number: 2

Plan number: 821360M

Is there any encumbrance on the Title such as a restrictive covenant, section 173 agreement or other obligation such as an easement or building envelope?: No

Will the proposal result in a breach of a registered covenant restriction or agreement?: No

Existing conditions : Vacant Residential land

Description of proposal : Development of a dwelling in two stages, and outbuildings

Estimated cost of development: 700,000

Has there been a pre-application meeting: No

ExtraFile: 3

Declaration: Yes

Authority Check: Yes

Notice Contact Check: Yes

Notice check 2: Yes

Privacy Statement Acknowledge: Yes

Plans: [20260511 56B Hazel Road - Town Planning - B.pdf](#)

3. Supporting information/reports: [Geotechnical Investigation.pdf](#)

2. Supporting information/reports: [21505 BMP V1.pdf](#)

Planning report: [21505 Report.pdf](#)

1. Supporting information/reports: [21505 BHSA V1.pdf](#)

Full copy of Title: [21505 Vol_12209_Fol_222.pdf](#)

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

VOLUME 12209 FOLIO 222

Security no : 124134109896B
Produced 27/04/2026 01:16 PM

LAND DESCRIPTION

Lot 2 on Plan of Subdivision 821630M.
PARENT TITLE Volume 08967 Folio 796
Created by instrument PS821630M 08/05/2020

REGISTERED PROPRIETOR

Estate Fee Simple
Joint Proprietors
GLENN ANDREW REIMERS
HAZEL BRENDA REIMERS
AU160781B 22/03/2021

HEIDELBERG VIC 3084

ENCUMBRANCES, CAVEATS AND NOTICES

CAVEAT AY094314R 13/06/2024
Caveator
EAST GIPPSLAND REGION WATER CORPORATION
Grounds of Claim
STATUTORY CHARGE ARISING UNDER THE WATER ACT 1989.
Estate or Interest
INTEREST AS CHARGE
Prohibition
ABSOLUTELY
Lodged by
CLH LAWYERS
Notices to
ASHLEY DILGES OF CLH LAWYERS of LEVEL 2 577 LITTLE BOURKE STREET MELBOURNE VIC 3000

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.

DIAGRAM LOCATION

SEE PS821630M 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: 56B HAZEL ROAD KALIMNA VIC 3909

ADMINISTRATIVE NOTICES

NIL



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

DOCUMENT END

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Page 2 of 2

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Statement of Compliance issued: 07/04/2020

NOTATIONS

EASEMENT INFORMATION

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

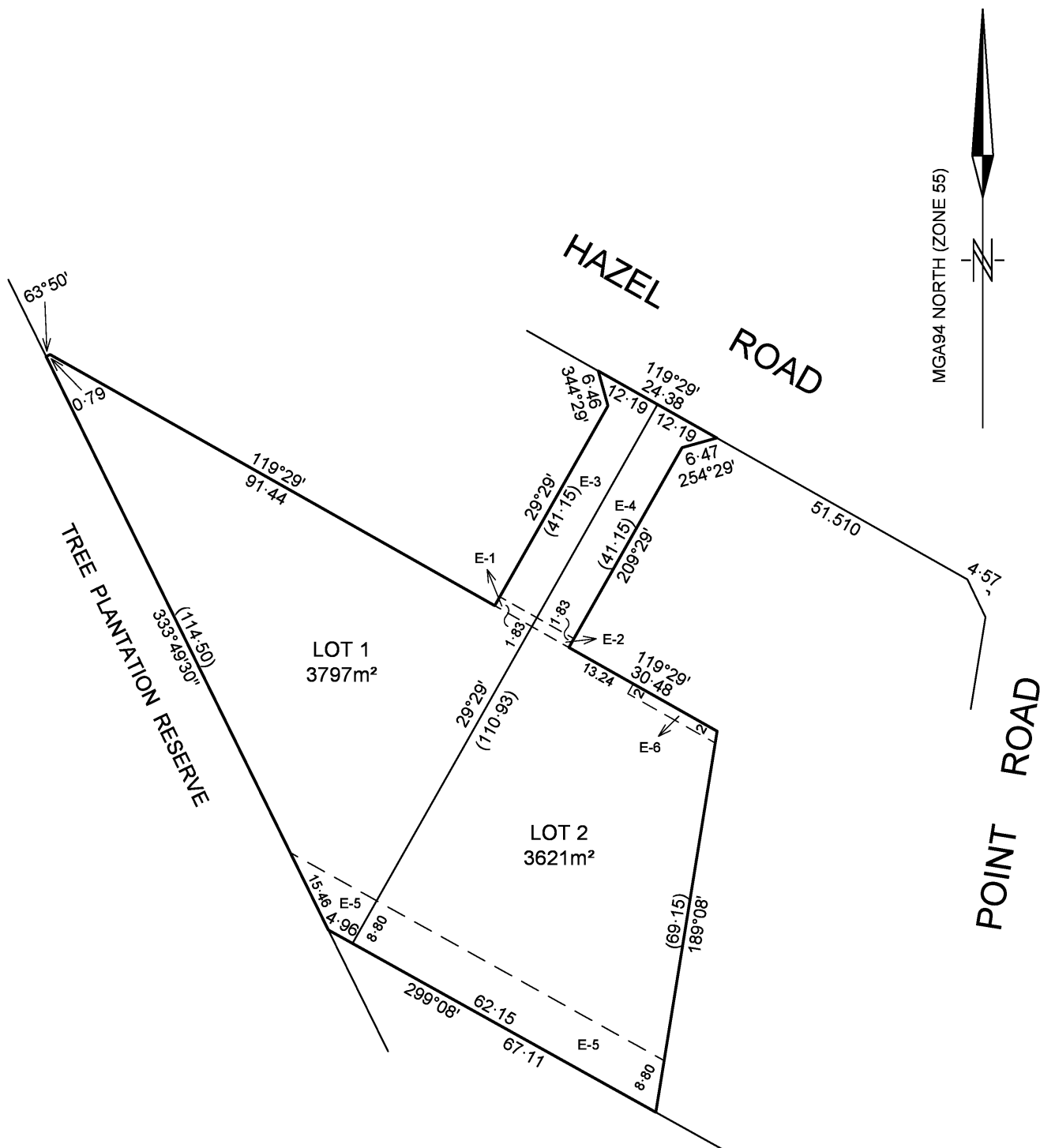


G. ANGELINI
Assistant Registrar

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PS821630M



AUSTEC SURVEYING
 BRUCE BOWDEN LS ABN 58703397201
 TITLE & ENGINEERING SURVEYORS
 LAND DEVELOPMENT CONSULTANTS
 Office: 43B NICHOLSON STREET
 P.O. Box 947 BAIRNSDALE, 3875.
 Telephone 5152 1197 Mob 0408 521197

SCALE
 1:750

7.5 0 7.5 15 22.5 30
 LENGTHS ARE IN METRES

Digitally signed by: Bruce Bowden, Licensed Surveyor,
 Surveyor's Plan Version (0),
 04/12/2019, SPEAR Ref: S150814S

ORIGINAL SHEET
 SIZE: A3

SHEET 2

Digitally signed by:
 East Gippsland Shire Council,
 29/01/2020,
 SPEAR Ref: S150814S

Printed 20/07/2026

Page 7 of 111

Planning Report

Buildings and Works (Dwelling)
56B Hazel Road, Kalimna

Our reference – 21505

May 2026



FS 520900



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Attachments

Proposed Site, Floor and Elevation Plans (*Sessionarchitecture*)

Geotechnical Investigation & Landslide Risk Assessment

(*SITE Geotechnical*)

Bushfire Hazard Site Assessment (Version 1)

Bushfire Management Plan (Version 1)

Copy of Title (Lot 2 on PS821630)

Note: Applicable Planning Application fee is Class 5 - \$1,580.10

1. Introduction

This Planning Report is prepared in support of proposed buildings and works (dwelling) at 56B Hazel Road, Kalimna. The Report addresses the provisions of the General Residential Zone, Design and Development Overlay and Erosion Management Overlay as contained within the East Gippsland Planning Scheme.



Aerial image of the subject land and surrounds (Source: Google Earth)

2. Subject Land & Surrounding Context

Formally known as Lot 2 on PS821630 or otherwise known as 56B Hazel Road, Kalimna the subject land is an irregular shaped allotment being a sequestered lot which has an access to Hazel Road with the balance of the property being located behind 58 and 60 Hazel Road and 1, 3, 5, 7 and 9 Point Road.

The subject site is characterised by a slope, generally north to south. The property is substantially clear of vegetation with the exception of a patch of native vegetation located within the south-western corner. The property is currently vacant with the western and southern boundaries unfenced.

An existing drainage easement traverses the property aligned with the rear of properties fronting Hazel Road. A sewer easement is partly located along the northern boundary of the land and an electricity easement runs the length of the southern boundary of the site. The central area of the property is unencumbered by utility easements.



View east across subject land



View south across subject land



View from western boundary of the subject land



Entry to subject land and adjoining property from Hazel Road

North of the subject land are 58 and 60 Hazel Road, both of which take access from Hazel Road. Each property is developed with a double storey dwelling constructed within the southern area of their respective properties each with views over the subject site.



Rear of dwellings at 58 & 60 Hazel Road adjacent to northern boundary of subject land

East of the site are five residential properties that front and obtain access from Point Road with private open space of each property abutting the subject land.



Image of the eastern neighbouring properties that front Point Road

West of the subject land is 56A Hazel Road which is a large vacant residential zoned property that obtains access from Hazel Road. To the south of the site is Crown land which is heavily vegetated.

The neighbourhood is characterised by a variety of architectural styles spanning several decades with mix of single storey and double storey dwellings. Properties comprise of detached dwellings setback from boundaries. Roof forms are also mixed with a variety of simple pitched roofs with hipped or gable ends, complex pitched roofs and skillion roofs. Commonly used materials are brick, timber weatherboard and fibre cement in external walls. Roofs are predominately clad with corrugated coloured steel with some tiled roofs.

The landform on the south side of Hazel Road consists of moderate to steep slopes enabling view sharing. Many properties on the south side of Hazel Road benefit from views across the waterways and Lakes Entrance township and Bass Strait.

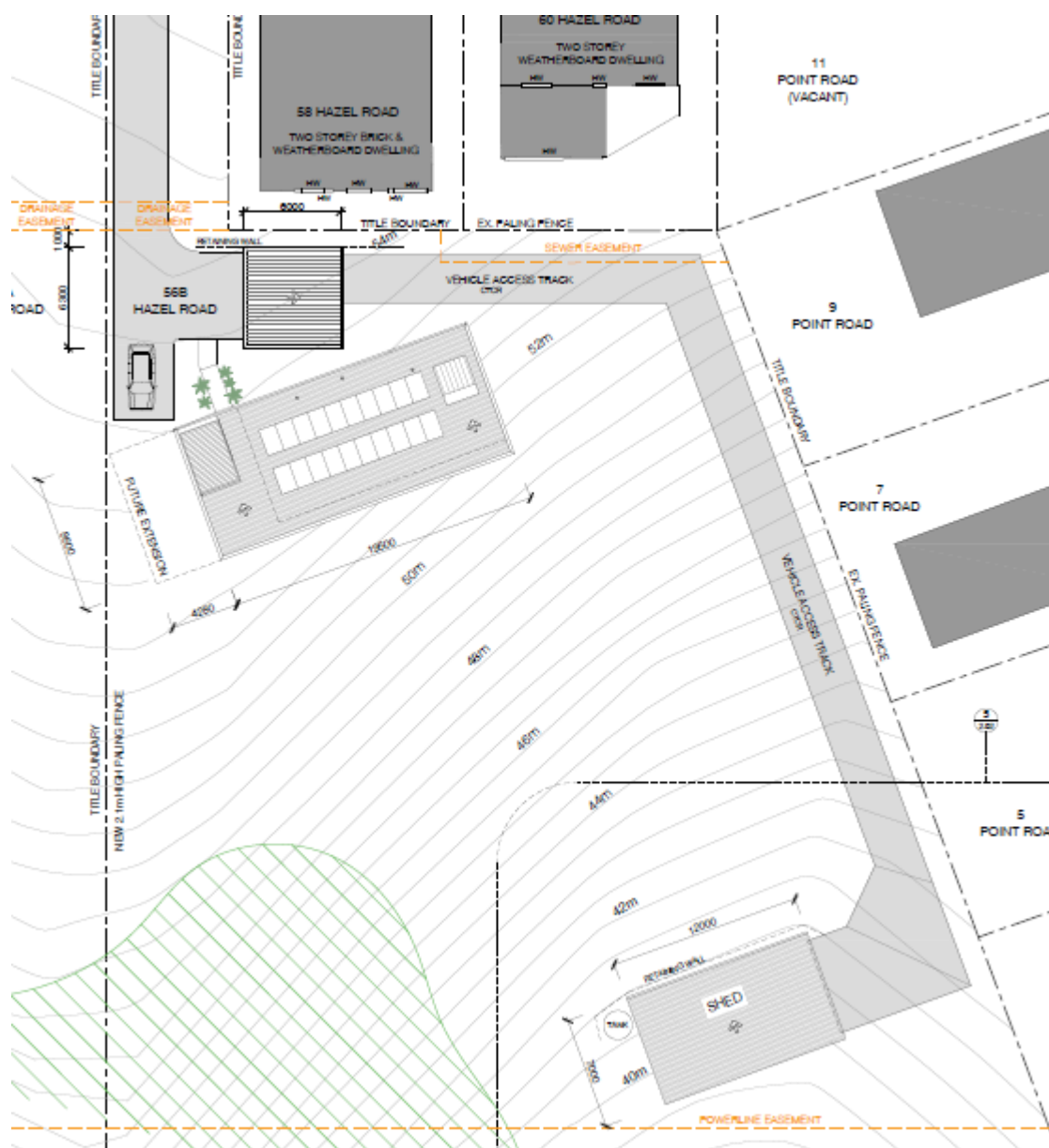
Established residential properties are substantially clear of vegetation.

3. The Application & Proposal

The application seeks approval for the development of a dwelling, carport and shed on the subject land.

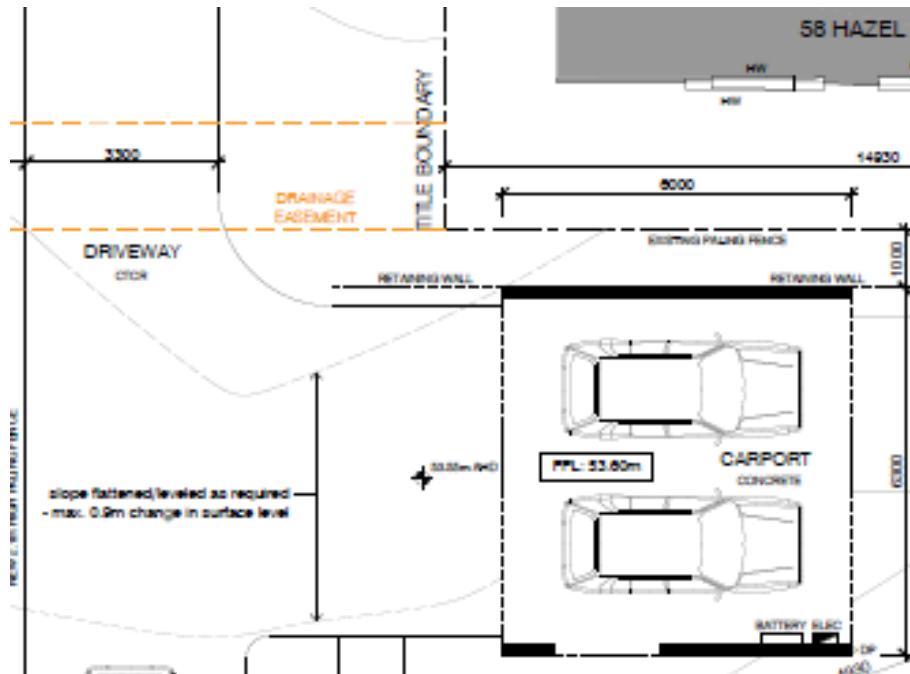
The proposed single storey dwelling and associated carport are to be located within the northern part of the subject land. Vehicle access to the carport will be provided by a gravel driveway which will also lead to an outbuilding sited in the south-east corner of the property. The total footprint for the three buildings is 326m².

The carport and shed will be constructed on moderate slopes calculated at 14% and 12.5% respectively. The slope on which the dwelling is to be constructed varies between 14% and 16%. The buildings are all single storey, the south east corner of the dwelling has a maximum height of 7.56m.



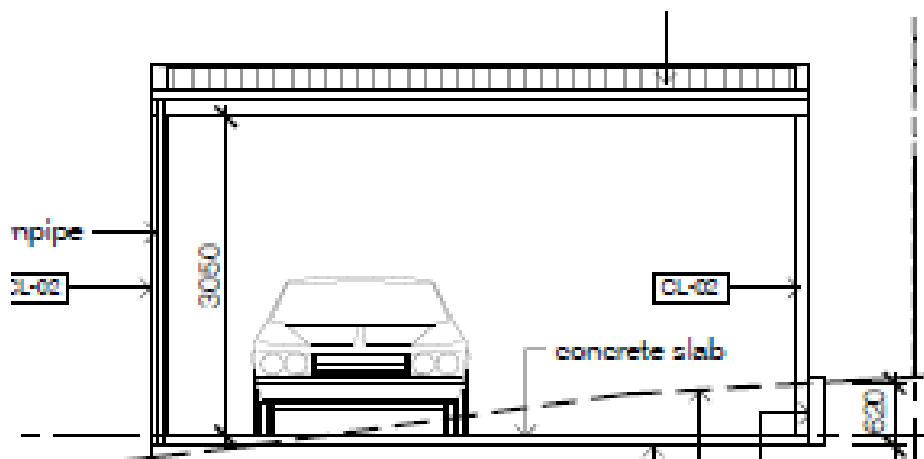
Extract of the proposed site plan (Source: Sessionachitecture)

The proposed carport will have a length of 6.3 metres and a width of 6.0 metres having an area of 37.8 square metres.



Floor plan of the proposed carport (Source: Session Architecture)

The proposed carport will have a height ranging between 3.3 metres and 3.6 metres to compensate for the site's landform with wall cladding being concrete panelling and having Kliplock roofing coloured light grey.



Extract of the proposed carport east elevation (Source: Sessionarchitecture)

The proposed elevated single storey dwelling will be constructed on piles with the highest point of the building being within the south-western corner at 7.56 metres.

It is proposed to construct the dwelling over two stages:

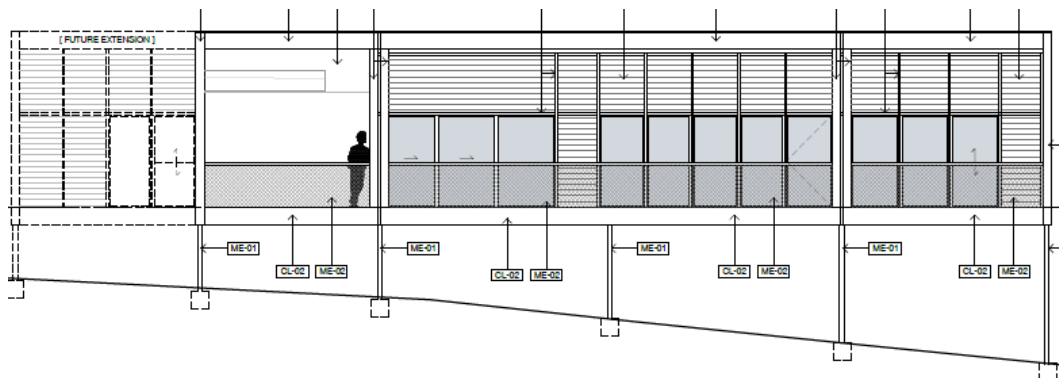
- Stage 1 will see the development of a master bedroom with walk in robe and ensuite, open plan kitchen/living/dining, laundry and toilet. A walkway leads to the entry and deck to the west and wraps around to the south of the building.
- Stage 2 includes two additional bedrooms and a bathroom.



Extract of the proposed floor plan (Source: Sessionarchitecture)

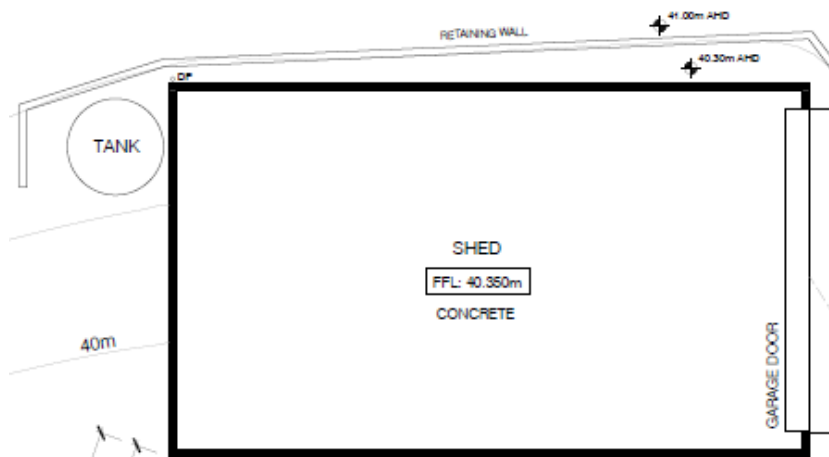
The proposed building form incorporates strong horizontal lines with a modest sloping roof incorporating a solar panel system. Northern facing highlight windows will allow solar energy access into the building, while maintaining the northern neighbour's privacy.

Wall cladding will be a combination of horizontal cladding coloured light grey, concrete panelling in a natural finish and light grey timber battens. Permeable metal mesh is proposed to surround the deck, piles will be Zincalume steel with roofing being custom orb in a light grey colour.



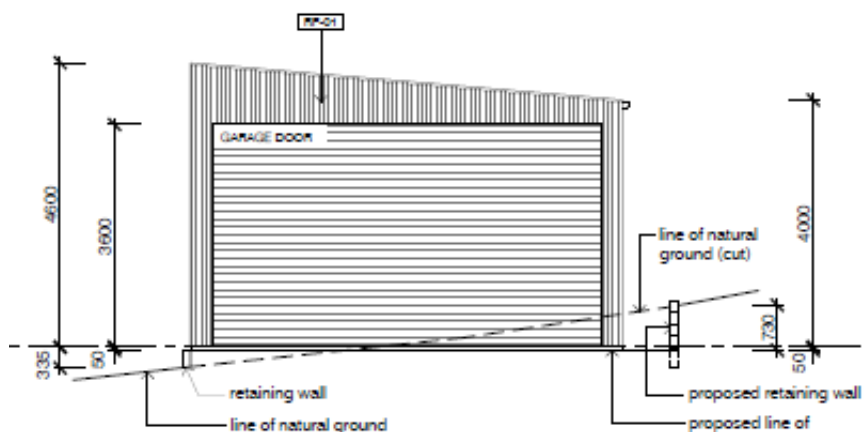
Extract of the south elevation (Source: Sessionarchitecture)

An outbuilding within the southern part of the subject land is proposed with a length of 12.0 metres and a width of 7.0 metres having an area of 84 square metres. A rainwater tank will be fitted to the western end of the building allowing for rainwater harvesting for irrigation use within garden areas.



Extract of the shed floor plan (Source: Sessionarchitecture)

The outbuilding will have a height of 4.6 metres and will incorporate a 3.0 metre high garage door within the eastern elevation. The shed will be constructed in custom orb coloured light grey.



Extract of the east elevation (Source: Sessionarchitecture)

Planning approval is required pursuant to the following Clauses of the East Gippsland Planning Scheme:

Planning Scheme Clause	Matter for which a Permit is required
43.02-2 Design and Development Overlay	Construction of buildings having a combined footprint greater than 300m ²
43.02-2 Design and Development Overlay	Construction of a building on a slope greater than 15%
43.02-2 Design and Development Overlay	Construction of a building with a height greater than 7.5 metres from natural ground level
44.01-2 Erosion Management Overlay	Buildings and works

4. Design Response

The proposed dwelling is considered to offer an appropriate response to the features and constraints of the site and to the design objectives for the township.

The proposed dwelling and outbuildings are modest in size and scale limited to single storey in height. The dwelling is located on the elevated portion of the property taking advantage of views to the south. The low scale and height of the dwelling ensures views from neighbouring dwellings are not impacted.

The dwelling is constructed on more moderate slopes and above natural ground level. The carport and shed are also on moderate slopes avoiding earthworks greater than one metre in depth.

The dwelling is located at the northern end of the property maximising the separation from the nearby bushfire hazard and native vegetation. Construction of the dwelling and outbuildings avoid the removal and of significant vegetation.

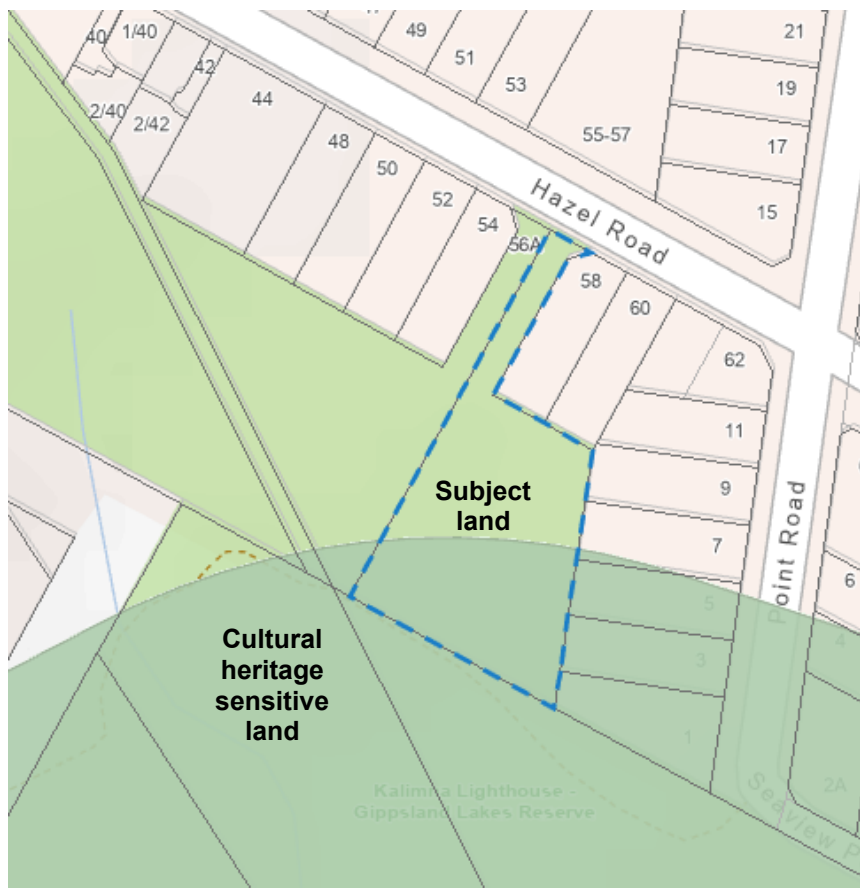
The dwelling will not be highly visible or dominant when viewed from the public realm lakes, coastal areas or distant view points.

The building will be constructed from lightweight materials including weatherboards, cement sheet panelling with selected colour finishes, custom orb and cliplock steel cladding. The selection of light muted tones is in keeping with the preferred character for the coastal settlement.

5. Cultural Heritage

Pursuant to Regulation 7 of the *Aboriginal Heritage Regulations 2018*, a CHMP is required for an activity if:

- (a) *all or part of the activity area for the activity is in an area of cultural heritage sensitivity; and*
- (b) *all or part of the activity is a high impact activity*



Extract from Cultural Heritage Sensitivity mapping – cultural heritage sensitive land is shown in dark green (Source: VicPlan)

Part of the property is contained within an area of cultural heritage sensitivity however, the construction of one dwelling on a lot is an exempt activity. As such a CHMP is not required for the proposed development.

6. Planning Policy

6.1 Planning Policy Framework

Clause 11.01-1S Settlement provides support for the proposed development of a dwelling on this large vacant serviced urban lot as the property is located within the settlement boundaries of Lakes Entrance, it promotes infill development, assists to limit urban sprawl and provides for population growth.

Consistent with Clause 12 Environmental and Landscape Values the proposal will have no detrimental impact on the local environment as the proposed dwelling will be connected to reticulated sewerage and avoids the need to remove native vegetation.

The land is contained within an Erosion Management Overlay as such Clauses 13.04-2S and 13.04-2L Erosion are relevant to the proposal. The proposed dwelling development has been designed to avoid earthworks through the use of pile construction for the main structure and minimising earthworks for the carport and outbuilding.

As encouraged within Clause 15.01-2S, the proposed dwelling has been designed to provide for an energy efficient dwelling. It is proposed to incorporate solar panels within the design, northern facing windows have been included and proposed materials are low embodied. Rainwater harvesting from the proposed shed will be undertaken for reuse on the property and minimising stormwater runoff.

The proposed form and scale of the dwelling is comparable with other dwellings in the area. The building design is respectful of the land topography avoiding significant earthworks, provides for a modest building footprint by providing a horizontal building form across the site and incorporates muted tones reducing visual appearance of the building within the landscape.

Developing a vacant, residential zoned and serviced site with a dwelling will reduce pressure on greenfield development areas and assists to minimise urban sprawl as sought within Clause 16.01-1S Housing.

6.2 Municipal Planning Strategy

Developing a dwelling on a large underutilised serviced allotment within the Lakes Entrance settlement boundary is an outcome sought within Clause 02.03-1 Settlement – Managing growth.

Clause 02.03-1 Settlement Roles advises that Lakes Entrance is a district town where the future role of the settlement is providing for population growth and infill development of established residential areas. The proposal will positively forward the desired future role of the town allowing for population growth within the Kalimna urban area.

The proposed siting of the dwelling and outbuilding has had regard to the existing vegetation on the land, being well setback and avoiding detrimental impacts as encouraged by Clause 02.03-2 Environmental and landscape values.

Careful regard to avoid the potential of erosion processes occurring as a result of dwelling construction has been considered in the dwelling design. The use of piles will negate the need to undertake significant earthworks associated with the main building construction as sought within Clause 02.03-3 Environmental risks and amenity.

Consistent with Clause 02.03-5 Built environment and heritage the proposed dwelling will provide for an energy efficient design reducing reliance on mains electricity. The proposed form and structure of the dwelling is commensurate with the surrounding urban development and will sit comfortably within the modified environment.

Clause 02.03-6 Housing advises it is projected that East Gippsland will need to provide approximately 8,300 new homes to accommodate population growth by 2041. The proposed development provides for the efficient use of residential zoned land and provides for housing supply within a well serviced district town of the municipality.

7. Planning Elements

7.1 General Residential Zone

The subject land is contained within the General Residential Zone under the East Gippsland Planning Scheme.



Planning scheme mapping (Source: Vicplan)

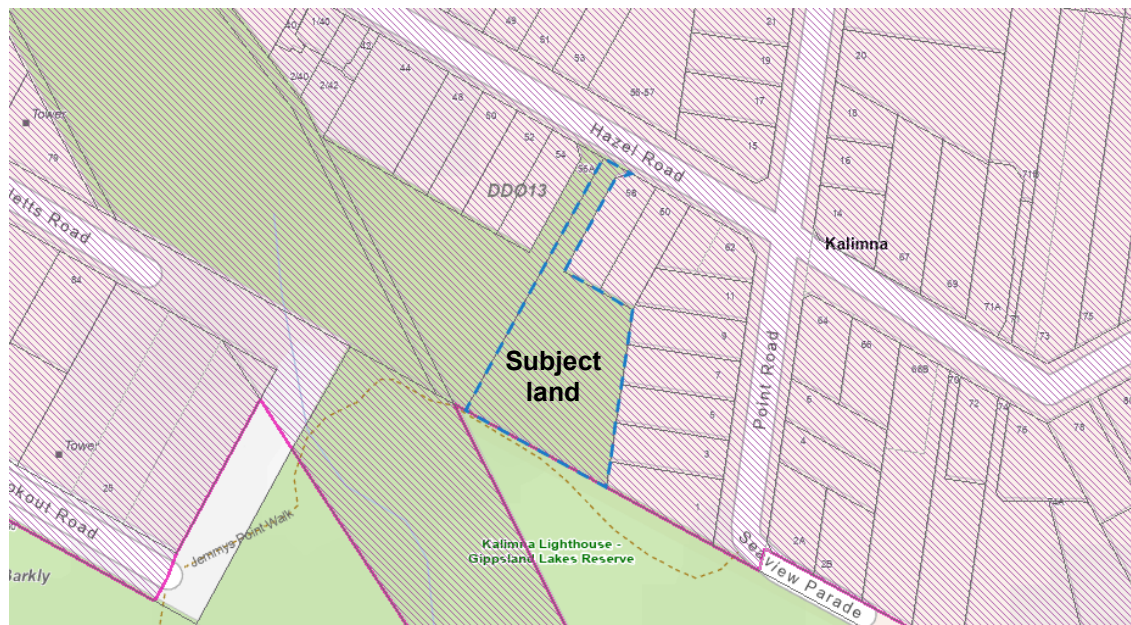
The use of the land for the purposes of a dwelling is as of right pursuant to Clause 32.08-2.

In accordance with Clause 32.08-4 the construction of the proposed dwelling on the subject land will provide for the minimum garden area of 35% of the site area.

As the lot exceeds 300 square metres a permit is not required to construct a dwelling under the zone provisions as specified within Clause 32.08-5.

7.2 Design and Development Overlay

The subject land is contained within the Design and Development Overlay, Schedule 13.



Planning scheme overlay mapping (Source: VicPlan)

Schedule 13 to the Overlay is Residential Development in Coastal Settlements: Lakes Entrance. The subject land is located within town character area 3 Kalimna.

In accordance with sub-clause 2.0 of the Schedule a planning permit is required for the proposed dwelling given the total building area is greater than 300 square metres, part of the dwelling will be constructed on a the slope greater than 15 percent and the height of the dwelling at the south-east corner is slightly more than 7.5 metres above natural ground level.

The application includes all the information as prescribed by Clause 5 of the Schedule.

Application requirement	Response
The location of any proposed buildings clearly dimensioned on its allotment.	The location of proposed buildings are included on plans submitted with the application.
Information that describes how the proposal achieves the design outcomes for the settlement as outlined in the decision guidelines of this schedule, in the form of a neighbourhood and site description, and design response.	A description of the adjoining properties is provided at Part 2 (page 4) of this report. A design response is described in Part 3 (page 11)

Application requirement	Response
The location, type and size of any vegetation to be removed.	The removal of vegetation is limited to grass.
Sufficient spot heights to enable the slope of the site and the slope of the works area(s) to be determined.	The plans include contour levels enabling the slope of the land to be determined.
The location, dimensions and depth of any proposed earthworks involving excavations or fill.	The location and depth of earthworks for the carport and shed are included on the plans submitted.
The colour, finishes and materials to be used on all external surfaces, including the roof.	A schedule of materials and colour finishes are included on the plans submitted
Proposed new planting or site landscaping works.	New planting has not yet been determined. Given the property is contained within a designated Bushfire Prone Area maximum separation should be retained between the proposed dwelling and the bushfire hazard.
An application for subdivision must include the location, type and size of trees to be removed.	There are no trees to be removed for to accommodate the proposed development.

A review of the design objectives and decision guidelines of the Schedule has been undertaken for all areas, and the following commentary is provided.

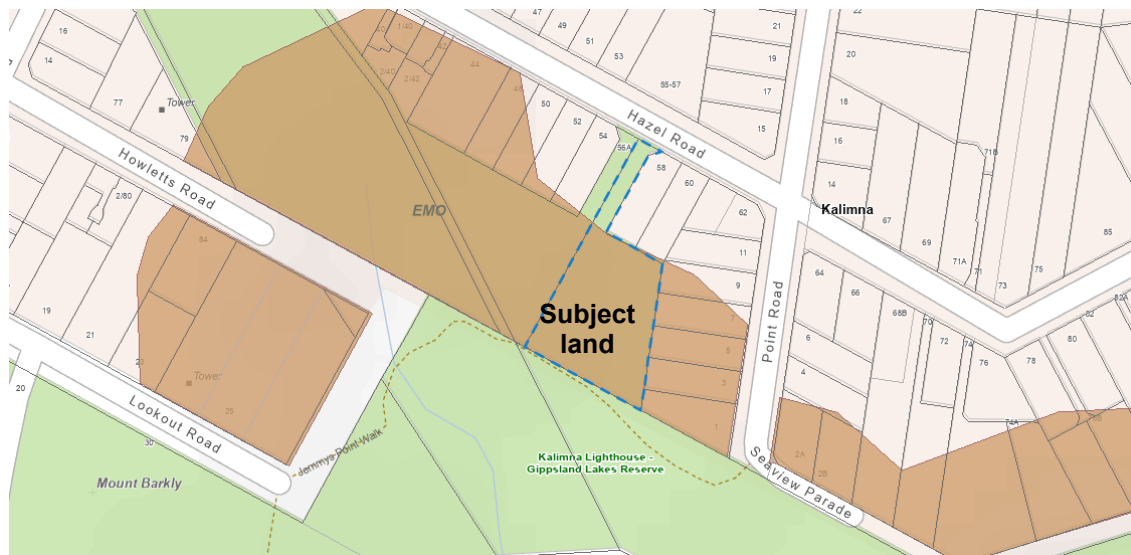
Design Objective	Response
To protect and manage the township character of coastal settlements.	The scale of the proposed dwelling is relatively modest with a building footprint of 205m ² with and a central open deck providing built form relief. The modest scale of the building is considered to be compatible with the coastal neighbourhood setting
To ensure that the height and visual bulk of new development is compatible with the coastal neighbourhood setting.	The proposed building height is reflective of dwelling heights within the area, which are generally double storey or elevated single storey buildings. While the south side of the dwelling is elevated, the building is limited to a single storey, retaining an open sub-floor structure.

Design Objective	Response
To ensure that new development is designed to minimise visual impacts on the natural landscape.	The proposed development is considered to have limited impact on the natural environment. The design of the dwelling is constructed above natural ground and avoids earthworks. Limited earthworks are required for the carport and shed.
To ensure that new development is visually and physically integrated with the site and surrounding landscape.	The dwelling is set in front of existing neighbouring buildings avoiding any visual change to the natural landscape. Proposed materials and colours to be used being muted tones will assist the building to blend with the natural environs.
To ensure that new development is sited and designed to be visually unobtrusive through and above the surrounding tree canopy when viewed from the public realm, lakes, coastal areas, or other distant viewpoints.	The site contains limited vegetation with canopy trees only in the south-west corner of the property. There is a notable absence of canopy trees on adjoining residential properties. The proposed dwelling will blend with the built form landscape and will not be visually prominent when viewed from the lake, the ocean or distant view points. Views of the subject land are limited the public realm.
To protect the vegetated character of the landscape, particularly where it is a dominant visual and environmental feature.	The character of the site and surrounds is not is not dominated by vegetation.
To maintain the generally small mass of buildings in the landscape.	The proposed dwelling is considered to be a modest size and scale compared to the size and height of double storey dwelling on neighbouring properties
Kalimna (area 3) To ensure that the design of buildings on prominent ridgelines minimises the impact of the development when viewed from distant viewpoints. To encourage the planting of indigenous tree species.	While the proposed dwelling is to be constructed on the higher portion of the property, the location is not considered to be a prominent ridgeline and is not highly visible from public areas or waterways. The property is a generous size with the ability to incorporate indigenous tree species.

It is considered that the proposed buildings and works responds appropriately to the features and constraints of the site and is satisfies the design objectives and decision guidelines under Schedule 13 and will not have a detrimental impact to the coastal urban area of Lakes Entrance.

7.3 Erosion Management Overlay

The site is subject to the Erosion Management Overlay.



Planning scheme overlay mapping (Source: VicPlan)

Schedule 1 to the Overlay is areas susceptible to landslip, within these areas the tolerable risk has to be understood and mitigated if necessary. To determine the risk sub-clause 4.0 of the schedule requires the provision of a geotechnical assessment and landslide hazard assessment. A geotechnical investigation and landslide risk assessment has been undertaken by *SITE Geotechnical*.

The assessment has concluded the site with the proposed dwelling is considered satisfactory/stable provided conditions are improved and anti-slide piles are adopted.

7.4 Clause 53.02 Bushfire Planning

The subject land is located within a Designated Bushfire Prone Area and as such Clause 53.02 applies to the proposed dwelling.

The provisions of Clause 53.02 do not apply to the carport and non-habitable outbuilding proposed in the south-east of the property as floor area of the outbuilding and carport are less than 100m².

A Bushfire Hazard Site Assessment has been prepared and is included with the application.

Response to Objectives and Standards to Clause 53.02

CLAUSE 53.02-3 Dwellings in existing settlements – Bushfire protection objective

Objective

To specify bushfire design and construction measures for a single dwelling or alteration and extension to an existing dwelling that reduces the risk to life and property to an acceptable level.

Approved Measures

AM 1.1

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 close to a public road.
- Access can be provided to the building for emergency service vehicles.

Response:

The proposed dwelling is to be constructed in the north of the property offering the maximum distance from the bushfire hazard.

The subject land is a battle-axe shape having a narrow frontage to Hazel Road. The northern end of the lot is limited to 7.6m being sufficient width for vehicle access but not for construction of a dwelling. The proposed dwelling is located approximately 60m from Hazel Road being the closest location to the road that can be achieved.

The access width at 7.6m is sufficient to provide access for emergency vehicles.

AM 12

A building is setback from the bushfire hazard in accordance with the vegetation type and slope set out in Table 1 to clause 53.02-5 in accordance with the corresponding distances.

Response:

Classifiable vegetation (the bushfire hazard) is located predominantly on the southern aspect. The vegetation has been classified as *Forest* which is established a moderate slope >5-10 degrees. A separation distance from classifiable vegetation of 39 metres can be achieved consistent with the distance prescribed in Column C under table 1 to Clause 53.02-5



View south from north-west corner of subject land

Vegetation on the western aspect is identified as *Forest* on an upslope. The *Forest* is approximately 70m from the proposed dwelling location. The adjoining property to the west is substantially clear of vegetation with a continuous cover of grass maintained in a low fuel condition.



View west across adjoining property from west side of subject land

AM 1.3

The setback between the building and the bushfire hazard is managed as an area of defendable space in accordance with the vegetation management requirements specified at Table 4 to clause 53.02-5 for the distance that satisfies AM 1.2 and the area is capable of being maintained in accordance with these requirements.

If adjoining land is included in the setback, there is a reasonable assurance that the adjoining land will remain or continue to be managed in accordance with Table 4 to clause 53.02-5.

Response:

The setback between the proposed dwelling and classifiable vegetation on the southern aspect consists of grass and able to be maintained as defendable space by the landowner in accordance with the requirements prescribed in Table 4 to Clause 53.02-5 for a distance of 39m from the dwelling.

Vegetation within the adjoining residential properties to the east, north and west is **Low threat**. Given the current standard of vegetation management occurring on the adjoining property to the west it is reasonable to assume this will continue and will provide a generous separation distance between the proposed dwelling and the bushfire hazard (Forest) contained on public land within the assessment area.

AM 1.4

A building is constructed to the bushfire attack level that corresponds to a setback that satisfies either:

- AM 1.2.
- The next lower bushfire attack level in accordance with Table 1 to clause 53.02-5 where all of the following apply:
 - A private bushfire shelter (a Class 10c building within the meaning of the Building Regulations 2018) is constructed on the same land as the dwelling.
 - A minimum bushfire attack level of BAL12.5 is provided in all circumstances.

Response:

The separation distance that can be achieved from the bushfire hazard corresponds to a bushfire attack level 29 (BAL-29). Construction of the dwelling can therefore satisfy AM1.2.

AM 1.5

A building is provided with:

- A static water supply for fire fighting and property protection purposes specified in Table 2 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.
- Vehicle access that is designed and constructed as specified in Table 3 to clause 53.02-5.

Response:

The subject land has an area greater than 1,000m² and therefore a static water supply of 10,000 litres will be provided in accordance with the requirements of Table 2 under Clause 53.02-5. The static water supply will be located within 4 metres of the driveway.

The internal driveway is less than 100 metres in length. The driveway has a width of 3.5 metres with 500mm clearance either side in accordance with the requirements of Table 3.

8. Conclusion

The proposed buildings and works (dwelling) at 56B Hazel Road, Kalimna is considered to accord with all relevant provisions of the General Residential Zone, Design and Development Overlay 13 and Erosion Management Overlay of the East Gippsland Planning Scheme. The proposal is consistent with the Planning Policy Framework and Municipal Planning Strategy and has been designed to complement the coastal character of Lakes Entrance.

For these reasons we respectfully request that Council consider the merits of the application favourably and resolve to issue a Planning Permit.



18 September 2024

Glenn Reimers

Heidelberg VIC 3084

Attention: Glenn Reimers

Dear Glenn,

RE: PROPOSED DWELLING, 56B (LOT 2) HAZEL ROAD KALIMNA
GEOTECHNICAL INVESTIGATION & LANDSLIDE RISK ASSESSMENT

Please find attached our report on the Geotechnical Investigation & Landslide Risk Assessment for the Proposed Dwelling project located at 56B (lot 2) Hazel Road, Kalimna.

Should you have any queries or comments regarding this report please feel free to contact the undersigned.

Regards

A handwritten signature in blue ink, appearing to be 'Frank Tostovrsnik', written over a dotted line.

Frank Tostovrsnik B.E. (Civil) Hons.
Senior Geotechnical Engineer
SITE GEOTECHNICAL PTY LTD

To contact us:

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Phone: 1300 557 260 | <http://www.sitegeo.com.au> | Email: admin@sitegeo.com.au

SITE Geotechnical

Soil Investigation Testing & Evaluation



Geotechnical Investigation & Landslide Risk Assessment

Proposed Dwelling
56B (lot 2) Hazel Road
Kalimna

18 September 2024
Report R8790-1

For
Glenn Reimers

Heidelberg VIC 3084



To contact us:

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Phone: 1300 557 260 | <http://www.sitegeo.com.au> | Email: admin@sitegeo.com.au

SUMMARY

Based on the findings from our slope modelling, site visit and plans provided it has been determined that the existing slope with the new proposed dwelling is considered satisfactory/stable from a landslide perspective if conditions are improved and anti-slide piles are adopted.

Site Geotechnical considers that tolerable risk conditions can be created during the lifetime of the project should the following measures be properly implemented¹. **These requirements should be considered as compulsory requirements for the development of the proposed project** as the assumptions, analyses, conclusions and recommendations presented within this report may become invalid if these requirements are not adequately carried out.

- The Guidelines for Hillside Construction from the AGS should be followed (**Appendix D – Some Guidelines for Hillside Construction**).
- In order to increase the stability of the site consideration should be given to adopting a row of anti-slide piles (stabilising piles) approximately 2m downslope of the proposed dwelling. As a guide pile diameters are anticipated to be $B=0.6\text{m}$, pile lengths are anticipated to be $L=7\text{m}$ deep and pile spacings (centre to centre spacings) are anticipated to be approximately $5B=3\text{m}$. Anti-slide piles should be installed prior to constructing the dwelling.
- It is recommended that the dwelling be founded on piles designed following engineering principles.
- Plans should be prepared/updated based on these report specifications and then presented to Site Geotechnical for their geotechnical revision.
- Retaining walls designed using engineering principles could also be considered.
- It is important that landowners, neighbouring properties and Council assures good hillside construction, slope management and maintenance in the area in order to maintain stable slope conditions and the assumptions made within landslide risk assessments. Elements such as the drainage systems of the area (including roads, drains/stormwater, etc.) should have the appropriate design, construction, supervision and maintenance.

Should site conditions change (ie poor drainage conditions, rise in groundwater table, flooding saturation of soils, increased surcharges, removal and/or loss of further vegetation, bushfire etc) then factors of safety could worsen. This highlights the importance of maintaining good vegetation, drainage and hillside practices across the site.

¹ The list within the summary is not exhaustive, additional measures regarding (but not limited to) drainage, vegetation etc are provided within the report however are too extensive to be outlined within the summary.

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1 INTRODUCTION

This report presents the findings of a Geotechnical Investigation & Landslide Risk Assessment undertaken by Site Geotechnical Pty Ltd for the Proposed Dwelling project located at the 56B (lot 2) Hazel Road, Kalimna. The work was commissioned by Glenn Reimers. The investigation was carried out in accordance with our proposal, reference Q8790, dated 14 September 2021.

2 OBJECTIVES AND SCOPE OF WORKS

The main objective of this geotechnical investigation is the characterisation of the soil profile for geotechnical design/analysis. The scope of works and methodology adopted has been based on site-specific conditions and information supplied.

2.1 Field Investigation and Testing Scope of Works

- Assess the existing condition through a visual condition survey
- Assess and identify components of existing layers and subsurface (or subgrade) soils and rock including any unusual conditions and groundwater conditions which will include visual and tactile assessment of materials encountered and provide interpretation of these findings within engineering logs generally complying with Australian Standard AS1726,
- At nominated test sites perform the Standard Penetration Test (SPT) to assist in the assessment of strength characteristics of underlying soils complying with Australian Standard AS1289.6.3.1,
- At nominated test sites perform dynamic cone penetrometer (DCP) tests to assist in the assessment of strength characteristics of underlying soils complying with Australian Standard AS1289.6.3.2,
- At nominated test location(s) undertake soil and material sampling for the purpose of further material assessment through laboratory testing

2.2 Laboratory Testing Scope of Works

- The laboratory testing was carried out in general accordance with the Australian Standard AS1289 including Methods of Testing Soils for Engineering Purposes
- Moisture content on selected samples in accordance with AS1289.2.1.1
- Laboratory soil classification using the Atterberg limits in accordance with AS1289.3.1.2, AS1289.3.2.1, AS1289.3.3.1 and AS1289.3.4.1 and sieve analysis in accordance with 1289.3.6.1.

2.3 Engineering & Reporting Scope of Works

- Report and graphically represent engineering log data
- Report and summarise visual conditions observed
- Prepare a report presenting the factual findings of the investigation together with comments relating to the design and construction options for the proposed works
- Provide a landslide risk assessment (LRA) for the proposed project following the Australian Geomechanics Society (AGS) 2007 Guidelines for the person most at risk.
- Evaluate suitability of the site and proposed project.
- Provide alternatives for risk mitigation measures if required.
- Undertake slope modelling to estimate factors of safety.

3 SITE DESCRIPTION

The surrounding topography is generally undulating to hilly terrain however becoming hilly/steep terrain closer to the inferred creek or drainage channel to the south west of the block, see Appendix A – Location Plan and the below pictures. The observed surrounding development comprises of a rural township area². An approximate location of the site is presented within Appendix A.



Figure 3-1 Aerial Image Highlighting Lot 1 and 2



Figure 3-2 Lot 2 (56B Hazel Road, Kalimna)

² Should further or more detailed information regarding the surrounding features of this site be required a specific neighbourhood and site description investigation possibly including a land survey should be carried out.

3.1 Vegetation

The majority of the slope comprised of grasses with the slope nearest to the creek/drainage reserve appearing to be generally well vegetated. According to Glade et al (2005), Vegetation affects the stability of soils and slopes in two major ways: first, by modifying components of the hydrological cycle largely through the processes of interception, evapotranspiration and infiltration; and second, by contributing strength to the soil via roots. "Removal of vegetation permits an increase in erosion (runoff)...an increase in infiltration during rainy periods (which may include an increase of groundwater level), and an increase in evaporation during dry spells resulting in surface desiccation and cracking" (Hunt, 2007).

Vegetation can have different effects on slope stability. Changes made by humans to the natural vegetation and environment are the most likely to cause detrimental consequences or effects on the slope stability if these changes are undertaken without proper analysis. Density of vegetation is an important factor in slope stability. Recently cleared upslope areas for logging, farming, or grazing are very likely to be locations where failures will occur in freshly made cuts, or in old cuts during severe weather conditions (Hunt, 2007).

3.1.1 General Effects of Vegetation in a Soil Slope Stability

- According to Hunt (2007) "Removal of vegetation permits an increase in erosion (runoff), a reduction in strength in the shallow portions of the slope from the loss of root structure, an increase in infiltration during rainy periods (which may include an increase of groundwater level), and an increase in evaporation during dry spells resulting in surface desiccation and cracking".
- According to Marden and Rowan (1993), rainfall-initiated shallow landslides have a higher probability to occur within grassed hill-slopes than slopes within an intact forest. Their study undertaken in New Zealand have shown that grassed hill-slopes are between 4 and 16 times more susceptible to this type of landslide than slopes with a mature standing-forest cover.
- Yarra Ranges Council has established within its Community Emergency Risk Management Plan 2010 that "Vegetation helps to reduce the risk of landslips by drawing moisture out of the ground, and the roots of plants, particularly trees hold the ground together. The loss of forest cover has a destabilising effect on the soil, when extensive root systems that bind the soil have largely gone and excess water formerly used by trees now remains in the soil. When trees are removed, the remaining roots left in the ground will still help hold the ground together for the short term, but in the long term, these roots will rot away and leave gaps in the soil that make it very weak".
- Tree roots create lateral (tensional) strength within the soil as well they enhance the soil compression shear strength (O'Loughlin and Zhang, 1986). This effect is highly dependent on the tree density.

3.2 Rock

No exposed area of rock that is inferred to be continuous with underlying rock was observed within the site though some inferred weathered sandstone type material was observed in road cuttings along the Princes Highway to the south of the site as illustrated in the google maps picture below. Furthermore, subsurface exploration did not encounter auger refusal within the depth of investigation.



Figure 3-3 Rock Outcrop Observed along Princes Highway (Google Maps)

3.3 Fill³

The presence of fill is normally regarded with caution as it is often associated with high variation in strength, poor bearing capacity and potential for differential settlement. Non-engineered fills, which have been placed under uncontrolled conditions, can lead to settlement and/or differential movement. Observations across the site inferred that soil disturbance could be broadly categorized as essentially having a low likelihood of effective disturbance close to the slope however some fill was located at the top of slope within borehole 04, this fill may be related to previous works such as the removal of vegetation and previous landscaping earthworks.

3.4 Desktop Study Evidence of Recent and Past Landslide Activity

3.4.1 Observations During Site Inspection

Some minor instability was identified within the vegetated area towards the south west of the block during our inspection where a relatively shallow translation or rotational landslide was observed as illustrated below. Further, anecdotal evidence provided by neighbours during our site inspection indicates that they have witnessed shallow failures within the grassed section of the slope.



Figure 3-4 Minor Landslide within South West Corner of the Site

³ The extent to which non-engineered fill will be suitable as foundation material depends largely on its age, composition, uniformity, properties and the method by which the material was placed. Therefore with these factors unknown it is recommended that footings and pavements are founded into the naturally occurring soils through the filling where possible.



Figure 3-5 Previous inferred cut within the South East Corner of Lot 1

3.4.2 Historical Landslide Activity

A brief desktop review of nearby landslide activity did not highlight any major historical landslides within or near the site. Review of a recent GHD report which was commissioned by the Department of Environment, Land, Water and Planning (DELWP) to undertake a review of the existing planning controls in place in East Gippsland Shire LGA (EGSC), titled “Landslide and Erosion Hazard and Planning Review East Gippsland Shire” dated 12 January 2023 highlights that the in an overall sense across the LGA there does not appear to be many recognisable landslides as highlighted in the excerpt below.

“In the East Gippsland LGA area it was noted during discussions with former DPI employees that the extensive erosion assessments that have been completed over the decades by experienced soil scientists with significant local knowledge did not consider that landslides (other than debris flows) were a significant factor with regards to erosion in the area. This is believed to indicate the relative lack of recognisable landslides in the LGA.

Furthermore, discussions with Josh Coleman, a project engineer (engineering, state roads and crossing) at DELWP identified that most slope stability issues encountered are due to poor construction of the historical road network and not related to natural slope instability. This is consistent with the view of the geotechnical risk lead at Department of Transport/VicRoads, Justin Slater, and was further reinforced following discussion with local consultants and the CMA.”

The above information is provided in a general sense and does not mean that this particular site is risk free as discussed later in our report.

3.5 Site Drainage

Maintaining good drainage conditions is vital in reducing landslide risk. It is important that land owners, neighbouring properties and Council/Shire assures good hillside construction, slope management and maintenance in the area in order to maintain stable slope conditions and the assumptions made within landslide risk assessments. Elements such as the drainage systems of the area (including but not limited to roads, driveways, drains/stormwater, etc.) should have the appropriate design, construction, supervision and maintenance. A system should be in place to monitor potential leakages within the vicinity of slopes and appropriate measures implemented to undertake rectification works as required.

3.6 Site Climate

The site has a temperate climate with slightly warm summers (approximately between 13.2° C to 24.3° C) and cold winters (approximately between 6.0° C to 16.1° C). The site experiences an approximate average rainfall of about **737 mm/year** based on information from surrounding weather station Lakes Entrance (Eastern Beach Road) station number 84150 (Latitude: 37.87° S Longitude: 148.01° E, Elevation: 4 m) which is about 3.3 km from Kalimna. More information can be found in the Bureau of Meteorology webpage. <http://www.bom.gov.au/climate/data/>.

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	47.3	50.8	62.0	64.4	41.5	82.3	47.9	56.4	49.3	65.8	79.1	77.0	736.6
Lowest	4.6	12.8	13.2	4.6	16.0	12.6	7.8	22.4	17.4	10.2	18.2	12.6	404.6
5th %ile	6.7	15.5	14.1	16.0	16.0	14.8	9.8	25.1	21.8	14.1	22.3	17.9	468.3
10th %ile	13.8	25.9	14.6	22.3	17.3	25.7	11.6	26.7	24.1	21.4	25.9	31.3	497.7
Median	39.5	43.2	63.6	58.2	29.2	45.0	38.4	44.6	41.0	69.4	63.9	68.6	774.4
90th %ile	82.5	88.2	112.2	130.4	70.1	178.3	85.3	91.3	83.5	106.4	158.4	142.5	934.6
95th %ile	92.2	97.6	124.3	140.5	76.0	270.7	97.0	94.8	87.1	131.7	166.7	147.8	954.2
Highest	107.2	101.2	148.6	154.8	93.2	297.6	111.7	100.2	103.8	136.8	170.6	157.1	985.2

Figure 3-6 Summary statistics of monthly average rainfall

Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years
Temperature														
Mean maximum temperature (°C)	24.3	23.6	22.6	20.1	17.8	15.2	15.4	16.1	18.1	19.6	21.0	22.7	19.7	2008 2024
Mean minimum temperature (°C)	15.2	14.8	13.6	11.1	8.5	6.6	6.0	6.5	7.7	9.6	11.6	13.2	10.4	2008 2024

Figure 3-7 Summary statistics of average monthly temperature

4 SUBSURFACE CONDITIONS

4.1 Geology

Geological information obtained from the Department of Energy, Environment and Climate Action, Victoria, Australia indicates that the site is in the geological areas of Haunted Hills Formation bordering Coastal dune deposits as described below.

Haunted Hills Formation (Nlh): generic

Sand, silt, gravel: various shades of brown, yellow, red, white; variably sorted; variably rounded; crudely to well-bedded; commonly strongly oxidised with ironstone near the top and also within the formation

Pliocene to Pleistocene (over-bank stream flow - fluvial [environment])

Bordering

Coastal dune deposits (Qdl1): generic

Sand, silt, clay: well sorted, poorly consolidated; coastal dune and beach deposits, some swamp deposits

Holocene to Holocene (sand deposition - beach-ridge strandplain [environment])

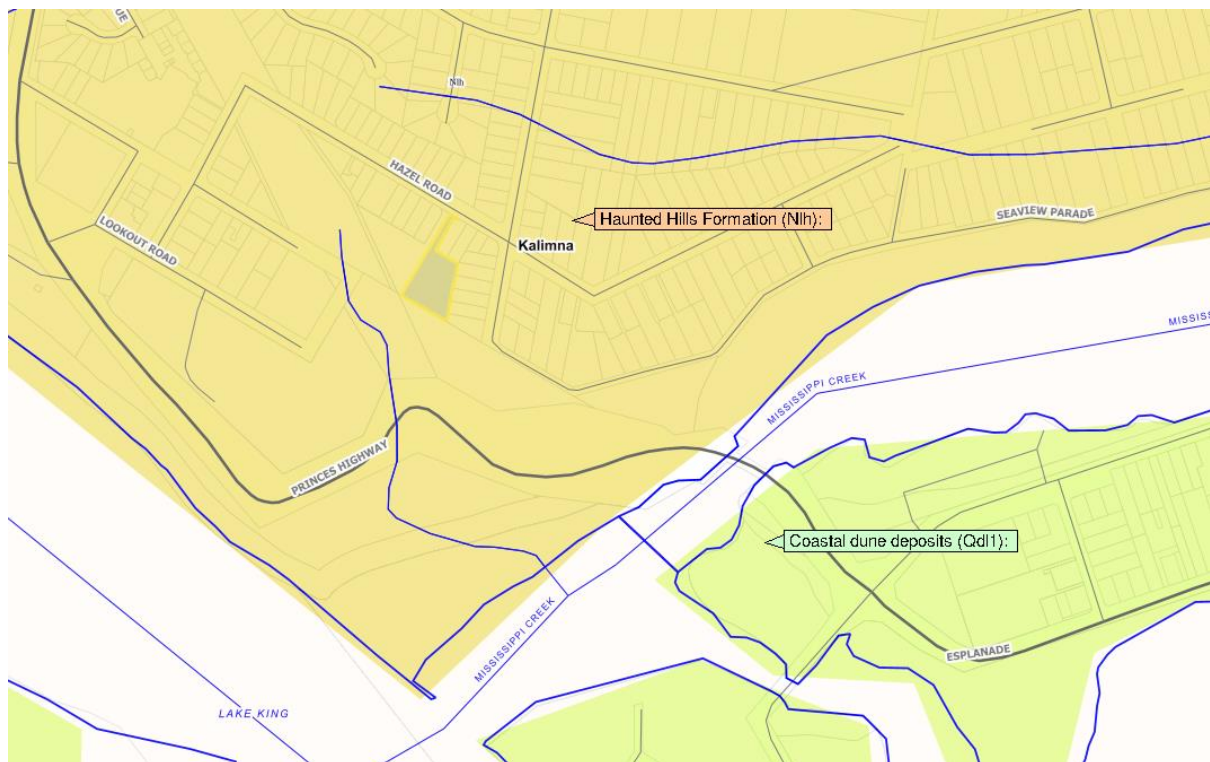


Figure 4-1 Geology of site and surrounds (watercourses shown in blue)

4.1.1 Weathering of Sedimentary Rock (Siltstone / Sandstone)

The weathering of sedimentary (siltstone / sandstone) rock usually follows a typical pattern. This typical pattern is illustrated within the figure below.

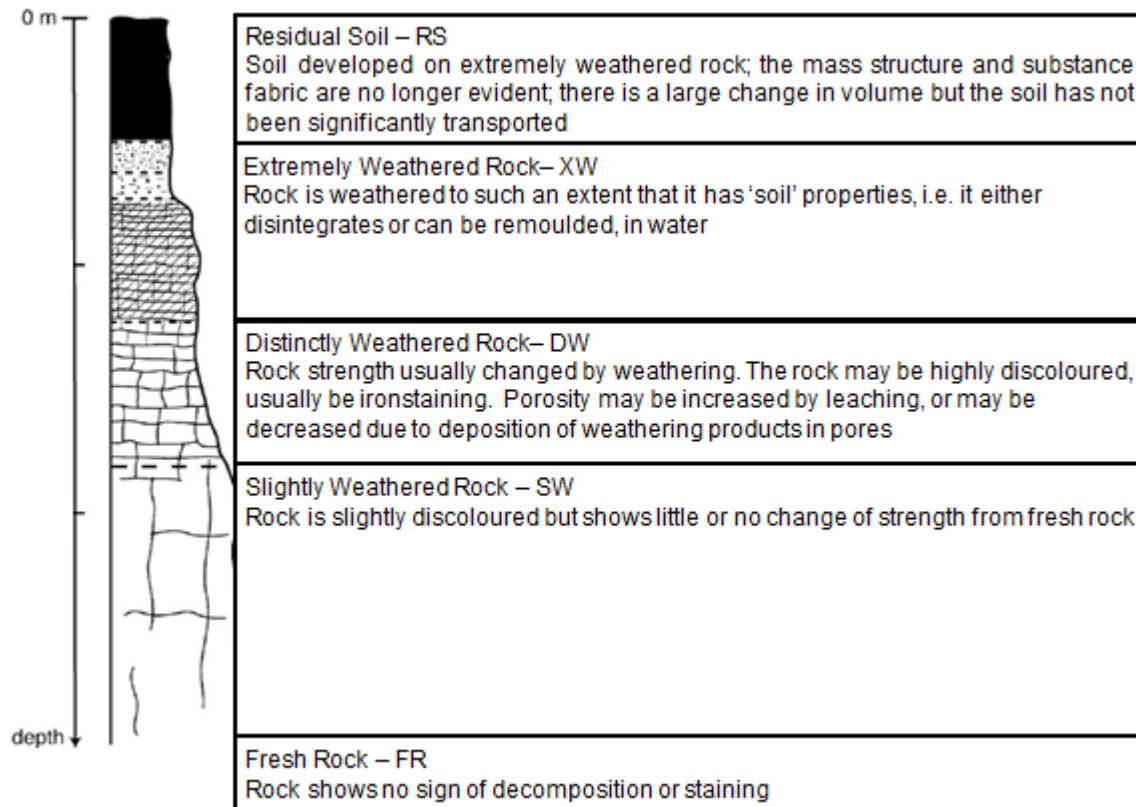


Figure 4-2 Weathering of sedimentary (siltstone/sandstone) rock

Sedimentary rock can vary greatly in strength. Some sandstones are stronger than many igneous rocks while siltstone sometimes referred to as soft rock can be relatively weak (similar in strength to residual soil). Bedding may not show in hand specimens (via drilling) and is best seen in outcrops or large excavations.

4.2 Soil Profile Disclosed from Engineering Logs

The general soil profile recorded during the investigation is summarised as follow:

- Layer 1 - Variable FILL
- Layer 2 - CLAY
- Layer 3 - Sand / Silty Sand / Clayey Sand

Detailed engineering logs are attached within Appendix C – Borelogs & Laboratory Results with approximate locations shown within Appendix A – Location Plan the figure below represents a general graphical summary of the underlying profiles encountered.

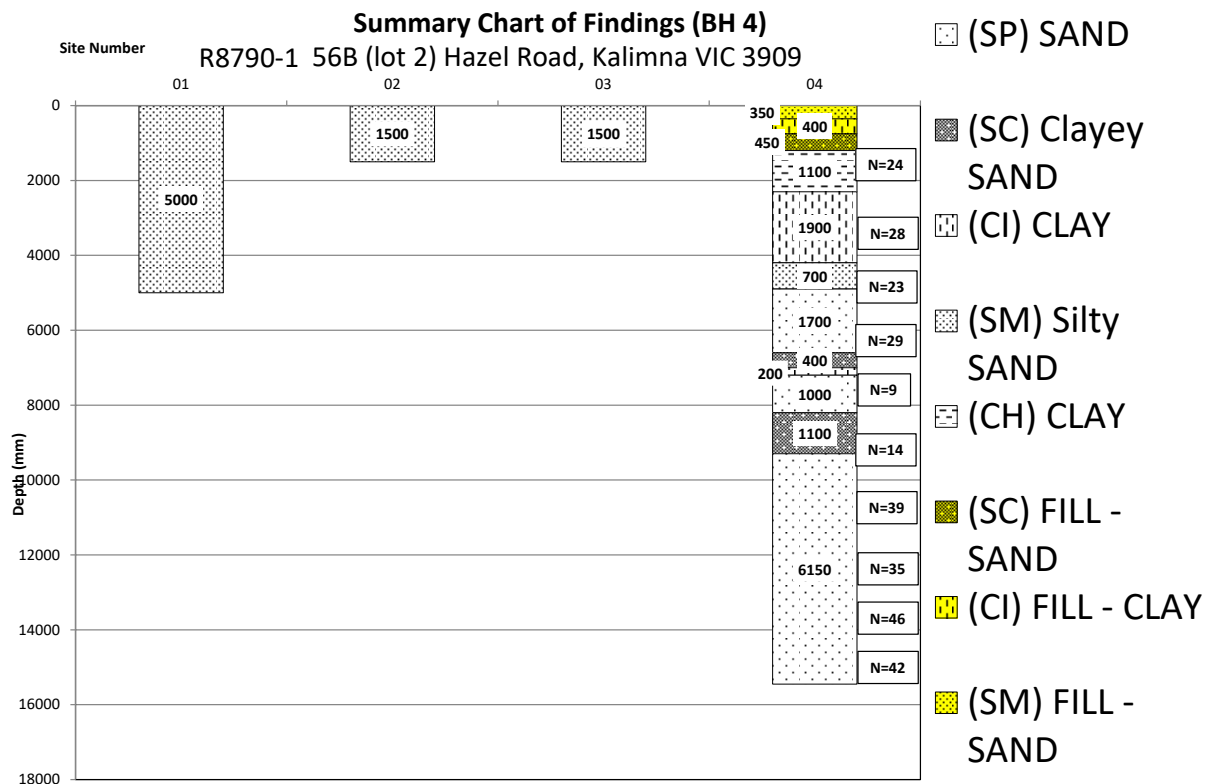


Figure 4-3 General soil profile

The (N) counts from SPT⁴ indicate the following approximate soil densities and consistencies:

- N value of 0 indicates SPT falling under its own weight.
- N values less than 2 indicate very soft/very loose soils.
- N values between 2 and 5 indicate soft/very loose soils.
- N values between 5 and 10 indicate firm/loose soils.
- N values between 10 and 20 indicate stiff/medium dense soils.
- N values between 20 and 40 indicate very stiff/dense soils.
- N values greater than 40 including Hammer Bouncing (HB) indicate hard/very dense soils.

⁴ The standard penetration test (SPT) gives a value for the penetration resistance of any soil.

4.3 Groundwater

Water exists in different forms and in different places and for widely varying times in the hydrologic cycle. Groundwater or soil moisture content depends on several factors such as permeability, infiltration rate, plant use, hydraulic gradient and surface runoff and evapotranspiration (Delleur).

Observations during the undertaking of engineering logs revealed evidence of groundwater within borehole 01 at the bottom of the slope where the sands were described as becoming wet at 3.5m. Information obtained from Visualising Victoria's Groundwater maps indicates that the groundwater table may be found within 20 to 50m from the surface (as a guide).

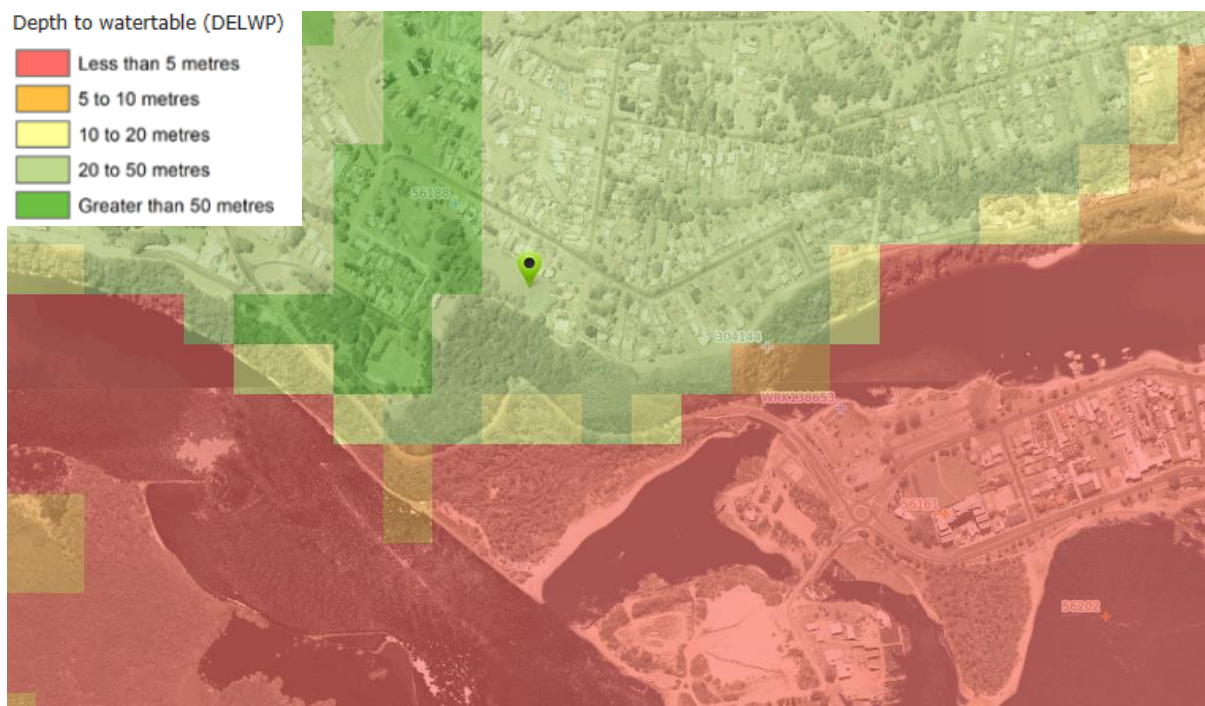


Figure 4-4 Depth to Watertable of Site and Surrounds

Should further or more detailed information regarding groundwater at this site wish to be obtained a specific groundwater investigation including surveying, the installation of piezometers, periodic monitoring, and groundwater bore licensing (where required) should be carried out. For higher levels of groundwater assessment consideration should be given to engaging a hydrogeologist.

5 LABORATORY TESTING

Laboratory testing was undertaken on selected samples. The laboratory testing was carried out in general accordance with the Australian Standard AS1289 including Methods of Testing Soils for Engineering Purposes and are presented within the appendixes. A summary of the laboratory test results are presented within the tables below:

Table 5-1 Particle size distribution

SAMPLE INFORMATION				Sieve Analysis																
Test Site	Field Description	Sample		Sample I.D.	% Passing Sieve Size (mm)															
		From (mm)	To (mm)		53.0	37.5	26.5	19.0	13.2	9.5	6.7	4.75	2.36	1.18	0.60	0.425	0.300	0.150	0.075	
04	y, CLAY	2,300	3,000	S8790-1-04C	100	100	100	100	100	100	100	100	100	100	99	98	96	93	89	

Table 5-2 Atterberg limits and soil classification

SAMPLE INFORMATION					TEST RESULTS					
Test Site	Field Description	Sample		Sample I.D.	Field MC (%)	Atterberg Limits (%)				LCS
		From (mm)	To (mm)			LL	PL	PI	LS	
04	Silty, CLAY	2,300	3,000	S8790-1-04C	20.7	45	20	25	8.0	CI

Where: LL = Liquid Limit, PL = Plastic Limit, PI = Plasticity Index, LS = Linear Shrinkage, LCS = Laboratory Classification of Soil, NP= non plastic, N/O= Not obtained,

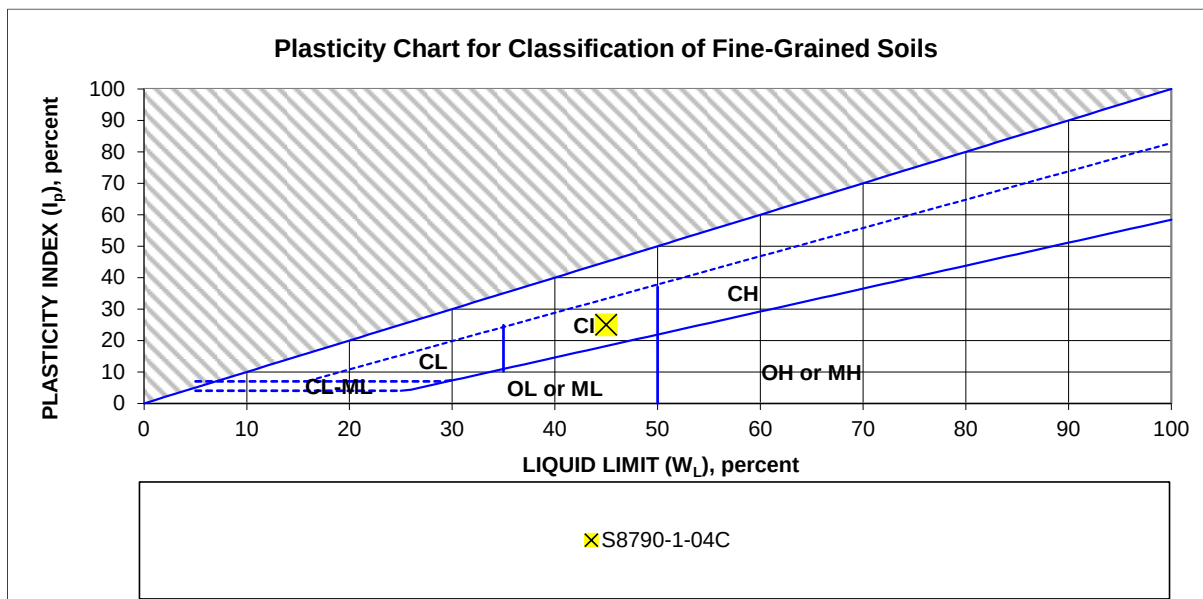


Figure 5-1 Plasticity Chart for Classification of Fine-Grained Soils

6 LANDSLIDE RISK ASSESSMENT

6.1 Hazard Analysis: Landslide Characterization

It is considered that the site is most susceptible to rotational or translational earth slides under adverse conditions (such as over wet soils from poor drainage) This potential type of landslide is considered to pose some risk to the proposed project. Consequently, good hillside construction practices and risk mitigation measures are deemed necessary to keep the levels of risks within tolerable limits. Risk mitigation measures should be focused on good hillside construction, slope management, improved drainage and maintenance.

- Rotational earth slide: This type of failure can be associated with topography that has a spoon shape. Shallow and deep seated slides and slope angles typically ranging from 20° to 40° could be expected. Small to large scale events may be considered to occur under adverse conditions. Intense and / or sustained rainfall, earthquake and poor drainage conditions on the top or crest of the slope may trigger this type of mechanism. Their velocity may range between extremely slow to moderate. Short travel distances can be expected.
- Earth translational slide: The contact between the upper soil layers, which usually present S.P.T. blow counts less than 10, and the underlying rock or hard or very dense soil creates a potential slip surface for translational slides. Small to medium scale events can be considered to occur. Intense and / or sustained rainfall, leakage from pipes, under-cuttings or erosion of the toe can trigger this type of mechanism. Moderate to rapid velocities and short to medium travel distances can be expected.

6.2 Slope Modelling

6.2.1 Analysis Input-Geometry and soil Profile

The cross section for slope stability analysis has been created based on Crowther and Sadler survey plan reference 19557 dated 29 June 2021, see Appendix B – Crowther & Sadler Survey Plan 19557 Cross Section. The soil profile has been created based on the borelogs and in-situ testing undertaken by Site Geotechnical. Additional laboratory testing could be considered to further refine the soil parameters selected within the slope model.

6.2.2 Slope Stability Analysis

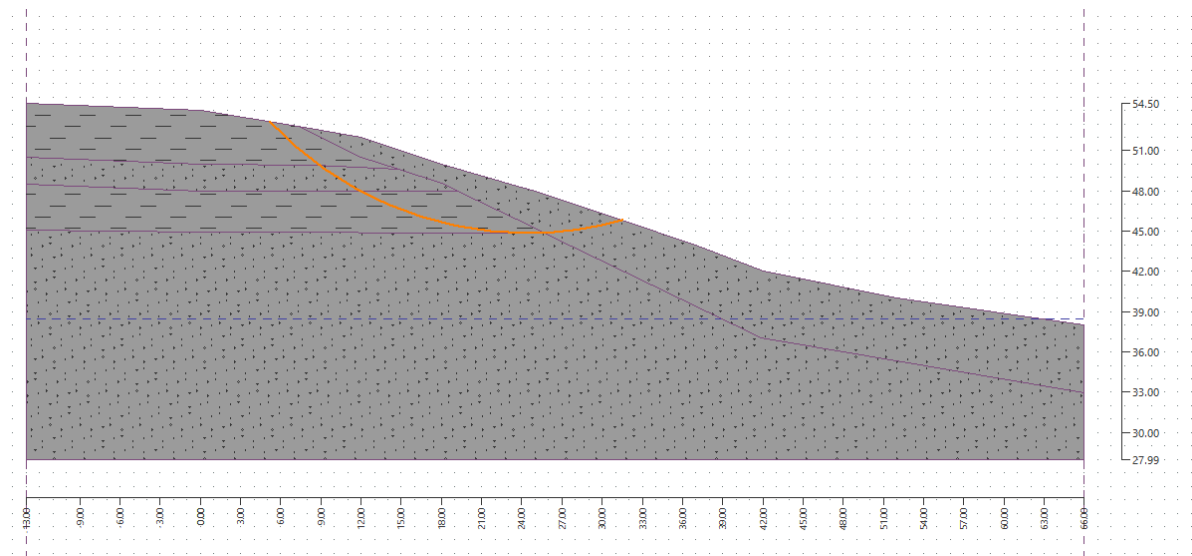
Slope stability analysis is undertaken using limit equilibrium methods in order to create a perspective to see when a slope is unstable (i.e. FOS<1.0), marginally stable (i.e. FOS between 1 and 1.5) and sufficiently stable (i.e. FOS>1.5). The cross section has been analysed using GEO5 slope stability modelling software with detailed results available in Appendix F – Slope Modelling Output.

6.3 Slope Stability Results

A staged slope stability analyses was undertaken for sensitivity analysis (Refer to Appendix F – Slope Modelling Output). The conclusions obtained from the **factors of safety (FOS's or FS's)** and sensitivity analyses are presented below. The following recommendations should be considered as a guide. Should site conditions change (i.e. poor drainage conditions, rise in groundwater table, saturation of soils, increased surcharges, removal and/or loss of vegetation etc) then factors of safety could worsen. This highlights the importance of maintaining good vegetation, drainage and hillside practices across the slope.

6.3.1 Analysis of Cross Section A-A Slope Current Conditions

- The existing slope has been analysed for comparative purposes. The slope was considered to be stable (FOS > 1.5)



Slope stability verification (Morgenstern-Price)

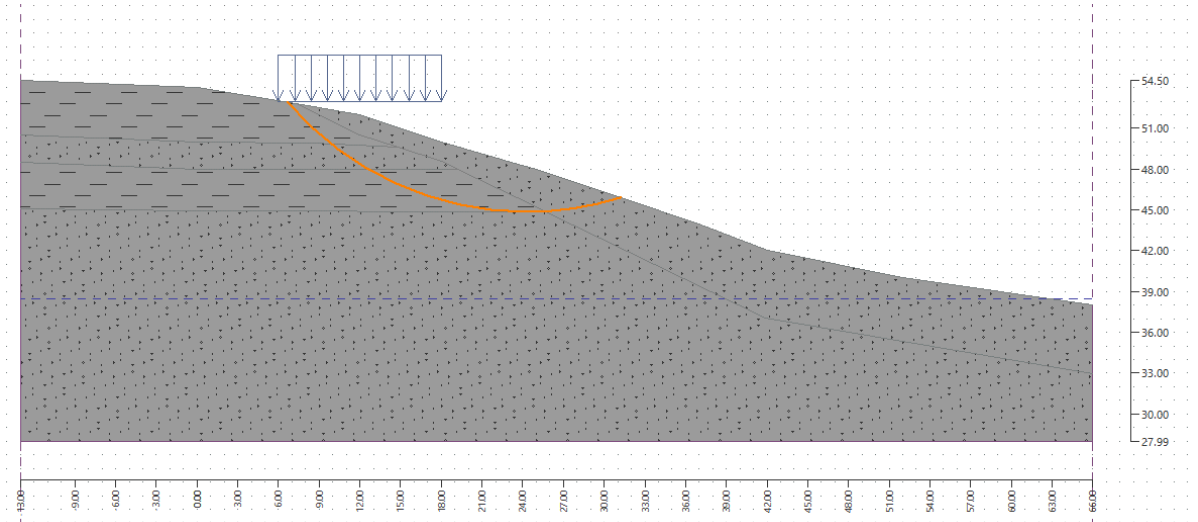
Factor of safety = 1.69 > 1.50

Slope stability **ACCEPTABLE**

Figure 6-1 Slope Stability of the Existing Slope

6.3.2 Analysis of Cross Section A-A with New Dwelling

- The existing slope with the proposed new dwelling has been analysed for comparative purposes. The slope was considered to be marginally stable (FOS between 1 and 1.5) which is not considered acceptable for a new dwelling.



Slope stability verification (Morgenstern-Price)

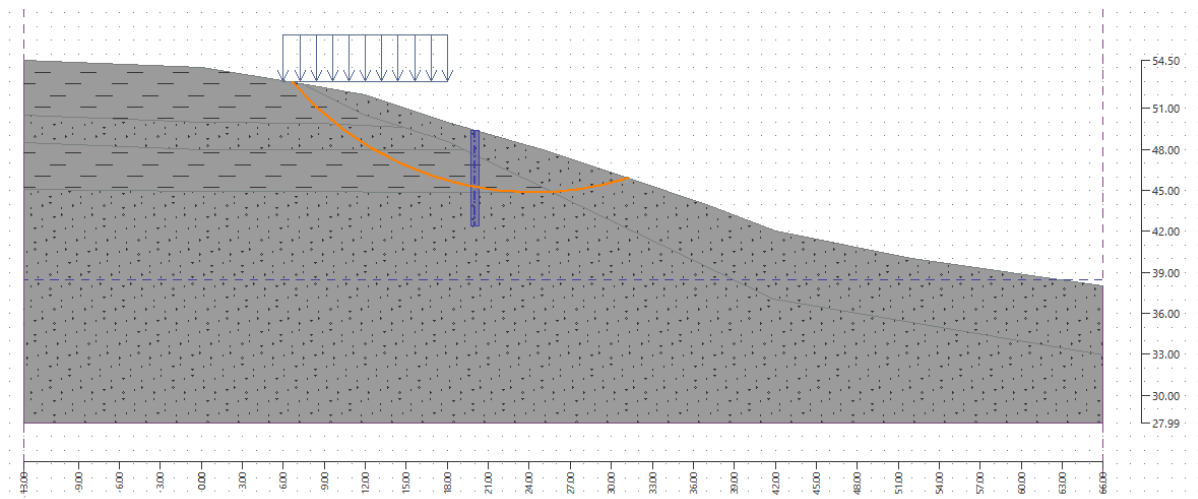
Factor of safety = $1.44 < 1.50$

Slope stability NOT ACCEPTABLE

Figure 6-2 Slope Stability of the Existing Slope with New Dwelling

6.3.3 Analysis of Cross Section A-A with New Dwelling and a Row of Anti Slide Piles

- The existing slope with the proposed new dwelling and the addition of anti slide piles has been analysed for comparative purposes. The slope was considered to be acceptably stable (FOS > 1.5) which is considered acceptable for a new dwelling.



Slope stability verification (Morgenstern-Price)

Factor of safety = $1.70 > 1.50$

Slope stability ACCEPTABLE

Figure 6-3 Slope Stability of the Existing Slope with New Dwelling and a Row of Anti Slide Piles

6.3.4 Preliminary Design of Anti-Slide Piles

As part of the analysis a preliminary design of the anti-slide piles has been undertaken, the final design of the piles should be undertaken by a structural engineer familiar with the design of anti-slide piles.

In order to increase the stability of the site consideration should be given to adopting a row of anti-slide piles (stabilising piles) approximately 2m downslope of the proposed dwelling. As a guide pile diameters are anticipated to be $B=0.6\text{m}$, pile lengths are anticipated to be $L=7\text{m}$ deep and pile spacings (centre to centre spacings) are anticipated to be approximately $5B=3\text{m}$.

Preliminary recommended reinforcement undertaken in GEO5 is outlined in the figure below.

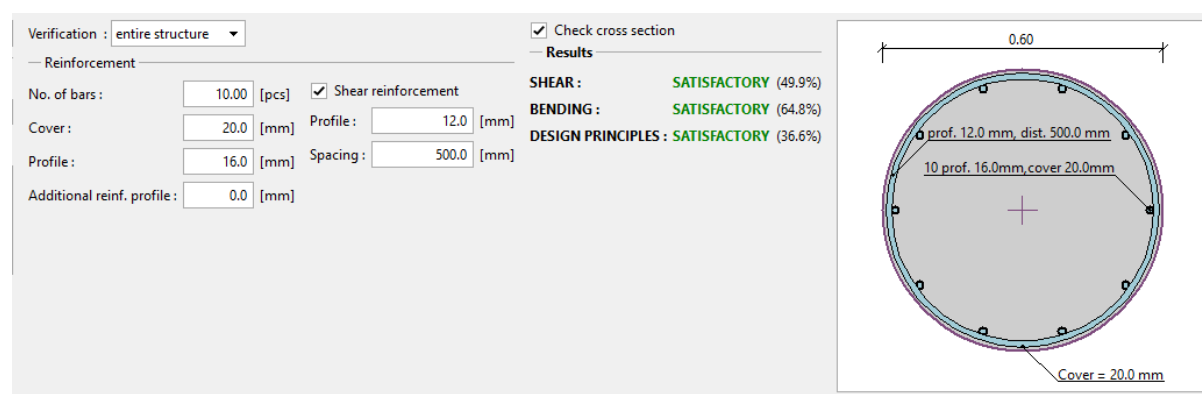


Figure 6-4 Proposed Pile Reinforcement

6.4 Risk Analysis Discussion

A quantitative risk assessment was carried out for the person most at risk. The analysis and results of the risk estimation are presented within Appendix E - Preliminary Landslide Risk Assessment. Each individual risk is summed for all landslide hazards and results are compared to the suggested tolerable loss of life risk for the person at most risk, according to AGS LRM guidelines 2007. It is believed that a Risk Management Program will maintain the annual probability of land sliding risk within tolerable limits.

The work carried out to date can be used as an initial screening process to identify risks and hazards. Considering the proposed slope **with risk mitigation measures**. The risk to life result ($9.2\text{E-}06$) is considered less than the tolerable limit boundary ($1.0\text{E-}05$) which may infer a tolerable scenario depending on the assumptions made within the analysis. The risk assessment values should not be overemphasised; rather they should be taken as part of a holistic approach of the existing problem.

A qualitative assessment for risk to property is carried out as an initial screening process because of the level of risk and the possibility of obtaining numerical data is limited. The terminology and methodology followed are based on the Appendix C: Landslide Risk Assessment Qualitative Terminology for Use in Assessing Risk to Property of AGS Practice Note Guidelines for Landslide Risk Management 2007. These results are compared to suggested tolerable levels by the AGS 2007 Guidelines. The recommendation proposed by the AGS commentary on Practice Note Guidelines for Landslide Risk Management 2007 specifies that for structures of level of importance of 2, a moderate risk is tolerable.

The risk to property assessment shows that there is a low risk with risk mitigating measures. The assessment was based on that landslides can cause medium damage, which depends on the presumptive cost of damage. Medium damage infers an indicative value of up to 20%.

6.4.1 Analysis of Risk Results

The levels of risk are found to be within the tolerable limits according to the AGS (2007) *if a risk management program is implemented*. Site Geotechnical considers that tolerable risk conditions can be maintained during the lifetime of the project if a risk management program is carried out. The analysis and results of the risk estimation are presented within Appendix E - Preliminary Landslide Risk Assessment.

As a reference the following table from the AGS highlights the risk level implications.

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.

Table 6-1 AGS risk level implications

"The regulator is responsible for setting the Tolerable Risk Criteria within their policy. Implementation of a tolerable risk level has implications to the community at large, both in terms of relative risks or safety, but also in terms of economic impact.

Regulators may decide to apply “acceptable risk”⁵ criteria for high consequence cases, such as schools, hospitals and emergency services in recognition of the importance of these structures and as a way of covering societal risk concerns. The community may tolerate higher risks from natural hazards than man made hazards (IUGS 1997). Such a consideration by the regulator may result in some natural hazards being tolerated in the face of exceptional expenditure to reduce the risk to tolerable levels. An example of this may be the risks associated with boulder falls from natural cliff lines in a bush reserve adjacent to existing residential development” (Commentary on Practice Note Guidelines for Landslide Risk Management 2007 of the AGS.).

According to Crozier et al (2005), the nature of response to risk depends on the judgments of whether the risk is acceptable, tolerable or intolerable. As with perception, these judgments are highly subjective and influenced by psychological, sociological and cultural perspectives. Judgments can also be influenced by the nature of the risk. As a reference the following table presents the probability of death per person per year of different hazards.

Hazard	Deaths per year	Probability of death per person per year
Smoking	4 000	1.1×10^{-3}
Road accident	600	1.7×10^{-4}
Suicide	380	1.1×10^{-4}
Falls	300	8.6×10^{-5}
Drowning	120	3.5×10^{-5}
Homicide	50	1.4×10^{-5}
Fire	32	9.0×10^{-6}
Natural hazards	6	1.6×10^{-6}

Table 6-2 Comparison of individual risk of death from hazards in New Zealand (population ~3.5 million). Annual average between 1840 and 1990 (Tephra, 1994)

As a reference, road accidents, falls and smoking are likely to represent a higher risk than the site *under proposed conditions*. Risk mitigation measures should be considered to reduce the existing risk.

⁵ Acceptable Risks, which are lower than the tolerable risks, are risks which everyone affected is prepared to accept. Action to further reduce such risk is usually not required unless reasonably practicable measures are available at low cost in terms of money, time and effort.

7 LANDSLIDE RISK MANAGEMENT

Site Geotechnical considers that tolerable risk conditions can be created during the lifetime of the project should the following measures be properly implemented. **These requirements should be considered as compulsory requirements for the development of the proposed project** as the assumptions, analyses, conclusions and recommendations presented within this report may become invalid if these requirements are not adequately carried out.

7.1 Design

- The Guidelines for Hillside Construction from the AGS should be followed (**Appendix D – Some Guidelines for Hillside Construction**).
- In order to increase the stability of the site consideration should be given to adopting a row of anti-slide piles (stabilising piles) approximately 2m downslope of the proposed dwelling. As a guide pile diameters are anticipated to be $B=0.6\text{m}$, pile lengths are anticipated to be $L=7\text{m}$ deep and pile spacings (centre to centre spacings) are anticipated to be approximately $5B=3\text{m}$. Anti-slide piles should be installed prior to constructing the dwelling.
- It is recommended that the dwelling be founded on piles designed following engineering principles.
- Plans should be prepared/updated based on these report specifications and then presented to Site Geotechnical for their geotechnical revision.
- Retaining walls designed using engineering principles could also be considered.
- It is important that landowners, neighbouring properties and Council assures good hillside construction, slope management and maintenance in the area in order to maintain stable slope conditions and the assumptions made within landslide risk assessments. Elements such as the drainage systems of the area (including roads, drains/stormwater, etc.) should have the appropriate design, construction, supervision and maintenance.

7.2 Drainage

- The most important factor to consider in this case is to divert upslope stormwater (excessive moisture) around and/or away from the steep slopes in the area.
- Water should be prevented from ponding anywhere on the site. Good drainage should be always provided. Uncontrolled water runoff should not be permitted.
- All stormwater should be diverted to a legal point of discharge or soakage pits designed with engineering principles.
- All hard surfaces should have formal drainage systems.
- Drainage design is an important element in preventing erosion and maintaining slopes. A suitably qualified drainage engineer should be engaged to assist with the drainage design.
- For even higher levels of performance consideration could be given to a concrete cutoff culvert to divert water from the slope.
- HDPE pipes provide enhanced flexibility and resistance to ground movement compared to conventional UPVC pipework, making them a more reliable choice for installation in landslide-prone areas, as they reduce the risk of cracking and potential leaks caused by shifting soils.

7.3 Construction

- Site Geotechnical should be engaged to undertake site visits (together with the building surveyor or superintendent of the project) from the beginning to the end of the project. Site Geotechnical should inspect the excavations, earthworks and any retention systems.
- The spoil from excavations and earthworks should be removed from the site.
- Slopes should not be excessively overloaded by construction equipment or materials (AS 3798).
- Further guidelines regarding to constructing in a hillside can be found within **Appendix D – Some Guidelines for Hillside Construction.**

7.4 Retaining Walls

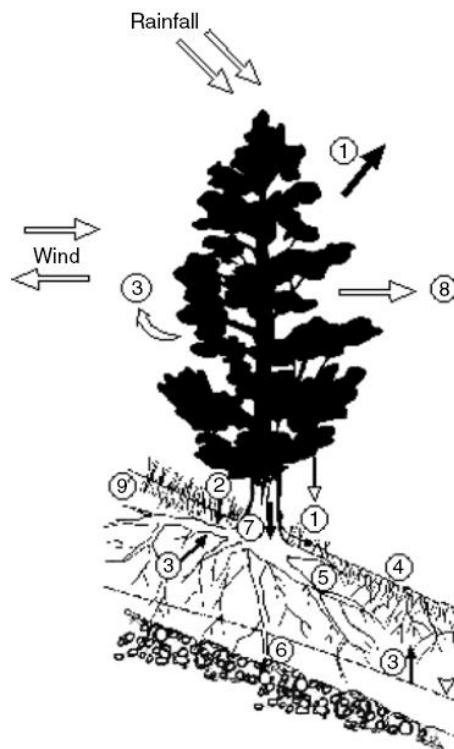
- All retaining walls should be engineered designed by a structural engineer and checked by a geotechnical engineer.
- Retaining walls should have adequate surface and subsurface drainage installed behind the crest and at the toe of the wall to collect water and direct it efficiently into the drainage system.
- The retaining walls should be constructed as soon as possible after the completed earthworks.

7.5 Vegetation

Adequate vegetation cover should be provided within slopes. It is recommended that all existing vegetation comprising of grasses, shrubs and trees be retained within the soil slopes. Dense vegetation cover of deep-rooted small shrubs and trees is an inexpensive and highly efficient method for minimising erosion and shallow instability. Revegetation is one of the most effective long-term stabilization techniques of slopes. The following bullet points briefly describe the recommended methodology for maintaining good site conditions at this stage:

- Revegetation of the site (as soon as practical upon completion of earthworks), encouraging dense vegetation cover of deep-rooted shrubs and trees within slopes.
- Native species of plants, shrubs and trees, which can cope with minimal watering after establishment, are highly recommended.
- Aim to select a mix of plant species focusing on early-stage or pioneer species that have fast growth rates and are drought tolerant. Long-lived species should also be planted to take place of the shorter-lived plants once they have stabilised the site.
- An arborist or horticulturist is recommended to be enlisted for the seedling selection.
- Avoid stock access and control weeds.

The following image illustrates the interaction between the vegetation and the slope. This image can be used as a guide for remedial work design.



Hydrological mechanisms	Influence
1 Foliage intercepts rainfall, causing absorptive and evaporative losses that reduce rainfall available for infiltration.	B
2 Roots and stems increase the roughness of the ground surface and the permeability of the soil, leading to increased infiltration capacity.	A
3 Roots extract soil moisture from the soil, which is lost to the atmosphere via transpiration, leading to lower porewater pressures.	B
4 Depletion of soil moisture may accentuate desiccation cracking in the soil, resulting in higher infiltration capacity.	A
Mechanical mechanisms	Influence
5 Roots reinforce the soil, increasing soil shear strength.	B
6 Tree roots may anchor into firm strata, providing support to the upslope soil mantle through buttressing and arching.	B
7 Weight of trees surcharges the slope, increasing the normal and downhill force components.	A/B
8 Vegetation exposed to the wind transmits dynamic forces into the slope.	A
9 Roots bind soil particles at the ground surface, reducing their susceptibility to erosion.	B

Note:
A – adverse to stability, B – beneficial to stability.
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Figure 7-1 Slope–vegetation interactions affecting slope stability (Greenway, 1987). Taken from Crozier et al (2005)

Revegetation with adequate plants and grasses of bare patches resulting from construction works is essential for limiting the effects of erosion within the whole site. Specialized direction and supervision is recommended during the remedial works.

7.6 Proposed Erosion Remedial Works

In areas where there is a risk associated with erosion, consideration should be given to⁶:

- Avoid concentrating water flow over areas that have dispersive topsoil or subsoils.
- Providing adequate drainage.
- Providing and maintaining adequate vegetation.
- Choosing building and construction methods that minimise the need for large excavation and subsoil exposure.
- Not constructing soakage pits and minimising surface runoff within the upper dispersive soils.
- Immediately infilling any trenches or excavations to prevent collection and ponding of water on subsoil surfaces.
- Compacting dispersive subsoils that have been disturbed or excavated.
- Burying any exposed subsoils with topsoil and revegetate.

⁶ Recommendations based on the “Soil & Water Fact Sheet No. 4 - Dispersive Soils” (2009) from the Derwent Estuary Program

- Covering dispersive soils with a minimum 100 mm layer of non-dispersive soil prior to revegetation, or concrete.

The following image illustrates the conceptual idea to improve the on-site vegetation.

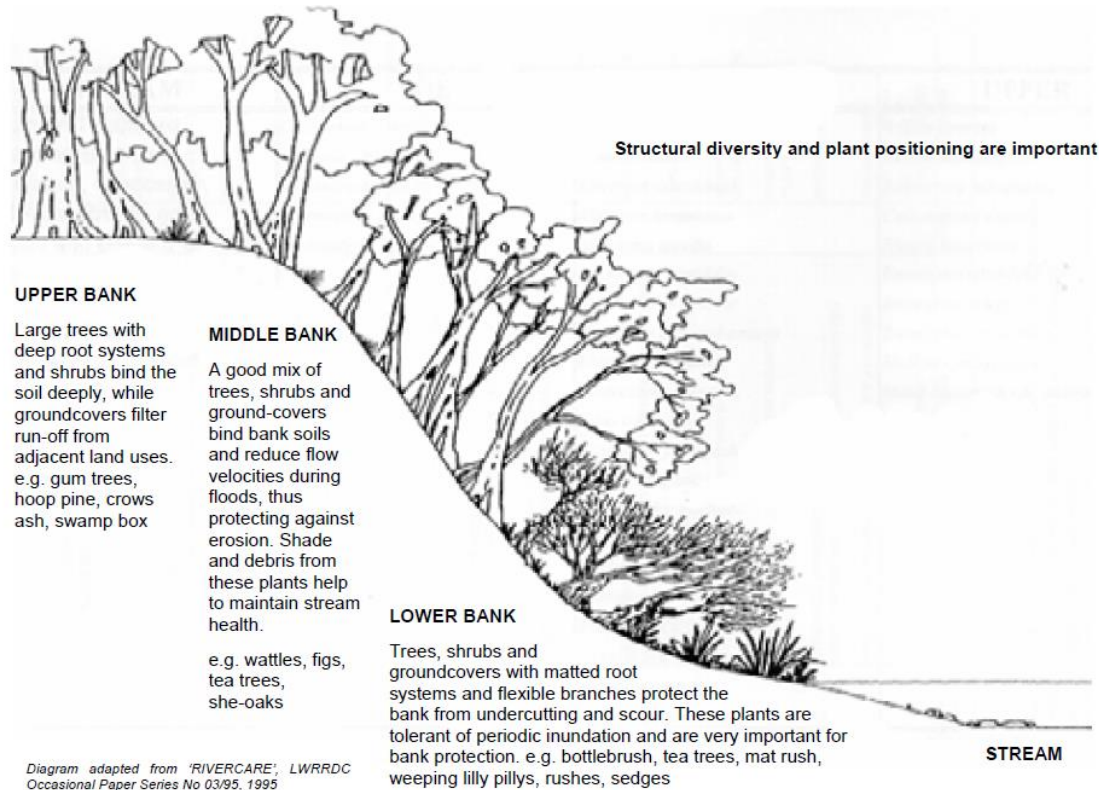


Figure 7-2 Stream bank planting guidelines and hints (Government of Queensland)

7.7 Supervision, Instrumentation and Monitoring

To ensure that the risk does not increase to unsatisfactory levels, it is strongly recommended that supervision during construction and monitoring of the site for evidence of deterioration in slope stability after construction are undertaken. It is recommended that following recommendations are taken for the design, construction and maintenance of the project:

- Site Geotechnical should be engaged in the designing and construction process in order to assure the correct implementation of these recommendations.
- Maintaining site drainage and monitoring the site for evidence of deterioration in slope stability are key components of any ongoing maintenance program for this site. **Should any condition change including appearance of soil movement, cracks within structures or soil or any other suspicious condition; Site Geotechnical should be notified to reassess the new circumstances⁷.**

⁷ The main uncertainty associated with the estimated probability of landslide is the prediction of the preparatory and triggering factors in the foreseeable future. D. K. C. Jones (1992) has recognised that there exist serious problems in using historical data to predict future landslide activity because of the non-linear relationship that exists between triggering factors such as rainfall and landslide activity, the variable effects of human development on vegetation, land use and water balance and the uncertain consequences of climate change.

- Owners of the land must take responsibility for the ongoing maintenance of the drainage and be responsible in assuring the maintenance of the drainage alongside their property is undertaken. It cannot be stressed how important it is to ensure the drains and / or waterways are never blocked and the maintenance or repair of any damaged drains should be undertaken promptly.
- It is recommended that regular checks of plumbing, drainage and stormwater systems be carried out, with repairs to leakages or breakages repaired immediately when observed.
- Continual monitoring of existing slopes should be undertaken.
- Instrumentation may be considered as a warning system to monitor any change of slope stability. Consideration may be given to simple tools such as extensometers or regular accurate level survey.
- The Australian GeoGuides for Slope Management and Maintenance, reference AGS 2007e is suggested as complementary information.

It is also important that the Council/Shire assures good hillside construction, slope management and maintenance in the area in order to maintain stable slope conditions and the assumptions made within landslide risk assessments. Elements such as the drainage systems of the area (including roads, stormwaters, etc.) should have the appropriate design, construction, supervision and maintenance.

8 SLOPE STABILITY CONCLUSION

Based on the findings from our slope modelling, site visit and plans provided it has been determined that the existing slope with the new proposed dwelling is considered satisfactory/stable from a landslide perspective if conditions are improved and anti-slide piles are adopted.

Site Geotechnical considers that tolerable risk conditions can be maintained during the lifetime of the project if a risk management program is carried out. Therefore, good hillside construction, slope management and maintenance should be followed within the site in order to maintain the risks within tolerable limits.

Should site conditions change (ie poor drainage conditions, rise in groundwater table, flooding saturation of soils, increased surcharges, removal and/or loss of further vegetation, bushfire etc) then factors of safety could worsen. This highlights the importance of maintaining good vegetation, drainage and hillside practices across the site.

9 PRELIMINARY GEOTECHNICAL ASSESSMENT FOR DEEP FOUNDATIONS

9.1 Proposal

The following geotechnical assessment provides a general interpretation of the geotechnical behaviour of the soil profile in order to provide geotechnical solutions that could be considered for the proposed project. Different types of foundations may be considered. Each type of foundation has its advantages and disadvantages relating to constructability and geotechnical-structural behaviour, which should be evaluated within the design. It is recommended that the client evaluate the pros and cons of each alternative. The following points briefly discuss relevant elements for different types of foundations. Once a design has been adopted by the structural engineer, it is recommended that Site Geotechnical review plans and geotechnical specifications. At this stage structural loads have not been provided and the following information may be used as a guide. Once further details (including loads) have been provided the following data may need to be refined.

9.2 Design Principles

The geotechnical design should consider but not be limited to the following points:

- Vertical and Horizontal allowable bearing capacity (q_{v-a}) considering vertical and horizontal loads, moments and maximum tolerable settlements.
- Global stability.
- Surcharges of surrounding structures.
- Different earth pressures.
- Groundwater levels or pore water pressures.
- Particular attention should be addressed to the chemical conditions of the soils as aggressive chemicals could affect the foundations. Further advice is recommended to be sought from an environmental/contamination professional.

The geotechnical design involves a series of assumptions and calculations that create a repetitive iterative process. Bearing capacity calculations depend on the width on the foundation, type of foundation (deep or shallow), allowable settlement, angle of inclination of the load, pressure generated by the retained soil, etc; therefore, the following recommendations may need to be revised based on the specific project details.

9.3 Foundation Recommendations for Piles

Driven, bored and screw piles may be considered. Each type of pile has its advantages and disadvantages relating to constructability and geotechnical-structural behaviour, which should be evaluated within the design. Consideration should be given to pile load testing or other construction monitoring tests such as penetration monitoring or torque measuring and recording during driven or screw pile installation. Further advice from a specialised contractor and/or designer should be sought.

The following tables provide the factored average skin friction and the factored base pressure per meter for different types of piles. The capacities provided at this stage are considered to be of preliminary nature and further investigation including pile testing is recommended.

Foundations are recommended to be founded within materials of medium strength (e.g. greater than 100kPa) as a minimum. The depth where materials of medium strength are encountered can significantly influence the feasibility of foundations.

Table 9-1 Factored average skin friction for different types of piles

Depth (BGL) m	Factored average skin friction (kPa) ($\phi_g \times f_s$)			
	Driven Pile	CFA Pile	Bored Pile	Steel Screw
1	0	0	0	0
2	10	6	6	6
3	11	8	8	8
4	13	9	9	9
5	14	10	10	10
6	16	10	10	10
7	11	7	7	7
8	12	8	8	8
9	18	12	12	12
10	23	15	15	15
11	24	16	16	16
12	24	16	16	16
13	29	20	20	20
14	30	20	20	20
15	33	22	22	22
16	33	22	22	22
Geotechnical reduction factor ϕ_g				0.40

It is recommended to ignore the skin friction of the first 1.5m due to the seasonal changes of the soils.

Table 9-2 Factored base pressure for different types of piles

Depth (BGL) m	Factored base pressure (kPa) ($\phi_g \times f_b$)			
	Driven Pile	CFA Pile	Bored Pile	Steel Screw
1	144	144	144	144
2	288	288	288	288
3	288	288	288	288
4	288	288	288	288
5	288	288	288	288
6	288	288	288	288
7	144	144	144	144
8	144	144	144	144
9	288	288	288	288
10	432	432	432	432
11	432	432	432	432
12	432	432	432	432
13	576	576	576	576
14	576	576	576	576
15	648	648	648	648
16	648	648	648	648
Geotechnical reduction factor ϕ_g				0.40

Pile settlement is determined using specific loading and pile dimensions and has not been provided in this report. The bearing capacities provided will need to be confirmed via pile testing and geotechnical inspection during construction.

9.3.1 Recommendations for Piles

- Further advice may be sought from specialised contractors/designers.
- It may be advantageous to obtain previous geotechnical reports, structural engineering information and construction plans relating to relatively recent completed works for review and comparison (if available).
- For pile groups, a minimum distance of 2.5 times the pile diameter or 600 mm (whichever is greater) between piles is recommended.
- A pile cap must be adopted for group of piles. **For pile groups the following reduction factors (i.e. group efficiency factor) are recommended: 0.88 for a pile group of 2 piles, 0.80 for a pile group of 3 piles and 0.76 for a pile group of 4 piles.**
- Hoyt and Clemence (1989) found the torque correlation method for screw piles to be a reliable method for predicting pile or anchor capacity. Thus, it is recommended that construction monitoring tests such as torque measuring during pile installation is undertaken to calibrate/confirm the geotechnical resistances for screw piles.
- For bored piles, water filtrations into the hole should not be allowed. Casing and/or bentonite should be used if groundwater is encountered⁸.
- Continuous Flight Auger (CFA) piles may be less expensive than bored piles as CFA piles are more suited for soft ground where deep casings or use of drilling support fluids might otherwise be needed.
- For the range of chemical conditions in the soil surrounding the piles, the condition leading to the most severe aggressive conditions shall be allowed for, and allowance shall be made for likely changes in groundwater levels (AS 2159-2009).
 - For screw piles, consideration should be given to one or a combination of protective measures to assure the durability of the pile. Consideration could be given to 1) corrosion allowance for uncoated steel as per Clause 6.3.4 of AS2159, 2) coating systems or 3) cathodic protection systems.
- **Pile load testing should be considered for higher levels of assessment, particularly in complex soil conditions.**

⁸ The construction of drilled shafts is not a trivial procedure. Maintaining the stability of the excavation prior to and during concrete placement is imperative to assure a structurally sound shaft. Any intrusion of ground water into the excavation can degrade the structure of the surrounding soil and hence reduce the capacity of the shaft. In situations where the ground water is present and likely to intrude, some form of wet construction should be used. Wet construction implies that a slurry is placed in the excavation that is capable of maintaining a net positive pressure against (or flow into) the walls of the excavation. The slurry can be mineral, synthetic, or natural.

10 GEOTECHNICAL ASSESSMENT FOR RETAINING WALL

“Retaining walls are soil-structure systems intended to support earth backfills. Construction of retaining walls is typically motivated by the need to eliminate slopes in road widening projects, to support bridges and similar overpass and underpass elements, or to provide a level ground for shallow foundations. Retaining walls belong to a broader class of civil engineering structures, earth retaining structures, which also encompass temporary support elements such as sheet-pile walls, concrete slurry walls, and soil nails” (Gunaratne, 2006).

10.1 Proposal

The following geotechnical assessment provides an interpretation of the geotechnical behaviour of the soils encountered in order to provide potential geotechnical solutions that may be used for the proposed project.

10.2 Design Principles

The geotechnical design should consider but not be limited to the following points:

- Vertical and Horizontal allowable bearing capacity (q_{v-a}) considering vertical and horizontal loads, moments and maximum tolerable settlements.
- Global stability.
- Surcharges of surrounding structures.
- Different earth pressure stages (pressures at rest, active and passive condition).
- Groundwater levels or pore water pressures.
- Comply with Earth Retaining-structures AS 4678-2002.

10.3 Soil Parameters

The following table presents estimated soil parameters⁹.

Table 10-1 Soil parameters

Material	Consistency / Relative Density	Unit Weight γ (kN/m ³)	Drained Condition		Undrained Condition		Deformation Parameters		
			Effective Angle of Friction ϕ' (°)	Effective Cohesion c' (kPa)	Angle of Friction ϕ (°)	Undrained shear strength S_u (kPa)	Vertical Short Term 'Elastic' Modulus E_v (MPa)	Vertical Long Term 'Elastic' Modulus E_v (MPa)	Poisson μ
Clay FILL	Soft	16.0-17.0	20-22	0	0	12-25	2-7	1-5	0.30-0.45
Silty Sand FILL / Silt FILL	Loose / Soft	18.0-20.0	28	0	0	12-25	<10	<8	0.25-0.45
Clay Cohesionless Sand	Stiff	18.0-18.5	25-28	0-5	0	50-100	10-25	7-20	0.30-0.45
	Very Stiff	18.5-19.0	28-30	0-10	0	100-200	20-50	15-35	0.30-0.45
	Medium Dense	18.0-19.0	30-34	0	-	-	8-30		0.25-0.45
	Dense	19.0-20.0	34-36	0	-	-	25-50		0.25-0.45
Silty Sand / Silt	Medium Dense / Stiff	18.0-20.0	30	0	0	25-50	10-20	8-15	0.25-0.45

Note: it is recommended to ignore the cohesion for the first ≈ 1.5 m to account for seasonal changes of the clay.

⁹ The foregoing values are estimations based on well-known correlations. These values should not be overemphasized and specialized laboratory testing is recommended if a higher level of accuracy is desired or required. In addition, other factors that need to be considered for soil and rock parameter selection are: geological and geotechnical background information, possible modes of failure, ranges of in situ and imposed stresses, potential variability of the parameter values and the sensitivity of the design to these variabilities, extent of the zone of influence governing the soil behaviour, influence of workmanship on artificially placed or improved soils, effects of construction activities on the properties of the in situ soil, etc (clause 7.3.4. of AS 5100.3).

10.4 Earth Pressure Distribution

The earth pressure basically depends on the soil type however its distribution will depend on the surcharge and the structural type and its allowable deformation. For gravity walls such as concrete cantilever or block walls, and soldier piles (without bracing or anchors) a triangular soil distribution is recommended.

The following equations can be used to calculate the lateral earth pressures when the **retained soil is horizontal**.

Coefficient of Lateral Pressure at Rest $k_0 = (1 - \sin \phi)$

Coefficient of Lateral Passive Pressure $k_p = \tan^2(45^\circ + \frac{\phi}{2})$

Coefficient of Lateral Active Pressure $k_a = \tan^2(45^\circ - \frac{\phi}{2})$

The following equation¹⁰ (Coulomb equation) is recommended when the wall is inclined and/or the retained soil is on an angle.

K_a = active pressure coefficient

$$= \frac{\cos^2(\phi + \omega)}{\cos^2 \omega \cos(\omega - \delta) \left[1 + \frac{\sin(\phi + \delta) \sin(\phi - \beta)}{\cos(\omega - \delta) \cos(\omega + \beta)} \right]^2}$$

ϕ = factored value of internal friction angle (degrees)

δ = external friction angle (degrees)

$= \frac{2\phi}{3}$ at interface between soil and facing

or, at interface between two soil layers, the smaller of the friction angles

or, at any interface with filter fabric, the external friction angle should be taken from test data. If no data is available, it should be assumed to be zero.

ω = slope of the wall (degrees)

β = slope of the backfill (degrees)

γ = factored value of soil density (kN/m³)

H = height of soil behind the wall (m)

Figure 10-1 Extract from Segmental Concrete Reinforced Soil Retaining Walls – Design and Construction Guide (Concrete Masonry Association of Australia, 2003)

¹⁰ As an example, a $k_a = 0.51$ and a $k_p = 2.56$ are obtained when considering $\phi' = 26^\circ$, $\delta' = 2/3 * 26^\circ = 17.3^\circ$, $\omega = 0^\circ$ (i.e. vertical wall) and $\beta = 20^\circ$. When considering the strength reduction factor for in-situ material [$\phi * \phi' = \tan^{-1}(\phi * \tan \phi') = \tan^{-1}(0.85 * \tan 26) = 22.5^\circ$, $\delta' = 2/3 * 22.5^\circ = 15^\circ$, $\omega = 0^\circ$ (i.e. vertical wall) and $\beta = 20^\circ$], a $k_a = 0.64$ and a $k_p = 2.24$ are obtained.

10.5 Relevant Considerations for Retaining Wall Design

- Where required, granular materials should be used as backfill. Clays and silts are not recommended as backfill.
- High plastic clays (CH) can be very expansive. An expanding retained soil places very large loads on the wall, far greater than the computed active or at-rest pressure. The exact magnitude of lateral pressures caused by expansive soils is difficult to predict (Coduto, 2001). As a guide, it is recommended to compute the lateral pressures based on k_0 instead of k_a for clays of medium and high plasticity. A value between k_0 and k_a could be considered for low reactive clay soils such as clayey sands (SC). Alternatively, Terzaghi and Peck (1967) method for Presumptive Lateral Earth Pressures could be used.
- Any retaining wall should have adequate surface and subsurface drainage installed behind the crest and at the toe of the wall to collect water and direct it efficiently into the drainage system.
- It should be noted that scoria or coarse gravel is not typically recommended as a drainage medium (or filter) for subgrades comprising of silt or clay as these materials tend to clog with fines in the long term. *Concrete washed sand is typically recommended to be used as a drainage layer when clays and/or silts are retained.* The following table from RC500.22 (Table 6.1 – Selection of Type of Subsurface Drain & Filter Type) may be used as a guide for the type of subsurface drain and filter types, depending on the subgrade type encountered. Filter material can be supplemented through the use of a geotextile between the drain and retained soils to prevent migration of fine material.

Table 2 – Subsurface Drain & Filter Type selection (VicRoads RC500.22 table 6.1)

Subgrade Type	Permeability Range m/sec	Type of Pavement Drain (SD 1601)	Grades of Granular Backfill Material
Homogenous clay with very low permeability	$< 10^{-9}$	Type 3 or Type 4	Sand (Grade A1 to A3)
Silty or sandy clays and stratified clays with moderately low permeability	10^{-9} to 10^{-5}	Type 2, Type 3 or Type 4	Sand (Grade A4 to A6)
Clean sand or gravel with high permeability	$> 10^{-5}$	Type 1 or Type 2	Aggregate (Grade B1 or B2)
Solid rock or clean broken rock with high permeability or permeable fissures	Not applicable	Type 1	Aggregate (Grade B3 or B4)

- The retaining wall design may provide an adequate drainage system, which ensures a drained condition. Nevertheless, it is recommended to be designed with some pore water pressure, say $\frac{1}{4}$ of the wall height, in order to prevent unexpected situations such as blockage of the drainage pipe or a rupture of a water pipe, or high rainfall/runoff.
- It is recommended that the wall drainage system consists of a 300 mm thick filter-drain material with a geotextile (not plastic) placed behind the wall.
- The retaining walls should be constructed as soon as possible after the completed earthworks. Delay of construction works may lead to excessive erosion of the slope materials and, in a severe case, shallow instabilities.

- Different types of wall can be considered. Each type of wall has its advantages and disadvantages relating to constructability and geotechnical-structural behaviour, which should be evaluated within the design.
- For sleeper retaining walls, it is anticipated that the minimum founding depth for the soldier piles would be in the order of 1.5 to 2 times the retained soil height of the wall.
- Refer to section 10.6 “General Requirements for Proposed Excavations” for comments related to excavations for construction.

10.6 General Requirements for Proposed Excavations

10.6.1 Unsupported Excavations

Proposed excavations and footings adjacent to excavations must be properly engineered. Existing or proposed trenches adjacent to existing or proposed footings could influence footing performance / stability. Special consideration should be given to excavations which have or will extend below a line of influence or angle that allows the soil under the footing to remain stable, (this may include requirements for underpinning or deepening of footings for example). Figure 10-2 Line of Influence, represents a typical pictorial representation of requirements for proposed or existing excavations adjacent to footings.

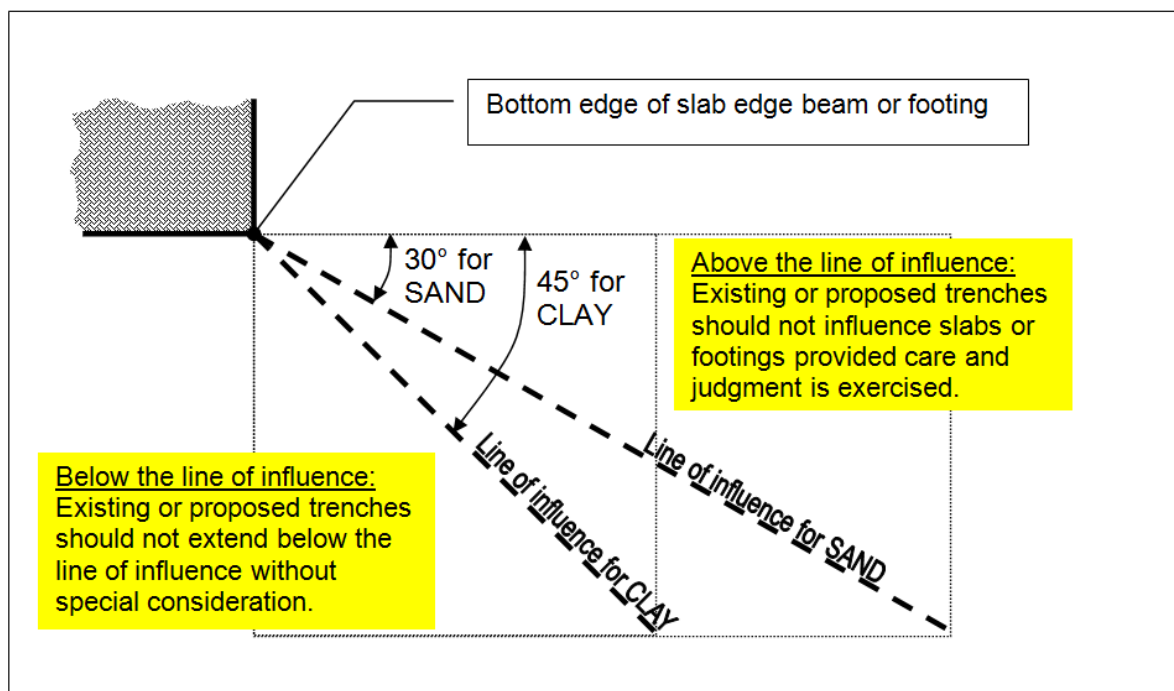


Figure 10-2 Line of Influence

Unsupported excavations should not be undertaken where the line of influence of an existing footing or infrastructure intercepts the excavation, as they could affect the surface structures. Sufficient setback distances should be provided from these adjacent structures or underground services. Setback distances can be calculated based on the previous figure. Where unsupported excavations cannot be undertaken, consideration should be given to supported excavations.

10.6.2 Unsupported Excavations

Vertical excavations up to 3 m depth in *firm-stiff clay* are anticipated to be stable for a short time if favourable climate conditions exist, there are not surcharges on the upper side of the cut and water filtrations are not observed during the excavation. Unsupported excavations, having limited space such as trenches, are recommended to be limited to 1.5 m depth when personnel access is required. The following table provides recommended batters for construction.

Table 10-3 Recommended Short and Long Term Unsupported Soil Batters with Good drainage, No Surcharge and No Water Seepages

Short and Long Term Unsupported Batters for Construction		
Material Type	Short Batter	Long Term Batter
SAND/SILT	1V: 1.5H (34° slope)	1V: 3H (18° slope)
CLAY	1V: 1H (45° slope)	1V: 2H (27° slope)

If water seepages are observed during construction, geotechnical inspection is recommended to assess the cut batter stability and the previous mentioned batter values may need to be re-assessed. A minimum distance (clearance) should be allowed between the edge of the cut and the stockpile of excavated material in order to avoid creating a significant surcharge. As a reference, for cuts less than 2 m depth, the clearance should not be less than a horizontal distance equal to the cut height plus 1 m.

Long term batters refer to batters that may be excavated in anticipated prolonged wet periods and/or batters that will remain open for several weeks. Waterproof sheeting should be available to cover the batter slope during any wet weather and the contractor should be prepared to backfill the excavation in the event of prolonged wet weather. Any seepage or run-off should be attempted to be intercepted well behind the excavation batter.

10.6.3 Supported Excavations

Supported excavations should be undertaken when unsupported excavations should not or cannot be carried out (e.g. where soft clays are encountered). Supported excavations are likely to be required for excavations deeper than 1.0-2.5 m depth or in areas having soft and/or wet soils.

Deep excavations within built-up areas usually need to provide protection to the adjacent structures, which can be gained through the installation of a lateral retaining system. A lateral retaining system can consists of sheet piled, secant piled, speed shores, trench box or shield, soldier pile and lagging shoring, etc. Their design basically depends on the interaction soil-structure (i.e. type and magnitude of the lateral retaining system movement), soil strength parameters, soil unit weight and drainage conditions within the retained soil. It is recommended that a suitably qualified engineer be engaged to design any proposed supported excavation system.

11 BIBLIOGRAPHY

- Austroads, A Guide to the Structural Design of Road Pavements
- Delleur, J. The Handbook of Groundwater Engineering. CRC Press LLC 2000 Corporate Blvd., N.W. Boca Raton, FL 33431, U.S.A.
- Department of Energy, Environment and Climate Action, Victoria, Australia, Geology Map, GeoVic.
- Glade et al, Landslide Hazard and Risk John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England.
- GHD (2023), Landslide and Erosion Hazard and Planning Review East Gippsland Shire
- Hunt, R. Geologic Hazards, A Field Guide for Geotechnical Engineers. CRC Press Taylor & Francis Group, USA
- Look, B. Handbook of Geotechnical Investigation and Design Tables. Taylor & Francis Group, London, UK
- Standards Australia, Geotechnical site investigations, AS1726
- Anderson, M; Crozier, M and Glade, T. (2005), Landslide Hazard and Risk. John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England.
- Australian Geomechanics Society (2007), Practice Note Guidelines for Landslide Risk management 2007, Journal and News of the Australian Geomechanics Society Volume 42 No 1.
- Australian Geomechanics Society (2007), Commentary on Practice Note Guidelines for Landslide Risk management 2007, Journal and News of the Australian Geomechanics Society Volume 42 No 1.
- Australian Geomechanics Society (2007), The Australian GeoGuides for Slope Management and Maintenance, Journal and News of the Australian Geomechanics Society Volume 42 No 1.
- Lee, E.M. and Jones, D.K.C. (2004) Landslide Risk Assessment Thomas Telford, London.
- Noel S, Bruce M & Marcus M (2001) A short course in Soil and Rock Slope Engineering, Thomas Telford Publishing, UK.
- Shire of Yarra Ranges (2003), Generic Landslip Contingency Plan, Emergency & Safety Planning Asset Management Services.
- U.S. Department of the Interior & U.S. Geological Survey (2008). The Landslide Handbook—A Guide to Understanding Landslides - Circular 1325. U.S. Geological Survey, Reston, Virginia, USA.

12 VALIDATION

Collection of information and its appraisal, should continue during any construction works, to confirm or otherwise the assumed ground model. In this case it may be preferred that the geotechnical consultant assess and monitor the ground conditions during construction, particularly in light of potentially poor or variable ground conditions or unexpected findings.

13 IMPORTANT INFORMATION

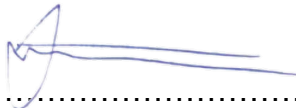
Ownership of the data collected and recorded by Site Geotechnical and any specialist testing remains with Site Geotechnical Pty Ltd until all amount owing to Site Geotechnical Pty Ltd by the client are fully discharged.

This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose. Copyright in this report is the property of Site Geotechnical Pty Ltd. The client and / or its representatives alone shall have a license to use this report. This report shall not be reproduced except in full.

Soil and rock exploration and testing have inherent uncertainties. Thus your attention is drawn to limitations inherent in the extrapolation of the limited subsurface information obtained from the site, which is further discussed within the last appendix.

Should you have any queries or comments regarding this report please feel free to contact the undersigned.

Regards,



Report reviewed by:-

Frank Tostovrsnik B.E. (Civil) Hons.
Senior Geotechnical Engineer



Report written by:-

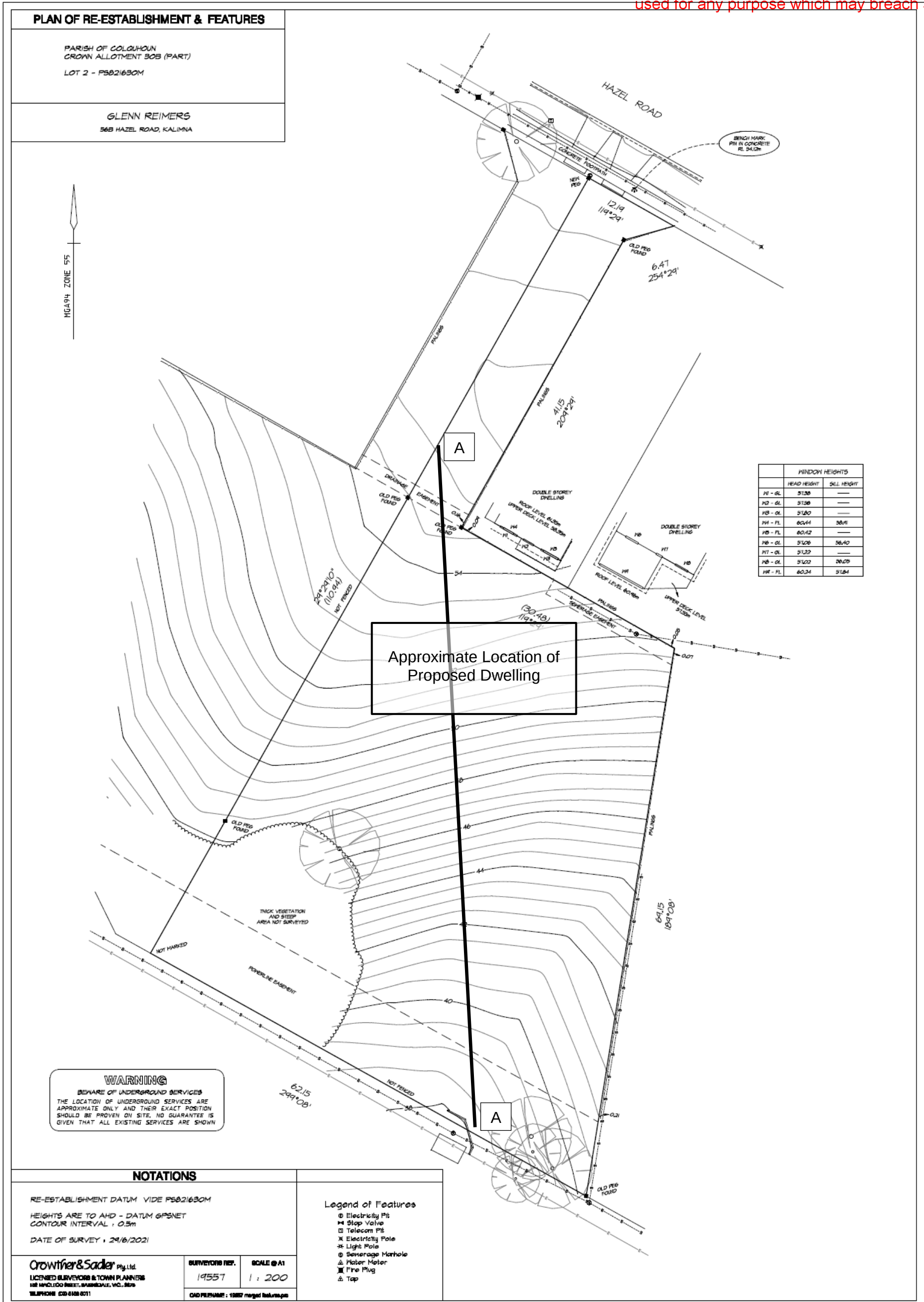
Stace Puts B.E. (Civil & Environmental)
Hons.
Geotechnical Engineer

18 September 2024

Appendix A – Location Plan



Appendix B – Crowther & Sadler Survey Plan 1957 Cross Section A-A



ADVERTISED

Proposed Dwelling 56B (lot 2) Hazel Road Kalimna Geotechnical Investigation & Landslide Risk Assessment
Our Reference: R8790-1

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Appendix C – Borelogs & Laboratory Results

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ENGINEERING LOG				REPORT NUMBER: 8790-1-01-BL		Engineering Log File																													
CLIENT: Glenn Reimers						Classification Graphical Summary																													
ADDRESS: 7/166 Cape Street, Heidelberg VIC 3084																																			
PROJECT: Proposed Dwelling																																			
LOCATION: 56B (lot 2) Hazel Road, Kalimna VIC 3909																																			
METHOD: AS1289.1.2.1.6.5.3 Sampling from in-situ material - Power Auger Drilling and AS1289.1.2.1.6.7 Sampling from in-situ material - Open-drive Samplers																																			
TEST SITE NUMBER: 01		JOB NUMBER: 8790		VISIT NUMBER: 1																															
Depth (m)	Field Description of Materials (as per AS 1726 - Appendix A)	Sample From To			Comments																														
0.000					Surfacing Comprises of Grass																														
0.750	SM, Silty, Fine SAND RESIDUAL SOIL, Of low plasticity, Dark grey-brown, Moist, Loose,	0.400	0.500	S8790-1-01 A	MC=10.9																														
4.500	SM, Silty, Medium SAND RESIDUAL SOIL, Fine sand throughout Of low plasticity, Brown, Moist, Medium Dense, Moist to wet at 3.5m. Wet at 3.7m,	0.800	0.900	S8790-1-01 B	MC=10.6																														
		1.500	1.950	S8790-1-01 C	MC=8.8																														
		3.000	3.450	S8790-1-01 D	MC=13.0																														
6.000	SM, Silty, Medium SAND trace CLAY, RESIDUAL SOIL, Fine sand throughout Of low plasticity, Brown, Wet, Medium Dense, Slightly clayey,	4.500	4.950	S8790-1-01 F	SPT= borehole colapse at 3.7m - two attempts																														
		6.000	6.450	S8790-1-01 E	MC=13.8																														
END	 																																		
AS 1289.6.3.2: Soil Strength and Consolidation tests - Determination of the penetration resistance of a soil - 9kg Dynamic Cone Penetrometer test (Estimated In Situ CBR based on Figure 5.3 Austroads 2004) <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Cumulative No Blows</th> <th>Cumulative Penetration (mm)</th> <th>Estimated Field CBR</th> </tr> </thead> <tbody> <tr><td colspan="3">Start Depth = 0mm</td></tr> <tr><td>2</td><td>100</td><td>4</td></tr> <tr><td>4</td><td>200</td><td>4</td></tr> <tr><td>6</td><td>300</td><td>4</td></tr> <tr><td>9</td><td>400</td><td>6</td></tr> <tr><td>12</td><td>500</td><td>6</td></tr> <tr><td>15</td><td>600</td><td>6</td></tr> <tr><td>17</td><td>700</td><td>4</td></tr> <tr><td>19</td><td>800</td><td>4</td></tr> </tbody> </table> Legend - Field Test Results DCP - Dynamic Cone Penetrometer - AS 1289.6.3.2 SPT - Standard Penetration Test - "N" Value is the number of blows for last 300mm - AS 1289.6.3.1 PSP - Perth Sand Penetrometer test - Np is the penetration resistance (blows per 300mm penetration) - AS 1289.6.3.3						Cumulative No Blows	Cumulative Penetration (mm)	Estimated Field CBR	Start Depth = 0mm			2	100	4	4	200	4	6	300	4	9	400	6	12	500	6	15	600	6	17	700	4	19	800	4
Cumulative No Blows	Cumulative Penetration (mm)	Estimated Field CBR																																	
Start Depth = 0mm																																			
2	100	4																																	
4	200	4																																	
6	300	4																																	
9	400	6																																	
12	500	6																																	
15	600	6																																	
17	700	4																																	
19	800	4																																	
END OF LOG: 15-August-2024		Legend - Laboratory Test Results		Legend - Field Test Results																															
TOTAL DEPTH OF HOLE: 6m		MC - Moisture Content (%) - AS 1289.2.1.1		DCP - Dynamic Cone Penetrometer - AS 1289.6.3.2																															
DEPTH TO GROUNDWATER: Not Determined		CBR - Laboratory Soaked CBR (%) - AS 1289.6.1.1		SPT - Standard Penetration Test - "N" Value is the number of blows for last 300mm - AS 1289.6.3.1																															
RELATIVE LEVEL (SURFACE): Not Determined		PI - Plasticity Index (%) - AS 1289.3.3.1		PSP - Perth Sand Penetrometer test - Np is the penetration resistance (blows per 300mm penetration) - AS 1289.6.3.3																															
LOGGED BY: Ben Corrie		LCS - Laboratory Classification of Soil - AS 1726 A2																																	
ENTERED BY: Luka Varga																																			

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ENGINEERING LOG				REPORT NUMBER: 8790-1-02-BL		Engineering Log File																															
CLIENT: Glenn Reimers						Classification Graphical Summary 																															
ADDRESS: 7/166 Cape Street, Heidelberg VIC 3084																																					
PROJECT: Proposed Dwelling																																					
LOCATION: 56B (lot 2) Hazel Road, Kalimna VIC 3909																																					
METHOD: AS1289.1.2.1.6.5.2 Sampling from in-situ material - Hand Auger Drilling																																					
TEST SITE NUMBER: 02		JOB NUMBER: 8790		VISIT NUMBER: 1																																	
Depth (m)	Field Description of Materials (as per AS 1726 - Appendix A)	Sample			Comments																																
		From	To																																		
0.000					Surfacing Comprises of Grass																																
	SM, Silty, Fine SAND	0.400	0.500	S8790-1-02 A	MC=13.2																																
	RESIDUAL SOIL,	0.800	0.900	S8790-1-02 B	MC=10.9																																
1.500	Becoming paler and brown at 0.3m. Medium dense at depth,																																				
END																																					
AS 1289.6.3.2: Soil Strength and Consolidation tests - Determination of the penetration resistance of a soil - 9kg Dynamic Cone Penetrometer test (Estimated In Situ CBR based on Figure 5.3 Austroads 2004) <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Cumulative No Blows</th> <th>Cumulative Penetration (mm)</th> <th>Estimated Field CBR</th> </tr> </thead> <tbody> <tr> <td colspan="3">Start Depth = 0mm</td> </tr> <tr> <td>1</td> <td>100</td> <td>2</td> </tr> <tr> <td>2</td> <td>200</td> <td>2</td> </tr> <tr> <td>3</td> <td>300</td> <td>2</td> </tr> <tr> <td>5</td> <td>400</td> <td>4</td> </tr> <tr> <td>6</td> <td>500</td> <td>2</td> </tr> <tr> <td>8</td> <td>600</td> <td>4</td> </tr> <tr> <td>10</td> <td>700</td> <td>4</td> </tr> <tr> <td>12</td> <td>800</td> <td>4</td> </tr> </tbody> </table>						Cumulative No Blows	Cumulative Penetration (mm)	Estimated Field CBR	Start Depth = 0mm			1	100	2	2	200	2	3	300	2	5	400	4	6	500	2	8	600	4	10	700	4	12	800	4		
Cumulative No Blows	Cumulative Penetration (mm)	Estimated Field CBR																																			
Start Depth = 0mm																																					
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2	200	2																																			
3	300	2																																			
5	400	4																																			
6	500	2																																			
8	600	4																																			
10	700	4																																			
12	800	4																																			
END OF LOG: 15-August-2024		Legend - Laboratory Test Results		Legend - Field Test Results																																	
TOTAL DEPTH OF HOLE: 1.5m		MC - Moisture Content (%) - AS 1289.2.1.1		DCP - Dynamic Cone Penetrometer - AS 1289.6.3.2																																	
DEPTH TO GROUNDWATER: Not Determined		CBR - Laboratory Soaked CBR (%) - AS 1289.6.1.1		SPT - Standard Penetration Test - "N" Value is the number of blows for last 300mm - AS 1289.6.3.1																																	
RELATIVE LEVEL (SURFACE): Not Determined		PI - Plasticity Index (%) - AS 1289.3.3.1		PSP - Perth Sand Penetrometer test - Np is the penetration resistance (blows per 300mm penetration) - AS 1289.6.3.3																																	
LOGGED BY: Ben Corrie		LCS - Laboratory Classification of Soil - AS 1726 A2																																			
ENTERED BY: Luka Varga																																					
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ENGINEERING LOG				REPORT NUMBER: 8790-1-03-BL		Engineering Log Field Classification Graphical Summary																														
CLIENT: Glenn Reimers						SITE 03																														
ADDRESS: 7/166 Cape Street, Heidelberg VIC 3084																																				
PROJECT: Proposed Dwelling																																				
LOCATION: 56B (lot 2) Hazel Road, Kalimna VIC 3909																																				
METHOD: AS1289.1.2.1.6.5.2 Sampling from in-situ material - Hand Auger Drilling																																				
TEST SITE NUMBER: 03		JOB NUMBER: 8790		VISIT NUMBER: 1																																
Depth (m)	Field Description of Materials (as per AS 1726 - Appendix A)	Sample		From	To	Comments																														
0.000	Surfacing Comprises of Grass																																			
0.400	SM, Silty, Fine SAND RESIDUAL SOIL, Of low plasticity, Dark grey, Moist, Loose, Paler with depth,																																			
1.500	SM, Silty, Fine SAND RESIDUAL SOIL, Clay pieces throughout Of low plasticity, Orange-brown, Moist, Loose, Medium dense with depth,	0.400 0.800	0.500 0.900	S8790-1-03 A S8790-1-03 B	MC=12.2 MC=11.8																															
END																																				
AS 1289.6.3.2: Soil Strength and Consolidation tests - Determination of the penetration resistance of a soil - 9kg Dynamic Cone Penetrometer test (Estimated In Situ CBR based on Figure 5.3 Austroads 2004) <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Cumulative No Blows</th> <th>Cumulative Penetration (mm)</th> <th>Estimated Field CBR</th> </tr> </thead> <tbody> <tr> <td colspan="3">Start Depth = 0mm</td> </tr> <tr> <td>1</td> <td>100</td> <td>2</td> </tr> <tr> <td>2</td> <td>200</td> <td>2</td> </tr> <tr> <td>3</td> <td>300</td> <td>2</td> </tr> <tr> <td>5</td> <td>400</td> <td>4</td> </tr> <tr> <td>7</td> <td>500</td> <td>4</td> </tr> <tr> <td>10</td> <td>600</td> <td>6</td> </tr> <tr> <td>13</td> <td>700</td> <td>6</td> </tr> <tr> <td>16</td> <td>800</td> <td>6</td> </tr> </tbody> </table>						Cumulative No Blows	Cumulative Penetration (mm)	Estimated Field CBR	Start Depth = 0mm			1	100	2	2	200	2	3	300	2	5	400	4	7	500	4	10	600	6	13	700	6	16	800	6	
Cumulative No Blows	Cumulative Penetration (mm)	Estimated Field CBR																																		
Start Depth = 0mm																																				
1	100	2																																		
2	200	2																																		
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5	400	4																																		
7	500	4																																		
10	600	6																																		
13	700	6																																		
16	800	6																																		
END OF LOG: 15-August-2024		Legend - Laboratory Test Results		Legend - Field Test Results																																
TOTAL DEPTH OF HOLE: 1.5m		MC - Moisture Content (%) - AS 1289.2.1.1		DCP - Dynamic Cone Penetrometer - AS 1289.6.3.2																																
DEPTH TO GROUNDWATER: Not Determined		CBR - Laboratory Soaked CBR (%) - AS 1289.6.1.1		SPT - Standard Penetration Test - "N" Value is the number of blows for last 300mm - AS 1289.6.3.1																																
RELATIVE LEVEL (SURFACE): Not Determined		PI - Plasticity Index (%) - AS 1289.3.3.1		PSP - Perth Sand Penetrometer test - Np is the penetration resistance (blows per 300mm penetration) - AS 1289.6.3.3																																
LOGGED BY: Ben Corrie		LCS - Laboratory Classification of Soil - AS 1726 A2																																		
ENTERED BY: Luka Varga																																				
FORM 555.1		REV2.7		22/01/2019		THIS DOCUMENT SHALL NOT BE REPRODUCED EXCEPT IN FULL Page 1 of 1																														

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ENGINEERING LOG				REPORT NUMBER: 8790-1-04-BI		Engineering Log Field Classification Graphical Summary	
CLIENT: Glenn Reimers						SITE 04	
ADDRESS: 7/166 Cape Street, Heidelberg VIC 3084							
PROJECT: Proposed Dwelling							
LOCATION: 56B (lot 2) Hazel Road, Kalimna VIC 3909							
METHOD: AS1289.1.2.1.6.5.3 Sampling from in-situ material - Power Auger Drilling and AS1289.1.2.1.6.7 Sampling from in-situ material - Open-drive Samplers							
TEST SITE NUMBER: 04		JOB NUMBER: 8790		VISIT NUMBER: 1			
Depth (m)	Field Description of Materials (as per AS 1726 - Appendix A)	Sample From To				Comments	
0.000	Surfacing Comprises of Grass						
0.350	SM, Silty, Fine SAND FILL, Of low plasticity, Dark grey, Moist, Loose, Paler with depth,						
0.750	CI, Silty, CLAY with SAND, FILL, Of medium plasticity, Brown, Moist, near plastic limit, Firm, Very sandy with depth,	0.400	0.500	S8790-1-04 A	MC=18.9		
1.200	SC, Clayey, Medium SAND FILL, Of low plasticity, Brown, Moist, Medium Dense, Becoming wet with depth,	0.800	0.900	S8790-1-04 B	MC=16.0		
2.300	CH, Silty, CLAY with SAND, RESIDUAL SOIL, Of high plasticity, Pale grey mottled orange-brown, Moist, near plastic limit, Stiff, Trace sand with depth and very stiff,	1.500	1.950	S8790-1-04 D	SPT=7, 9, 15, N=24, MC=16.6		
4.200	CI, Silty, CLAY RESIDUAL SOIL, White friable pockets throughout at 2.3-2.6m Of medium plasticity, Grey mottled brown-orange, Moist, near plastic limit, Stiff, Very stiff and fine sand throughout with depth,	3.000 2.300	3.450 3.000	S8790-1-04 E S8790-1-04 C	SPT=7, 12, 16, N=28, MC=13.8 MC=20.7, PI=25, LCS=CI		
4.900	SM, Silty, Fine SAND trace CLAY, RESIDUAL SOIL, Medium sand throughout Of low plasticity, Brown-orange, Dry, Medium Dense,	4.500	4.950	S8790-1-04 F	SPT=7, 11, 12, N=23, MC=8.6		
6.000	SP, Medium SAND trace CLAY, RESIDUAL SOIL, Of low plasticity, Orange, Moist, Medium Dense,	6.000	6.450	S8790-1-04 G	SPT=, 11, 13, 16, N=29, MC=10.8		
6.600	SP, Medium SAND trace CLAY, RESIDUAL SOIL, Coarse sand and fine gravels Of low plasticity, Orange-brown, Moist, Dense,						
7.000	SC, Clayey, Fine SAND RESIDUAL SOIL, Of low plasticity, Grey, Moist, Medium Dense,						
7.200	CI, Silty, CLAY RESIDUAL SOIL, Trace sand Of medium plasticity, Grey, Moist, near plastic limit, Soft,						
END OF LOG: 15-August-2024		Legend - Laboratory Test Results		Legend - Field Test Results			
TOTAL DEPTH OF HOLE: 7.2m		MC - Moisture Content (%) - AS 1289.2.1.1		DCP - Dynamic Cone Penetrometer - AS 1289.6.3.2			
DEPTH TO GROUNDWATER: Not Determined		CBR - Laboratory Soaked CBR (%) - AS 1289.6.1.1		SPT - Standard Penetration Test - "N" Value is the number of blows for last 300mm - AS 1289.6.3.1			
RELATIVE LEVEL (SURFACE): Not Determined		PI - Plasticity Index (%) - AS 1289.3.3.1		PSP - Perth Sand Penetrometer test - Np is the penetration resistance (blows per 300mm penetration) - AS 1289.6.3.3			
LOGGED BY: Ben Corrie		LCS - Laboratory Classification of Soil - AS 1726 A2					
ENTERED BY: Luka Varga							
FORM 555.1 REV2.7 22/01/2019		THIS DOCUMENT SHALL NOT BE REPRODUCED EXCEPT IN FULL Page 1 of 1					

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ENGINEERING LOG				REPORT NUMBER: 8790-1-04-BL		Engineering Log Field Classification Graphical Summary	
CLIENT: Glenn Reimers						SITE 04	
ADDRESS: 7/166 Cape Street, Heidelberg VIC 3084							
PROJECT: Proposed Dwelling							
LOCATION: 56B (lot 2) Hazel Road, Kalimna VIC 3909							
METHOD: AS1289.1.2.1.6.5.3 Sampling from in-situ material - Power Auger Drilling and AS1289.1.2.1.6.7 Sampling from in-situ material - Open-drive Samplers							
TEST SITE NUMBER: 04		JOB NUMBER: 8790		VISIT NUMBER: 1			
Depth (m)	Field Description of Materials (as per AS 1726 - Appendix A)	Sample From To				Comments	
7.200				Surfacing Comprises of Grass			
8.200	SP, Gravelly, Fine SAND trace CLAY, RESIDUAL SOIL, Coarse sand and quartz throughout Of low plasticity, Grey, Moist, Medium Dense, Becoming sandy, fine gravel and loose at 7.7m,	7.500	7.950	S8790-1-04 H	SPT=5, 5, 4, N=9, MC=5.1		
9.300	SC, Clayey, Medium SAND RESIDUAL SOIL, Coarse sand throughout Of low plasticity, Orange, Moist, Medium Dense,	9.000	9.450	S8790-1-04 I	SPT=4, 6, 8, N=14, MC=7.7		
10.800	SP, Fine SAND RESIDUAL SOIL, Medium sand throughout Of low plasticity, Pale brown, Moist, Medium Dense,	10.500	10.950	S8790-1-04 J	SPT=14, 17, 22, N=39, MC=7.2		
15.450	SP, Medium SAND RESIDUAL SOIL, Fine sand throughout Of low plasticity, Pale brown, Moist, Dense, Becoming orange at 13m,	12.000	12.450	S8790-1-04 K	SPT=12, 16, 19, N=35, MC=6.8		
		13.500	13.950	S8790-1-04 L	SPT=13, 22, 24, N=46, MC=9.8		
		15.000	15.450	S8790-1-04 M	SPT=12, 20, 22, N=42, MC=8.0		
END							
END OF LOG: 16-August-2024		Legend - Laboratory Test Results		Legend - Field Test Results			
TOTAL DEPTH OF HOLE: 15.45m		MC - Moisture Content (%) - AS 1289.2.1.1		DCP - Dynamic Cone Penetrometer - AS 1289.6.3.2			
DEPTH TO GROUNDWATER: Not Determined		CBR - Laboratory Soaked CBR (%) - AS 1289.6.1.1		SPT - Standard Penetration Test - "N" Value is the number of blows for last 300mm - AS 1289.6.3.1			
RELATIVE LEVEL (SURFACE): Not Determined		PI - Plasticity Index (%) - AS 1289.3.3.1		PSP - Perth Sand Penetrometer test - Np is the penetration resistance (blows per 300mm penetration) - AS 1289.6.3.3			
LOGGED BY: Ben Corrie		LCS - Laboratory Classification of Soil - AS 1726 A2					
ENTERED BY: Luka Varga							
FORM 555.1 REV2.7 22/01/2019		THIS DOCUMENT SHALL NOT BE REPRODUCED EXCEPT IN FULL Page 1 of 1					

SOIL MOISTURE CONTENT TEST REPORT

MC8790-1

PROJECT INFORMATION

REPORT NUMBER: MC8790-1

CLIENT: Glenn Reimers

CLIENT ADDRESS: 7/166 Cape Street, Heidelberg VIC 3084

PROJECT: Proposed Dwelling

PROJECT LOCATION: 56B (Lot 2) Hazel Road, KALIMNA VIC 3909

SAMPLING METHOD/S: AS1289.1.2.1.6.5.3 Sampling from in-situ material - Power Auger Drilling

AS1289.1.2.1.6.7 Sampling from in-situ material - Open-drive Samplers

TEST DETAILS

TEST METHOD: AS 1289.2.1.1 - Oven drying method (standard method)

Sample I.D.:	S8790-1-01A	S8790-1-01B	S8790-1-01C	S8790-1-01D	S8790-1-01E	S8790-1-02A	S8790-1-02B	S8790-1-03A	S8790-1-03B	S8790-1-04A
Sample Depth (mm)	400-500	800-900	1500-1950	3000-3450	5900-600	400-500	800-900	400-500	800-900	400-500
Date Sampled:	15/08/2024	15/08/2024	15/08/2024	15/08/2024	15/08/2024	15/08/2024	15/08/2024	15/08/2024	15/08/2024	15/08/2024
Date Tested:	20/08/2024	20/08/2024	20/08/2024	20/08/2024	20/08/2024	20/08/2024	20/08/2024	20/08/2024	20/08/2024	20/08/2024
Moisture Content (%):	10.9	10.6	8.8	13.0	13.8	13.2	10.9	12.2	11.8	18.9
Sample I.D.:	S8790-1-04B	S8790-1-04D	S8790-1-04E	S8790-1-04F	S8790-1-04G	S8790-1-04H	S8790-1-04I	S8790-1-04J	S8790-1-04K	S8790-1-04L
Sample Depth (mm)	800-900	1500-1950	3000-3450	4500-4950	6000-6450	7500-7950	9000-9450	10500-10950	12000-12450	13000-13450
Date Sampled:	15/08/2024	15/08/2024	15/08/2024	15/08/2024	15/08/2024	15/08/2024	15/08/2024	15/08/2024	15/08/2024	15/08/2024
Date Tested:	20/08/2024	20/08/2024	20/08/2024	20/08/2024	20/08/2024	20/08/2024	20/08/2024	20/08/2024	20/08/2024	20/08/2024
Moisture Content (%):	16.0	16.6	13.8	8.6	10.8	5.1	7.7	7.2	6.8	9.8
Sample I.D.:	S8790-1-04M									
Sample Depth (mm)	15000-15450									
Date Sampled:	15/08/2024									
Date Tested:	20/08/2024									
Moisture Content (%):	8.0									
Sample I.D.:										
Sample Depth (mm)										
Date Sampled:										
Date Tested:										
Moisture Content (%):										
Sample I.D.:										
Sample Depth (mm)										
Date Sampled:										
Date Tested:										
Moisture Content (%):										
Sample I.D.:										
Sample Depth (mm)										
Date Sampled:										
Date Tested:										
Moisture Content (%):										

WORLD RECOGNISED
ACCREDITATIONAccredited for compliance with
ISO/IEC 17025 - Testing

Date Issued: 28/08/2024

The results relate only to the items
testedAuthorised Signatory: 
Niklas West (Laboratory Manager)NATA Accredited
Laboratory Number: 17066

Site Geotechnical Pty Ltd

ABN: 23 114 166 997

Factory 3/8 Cannery Court,

Tyabb, VIC 3913

Phone: 1300 557 260

<http://www.sitegeo.com.au>Email: lab@sitegeo.com.au

SOIL CLASSIFICATION REPORT

LCS8790-1-04C

PROJECT INFORMATION		SAMPLE INFORMATION		CLIENT INFORMATION	
REPORT NUMBER:	LCS8790-1-04C	SAMPLE ID.:	S8790-1-04C	CLIENT:	Glenn Reimers
PROJECT:	Proposed Dwelling	SAMPLING METHOD:	AS1289.1.2, 1.6.5.3 Sampling from in-situ material - Power Auger Drilling	ADDRESS:	7/166 Cape Street, Heidelberg VIC 3084
PROJECT LOCATION:	56B (lot 2) Hazel Road, KALIMNA VIC 3909	SAMPLE LOCATION:	SITE 04	DATE:	15/09/2024
		SAMPLE DEPTH:	2300 mm to 3000 mm		
MATERIAL DESCRIPTION, IDENTIFICATION AND CLASSIFICATION (NOT COVERED UNDER NATA SCOPE OF ACCREDITATION)					
TEST		METHOD		RESULT	
Field Material Description (Estimation)		AS1726 A2.1 & A2.2		Silty, CLAY	
Material Classification (From Laboratory Test Results)		AS1726 A2.2		CI	
MATERIAL ANALYSIS (NATA ENDORSED)					
SAMPLE HISTORY		METHOD		RESULT	
TEST		METHOD		RESULT	
Moisture Content (%)		AS1289.2.1.1		20.7	
Liquid Limit (w _L) (%)		AS1289.3.1.2		45	
Plastic Limit (w _p) (%)		AS1289.3.2.1		20	
Plasticity Index (I _p) (%)		AS1289.3.3.1		25	
Linear Shrinkage (LS) (%)		AS1289.3.4.1		8.0	
Linear Shrinkage Remarks		AS1289.3.4.1		Cracking and curling but no crumbling	
Emerson Class Number		AS1289.3.8.1		Not Tested	
Plasticity Chart for Classification of Fine-Grained Soils					
LIQUID LIMIT (w _L), percent					
PLASTICITY INDEX (I _p), percent					
X S8790-1-04C					
SIEVE ANALYSIS					
GRAIN SIZE (MILLIMETRES)					
PERCENT FINER BY WEIGHT					
Sieve Size (mm)					
% Passing (by mass)					
75 100					
63 100					
53 100					
37.5 100					
26.5 100					
19 100					
13.2 100					
9.5 100					
6.7 100					
4.75 100					
2.36 100					
1.18 100					
0.6 99					
0.425 98					
0.3 96					
0.15 93					
0.075 89					
High Temp. Oven Dried (105-110°C), 19mm oversized					
AS1289.3.6.1 37.5mm oversized					
0.0%					
0.0%					



Accredited for compliance with
ISO/IEC 17025 - Testing

Authorised Signatory:
Niklas West (Laboratory Manager)

Date Tested: 20/09/2024
Date Issued: 20/09/2024

Printed: 20/07/2026
Page 79 of 111

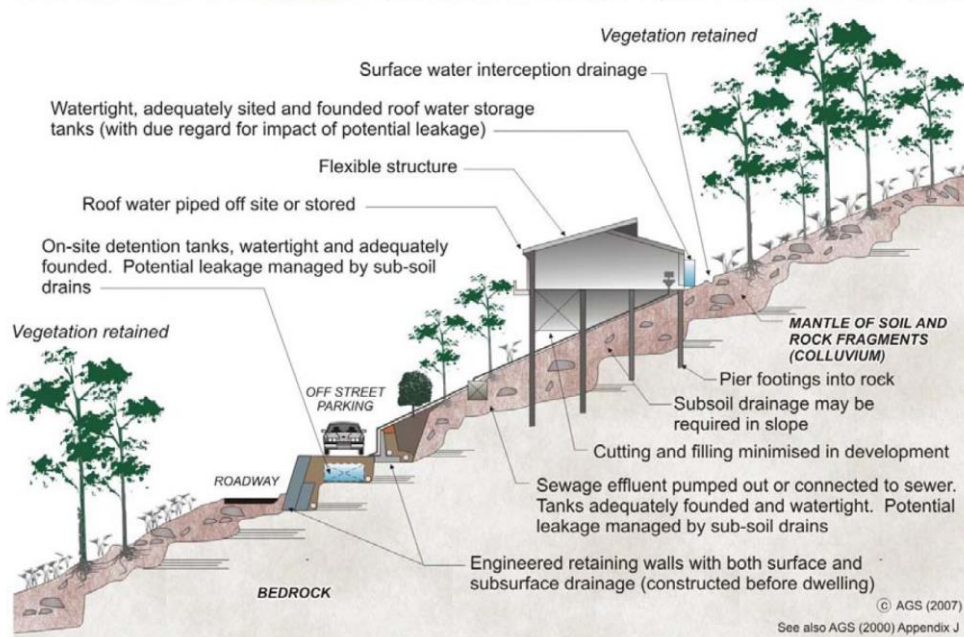
Appendix D – Some Guidelines for Hillside Construction

AUSTRALIAN GEOGUIDE LR8 (CONSTRUCTION PRACTICE)

HILLSIDE CONSTRUCTION PRACTICE

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

EXAMPLES OF GOOD HILLSIDE CONSTRUCTION PRACTICE



WHY ARE THESE PRACTICES GOOD?

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

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

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

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

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

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

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

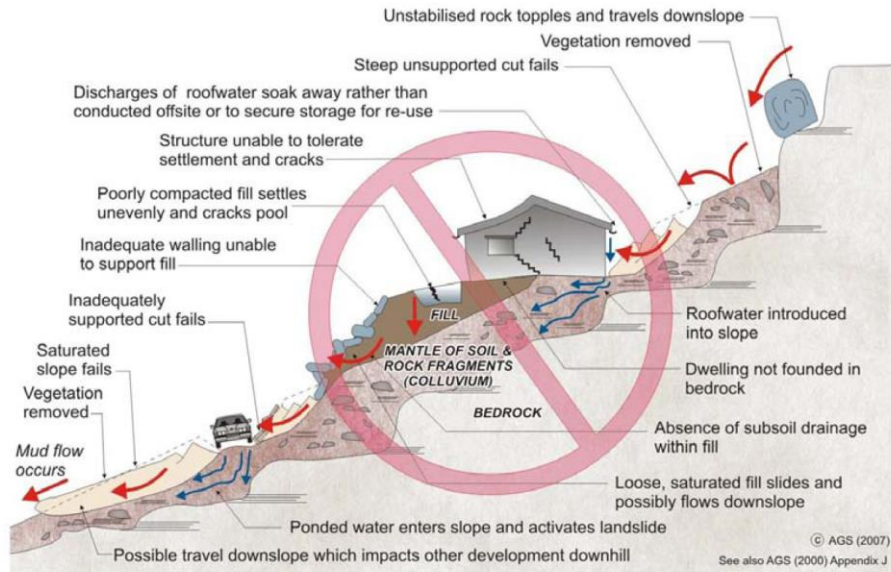
Vegetation clearance - on soil slopes has been kept to a reasonable minimum. Trees, and to a lesser extent smaller vegetation, take large quantities of water out of the ground every day. This lowers the ground water table, which in turn helps to maintain the stability of the slope. Large scale clearing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

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

ADOPT GOOD PRACTICE ON HILLSIDE SITES

AUSTRALIAN GEOGUIDE LR8 (CONSTRUCTION PRACTICE)

EXAMPLES OF **POOR** HILLSIDE CONSTRUCTION PRACTICE



WHY ARE THESE PRACTICES POOR?

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

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

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

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

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

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

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

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

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

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

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

Appendix E - Preliminary Landslide Risk Assessment

Hazard Analysis: Landslide characterization

Potential landslides within the site represent a hazard to property and life. A landslide characterization has been carried out based on slope forming processes, geology, historical data (if available), form and extent of slopes, triggering factors, relevant features that may indicate slope instability, and so on. The following points¹¹ present the most likely landslides¹² that may affect the proposed dwelling.

- Earth translational slide: The contact between the upper soil layers, which usually present S.P.T. blow counts less than 10, and the underlying rock or hard or very dense soil creates a potential slip surface for translational slides. Small to medium scale events can be considered to occur. Intense and / or sustained rainfall, leakage from pipes, under-cuttings or erosion of the toe can trigger this type of mechanism. Moderate to rapid velocities and short to medium travel distances can be expected.
- Rotational earth slide: This type of failure can be associated with topography that has a spoon shape. Shallow and deep seated slides and slope angles typically ranging from 20° to 40° could be expected. Small to large scale events may be considered to occur under adverse conditions. Intense and / or sustained rainfall, earthquake and poor drainage conditions on the top or crest of the slope may trigger this type of mechanism. Their velocity may range between extremely slow to moderate. Short travel distances can be expected

Hazard Analysis: Analysis of frequency, Annual Probability (P_h)

Estimations of annual probabilities (P_h) of landslides were carried out based on expert judgment. Several approaches are applied to determine and adjust P_h : the ranking system developed by Crozier (1984, 1986) which relates geomorphological descriptions of slopes with increasing probability of landslide occurrence, the flow chart developed by Fell et al (1996) which uses observational factors to provide an estimate of P_h and professional criteria based on conditioning and triggering factors, and experience. The following tables presents the estimated probabilities¹³ for each analysed case.

Low probabilities of landslide occurrence are expected within the improved site under investigation.

¹¹ Landslide characterizations are based on The Landslide Handbook descriptions (U.S. Department of the Interior & U.S. Geological Survey, 2008) and other references.

¹² The characterizations are based assuming that good hillside construction and slope management and maintenance are going to be followed according to the AGS guidelines.

¹³ A P_h of 10^{-2} or 1% does not mean that the slope will fail once in 100 year, every 100 years or 100 years apart; it means that if the year (e.g. when the site was assessed) was repeated indefinitely number of times; the slope would have, on average, one failure for every 99 no failures (Lee and Jones, 2004).

Hazard Analysis: Analysis of frequency, Probability of Spatial Impact by the Landslide ($P_{S:H}$)

Landslide location and travel distance will depend on several factors like slope characteristic, mechanism of failure and characteristic of the downhill path. The following presumptive values were made based on landslide modelling.

Consequence Analysis: Elements at Risk & Temporal Spatial Probability ($P_{T:S}$)

The following elements are considered at risk for the proposed project:

- Property: Proposed Dwelling.

It is inferred that person the most at risk (individual risk assessment) would be the governing consideration for the risk assessment of this site. It is not expected there will be high concentrations of people within large periods of time which could control the risk assessment. The temporal spatial probability for a resident at home during a landslide has been considered as 15 hours per day for 135 days of the year (considering that a landslide is more likely during the wetter winter and spring months, say 5 months of the year).

Vulnerability

The vulnerability is based on specific circumstance for each case. A value of 0.25 is expected for a person in the building at the time of a landslide. This values is considered consistent with the Appendix F-Example of Vulnerability Values of the AGS Practice Note Guidelines for Landslide Risk management (2007).

APPENDIX F- EXAMPLE OF VULNERABILITY VALUES

SUMMARY OF HONG KONG VULNERABILITY RANGES FOR PERSONS, AND RECOMMENDED VALUES FOR LOSS OF LIFE FOR LANDSLIDING IN SIMILAR SITUATIONS

The following table is adapted from P J Finlay, G R Mostyn & R Fell (1999). *Landslides: Prediction of Travel Distance and Guidelines for Vulnerability of Persons*. Proc 8th. Australia New Zealand Conference on Geomechanics, Hobart. Australian Geomechanics Society, ISBN 1 86445 0029, Vol 1, pp.105-113.

Case	Range in Data	Recommended Value	Comments
Person in Open Space			
If struck by a rockfall	0.1 – 0.7	0.5	May be injured but unlikely to cause death
If buried by debris	0.8 – 1.0	1.0	Death by asphyxia almost certain
If not buried	0.1 – 0.5	0.1	High chance of survival
Persons in a Vehicle			
If the vehicle is buried/crushed	0.9 – 1.0	1.0	Death is almost certain
If the vehicle is damaged only	0 – 0.3	0.3	High chance of survival
Person in a Building			
If the building collapses	0.9 – 1.0	1.0	Death is almost certain
If the building is inundated with debris and the person buried	0.8 – 1.0	1.0	Death is highly likely
If the debris strikes the building only	0 – 0.1	0.05	Very high chance of survival

EXAMPLE OF VULNERABILITY VALUES FOR DESTRUCTION OF PEOPLE, BUILDINGS AND ROADS

The following table is adapted from Marion Michael-Leiba, Fred Baynes, Greg Scott & Ken Granger (2002). *Quantitative Landslide Risk Assessment of Cairns*. Australian Geomechanics, June 2002.

Geomorphic Unit	Vulnerability Values		
	People	Buildings	Roads
Hill slopes	0.05	0.25	0.3
Proximal debris fan	0.5	1.0	1.0
Distal debris fan	0.05	0.1	0.3

EXAMPLE OF VULNERABILITY VALUES FOR LIFE FOR ROCKFALLS AND DEBRIS FLOWS FOR LAWRENCE HARGRAVE DRIVE PROJECT, COALCLIFF TO CLIFTON AREA, AUSTRALIA

The following table is adapted from R A Wilson, A T Moon, M Hendricks & I E Stewart (2005). *Application of quantitative risk assessment to the Lawrence Hargrave Drive Project, New South Wales, Australia*. Landslide Risk Management - Hungr, Fell, Couture & Eberhardt (eds) 2005. Taylor & Francis Group, London, ISBN 04 1538 043X.

Order of magnitude of landslide crossing road (m ³)	Rockfalls from Scarborough Cliff		Debris flow from Northern Amphitheatre	
	Landslide hits car	Car hits landslide	Landslide hits car	Car hits landslide
0.03	0.05	0.006	–	–
0.3	0.1	0.002	–	–
3	0.3	0.03	0.001	–
30	0.7	0.03	0.01	0.001
300	1	0.03	0.1	0.003
3,000	1	0.03	1	0.003

NOTE: The above data should be applied with common sense, taking into account the circumstances of the landslide being studied. Judgment may indicate values other than the recommended value are appropriate for a particular case.

Figure 0-1 Example of Vulnerability Values of the AGS Practice Note Guidelines for Landslide Risk management

Consequence Analysis: Qualitative measures of consequences to property

Landslide characteristic, slope dimensions and geometry, soil profile, geology, groundwater, travel distance, potential mobilized volume, and so on are considered to assess the effects of the slide on the property. The landslides under investigation are expected to cause medium damage to the proposed dwelling.

Risk Analysis & Assessment

Risk analyses to life are calculated based on the good hillside construction and maintenance, and these report recommendations. Each individual risk is summed for all landslide hazards and results are compared to the suggested tolerable loss of life risk for the person at most risk, according to AGS LRM guidelines 2007. The following table presents the risk to life calculations for each case.

Table 0-1 Risk Analysis to Life

Area	Classification	Approximate Annual Probability (P_H)	Probability of Spatial Impact by the Landslide ($P_{S,H}$)	Temporal Spatial Probability ($P_{T,S}$)	Vulnerability of the Individual ($V_{D,T}$)	Risk to Life for Each Landslide
Proposed Dwelling	Rotational Slide	1.0.E-04	8.00E-01	2.31E-01	2.50E-01	4.6E-06
Proposed Dwelling	Translational Slide	1.0.E-04	8.00E-01	2.31E-01	2.50E-01	4.6E-06
Total Risk to Life for person most at risk						9.2E-06
Suggested Tolerable Loss of Life Risk for the Person Most at Risk						1.0E-05
Result						Tolerable

A qualitative assessment for risk to property is carried out as an initial screening process because of the level of risk and the possibility of obtaining numerical data is limited. The terminology and methodology followed are based on the Appendix C: Landslide Risk Assessment Qualitative Terminology for Use in Assessing Risk to Property of AGS Practice Note Guidelines for Landslide Risk Management 2007. The following table presents the assessment for the property.

Table 0-2 Levels of Risk to Property

Area	Classification	Likelihood	Likelihood descriptor	Consequences to Property	Risk Level	Suggested Tolerable Value for Property Loss	Condition
Proposed Dwelling	Rotational Slide	1.0E-04	Unlikely	Medium	Low	Moderate	Tolerable
Proposed Dwelling	Translational Slide	1.0E-04	Unlikely	Medium	Low	Moderate	Tolerable

These results are compared to suggested tolerable levels. The recommendation proposed by the AGS commentary on Practice Note Guidelines for Landslide Risk Management 2007 specifies that for structures of level of importance of 2 (low-rise residential constructions or facilities below the limits set for importance level 3), a *moderate* risk is tolerable.

ADVERTISED

Proposed Dwelling 56B (lot 2) Hazel Road Kalimna Geotechnical Investigation & Landslide Risk Assessment
Our Reference: R8790-1

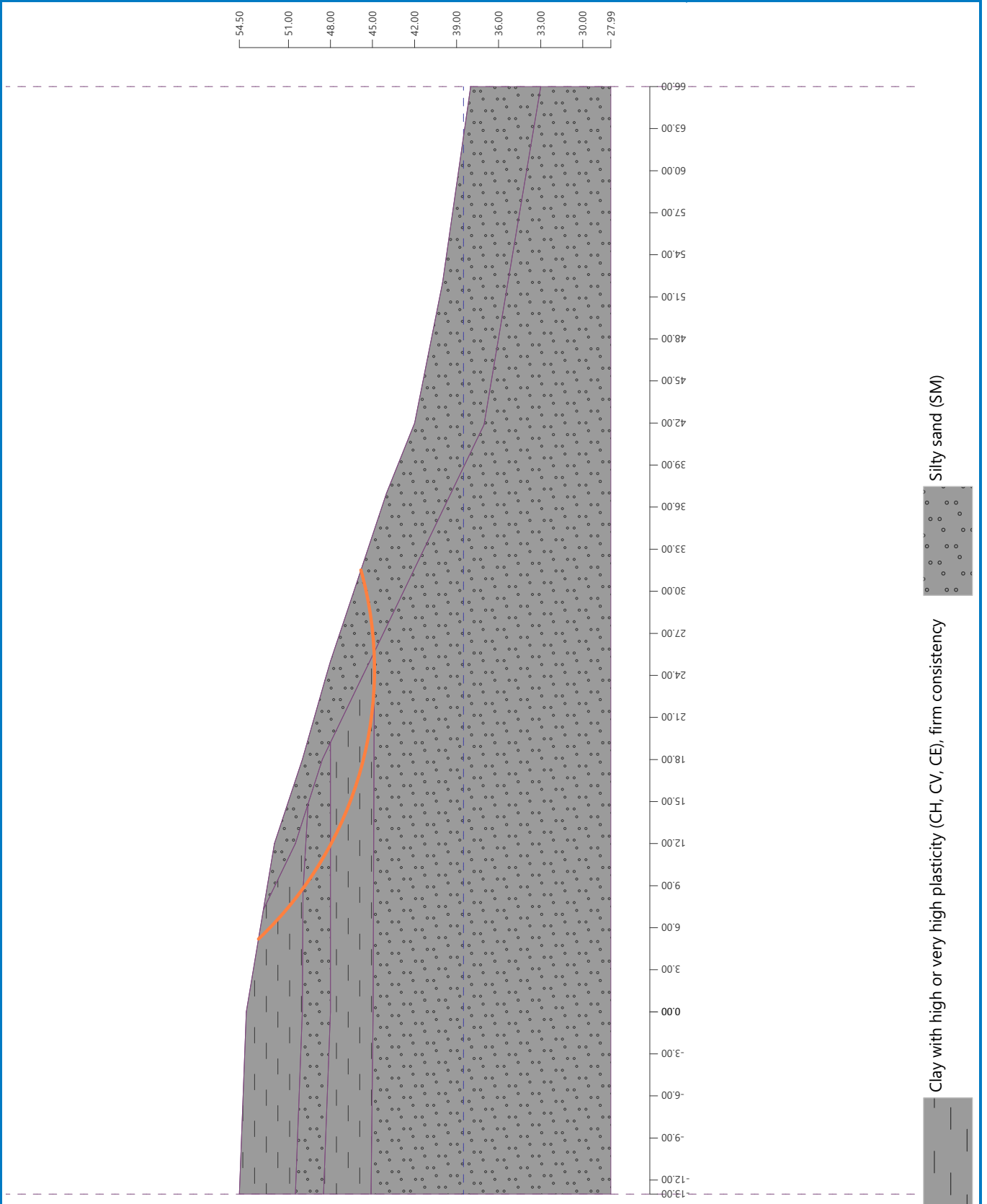
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Appendix F – Slope Modelling Output

Site Geotechnical

Name :

Stage - analysis : 1 - 1



The slip surface after optimization.

Slope stability verification (Morgenstern-Price)

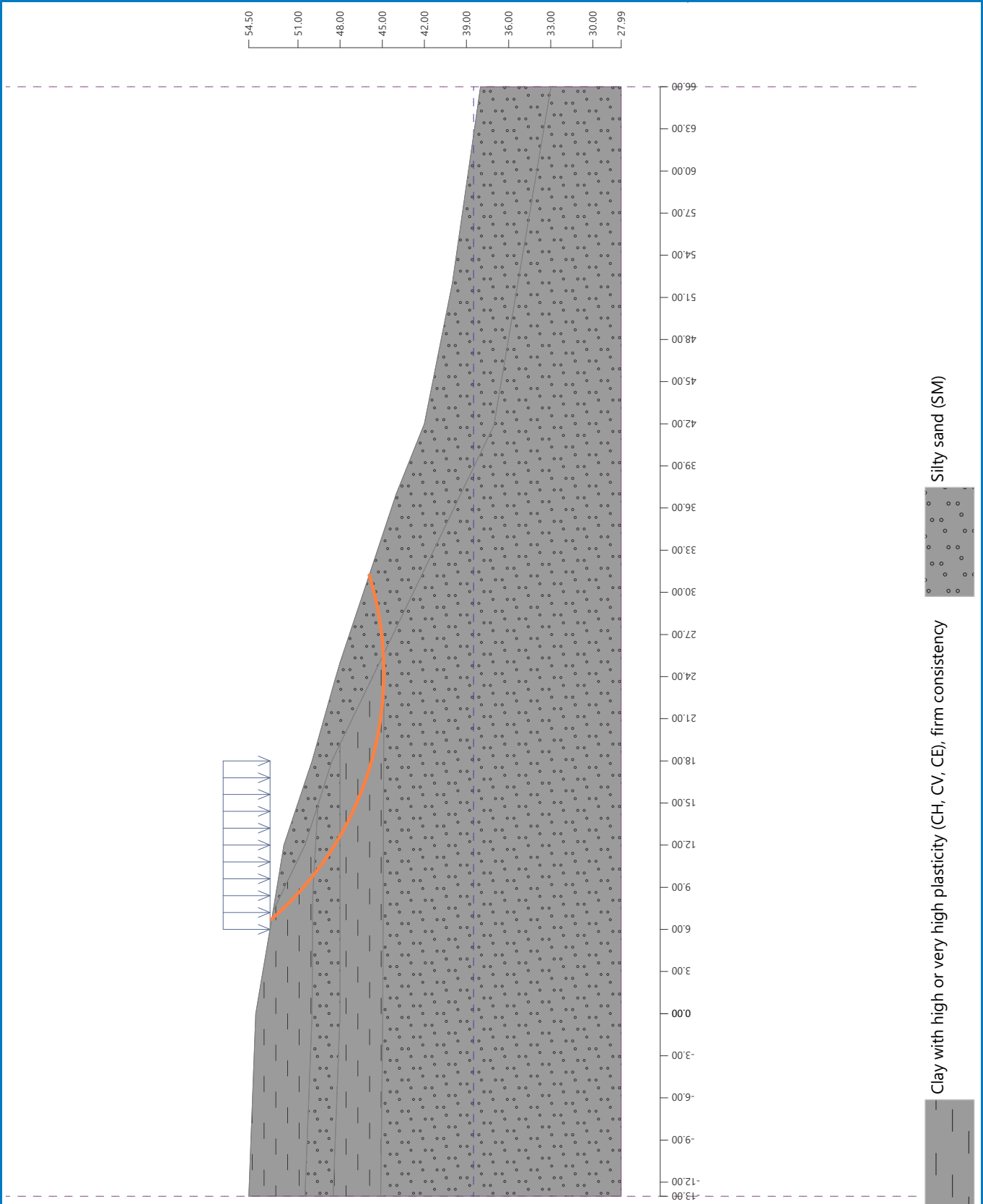
Factor of safety = 1.69 > 1.50

Slope stability ACCEPTABLE

Site Geotechnical

Name :

Stage - analysis : 2 - 1



The slip surface after optimization.

Slope stability verification (Morgenstern-Price)

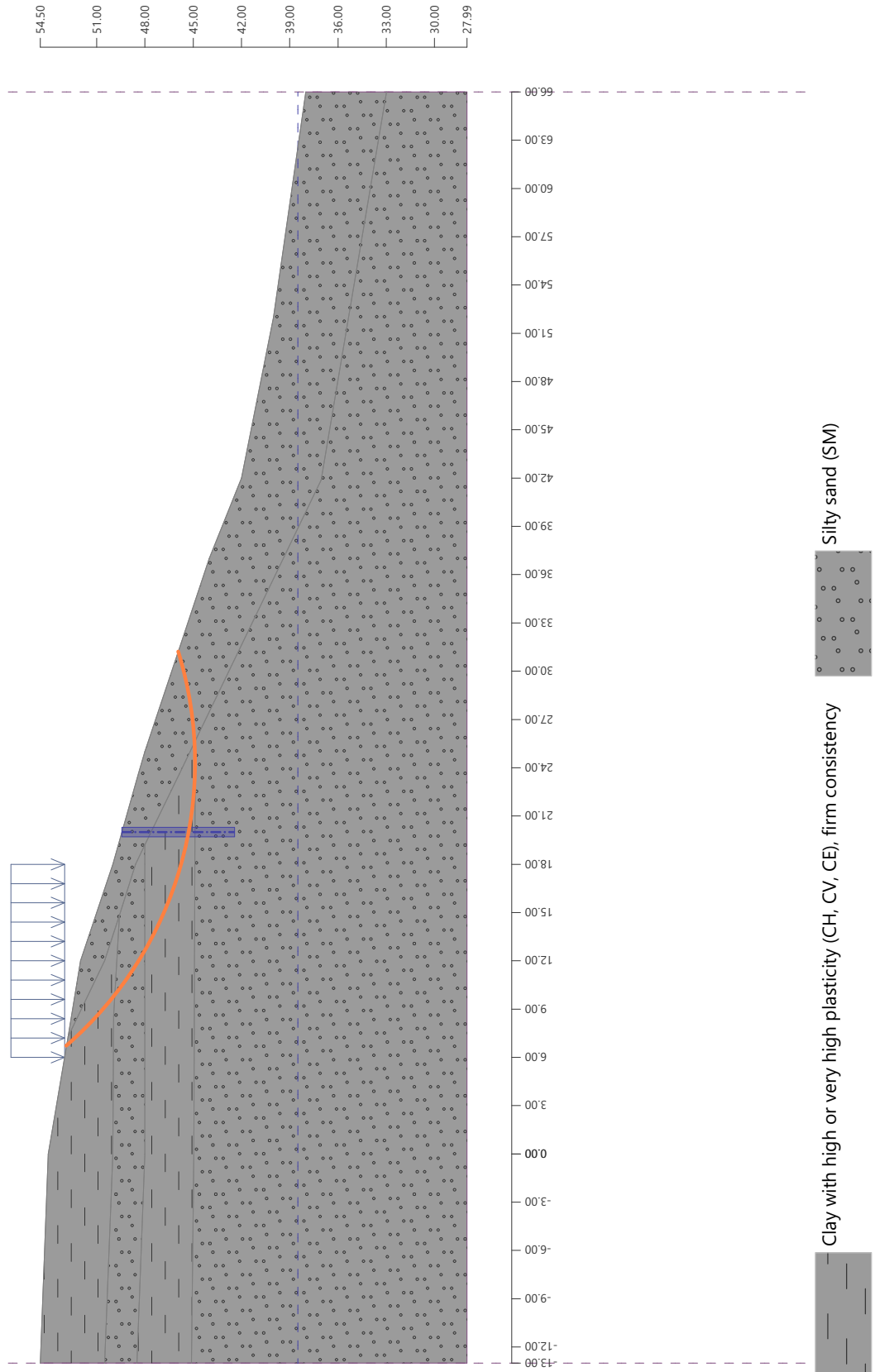
Factor of safety = 1.44 < 1.50

Slope stability NOT ACCEPTABLE

Site Geotechnical

Name :

Stage - analysis : 3 - 1



Analysis of the slip surface without optimization.

Slope stability verification (Morgenstern-Price)

Factor of safety = 1.70 > 1.50

Slope stability ACCEPTABLE

Site Geotechnical

Slope stability analysis

Input data

Project

Task : 56B (lot 2) Hazel Road, Kalimna
Author : Site Geotechnical
Date : 17/09/2024
Project ID : R8790-1

Settings

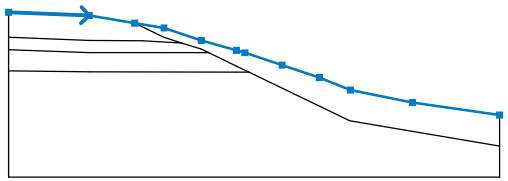
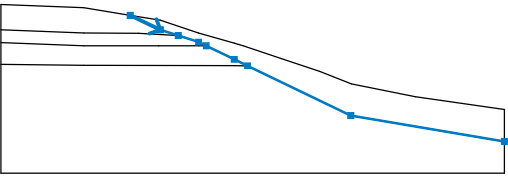
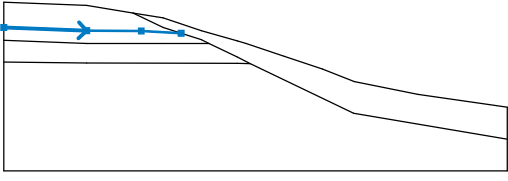
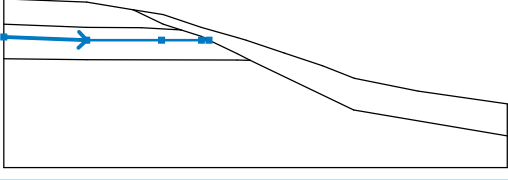
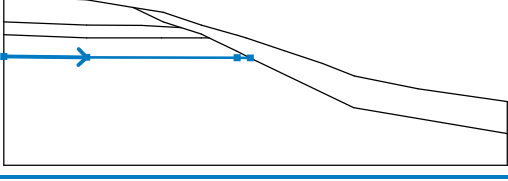
Standard - safety factors

Stability analysis

Verification methodology : Safety factors (ASD)
Earthquake analysis : Standard

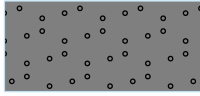
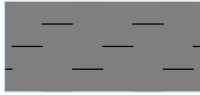
Safety factors		
Permanent design situation		
Safety factor :	$SF_s =$	1.50 [-]

Interface

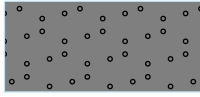
No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
1		-13.00	54.50	0.00	54.00	7.28	52.78
		12.00	52.00	18.00	50.00	23.65	48.39
		25.00	48.00	31.00	46.00	37.00	44.00
		42.00	42.00	52.00	40.00	66.00	38.00
2		7.28	52.78	12.00	50.50	14.83	49.59
		18.01	48.58	19.21	48.00	23.61	45.87
		25.70	44.86	41.88	37.05	66.00	32.99
3		-13.00	50.50	0.00	50.00	8.58	49.95
		14.83	49.59				
4		-13.00	48.49	0.00	48.00	11.76	48.00
		18.01	48.00	19.21	48.00		
5		-13.00	45.10	0.00	44.96	23.61	44.87
		25.70	44.86				

Site Geotechnical

Soil parameters - effective stress state

No.	Name	Pattern	Φ_{ef} [°]	C_{ef} [kPa]	γ [kN/m ³]
1	Silty sand (SM)		29.00	5.00	18.00
2	Clay with high or very high plasticity (CH, CV, CE), firm consistency		15.00	5.00	20.50

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [kN/m ³]	γ_s [kN/m ³]	n [-]
1	Silty sand (SM)		18.00		
2	Clay with high or very high plasticity (CH, CV, CE), firm consistency		20.50		

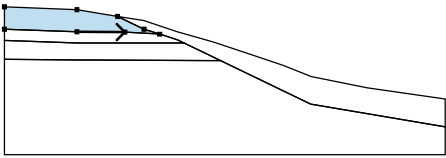
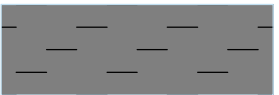
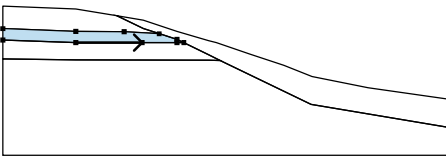
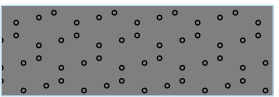
Soil parameters**Silty sand (SM)**

Unit weight : $\gamma = 18.00 \text{ kN/m}^3$
 Stress-state : effective
 Angle of internal friction : $\Phi_{ef} = 29.00^\circ$
 Cohesion of soil : $C_{ef} = 5.00 \text{ kPa}$
 Saturated unit weight : $\gamma_{sat} = 18.00 \text{ kN/m}^3$

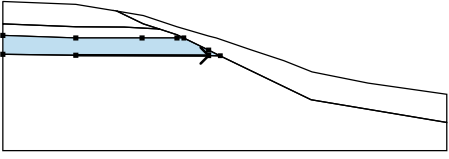
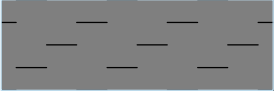
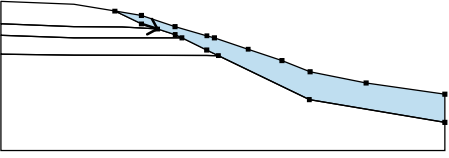
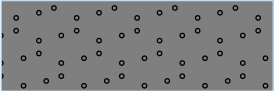
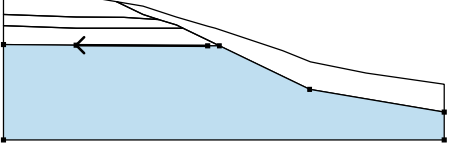
Clay with high or very high plasticity (CH, CV, CE), firm consistency

Unit weight : $\gamma = 20.50 \text{ kN/m}^3$
 Stress-state : effective
 Angle of internal friction : $\Phi_{ef} = 15.00^\circ$
 Cohesion of soil : $C_{ef} = 5.00 \text{ kPa}$
 Saturated unit weight : $\gamma_{sat} = 20.50 \text{ kN/m}^3$

Assigning and surfaces

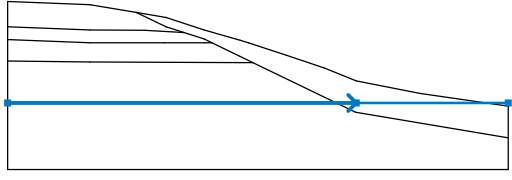
No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
1		0.00	50.00	8.58	49.95	Clay with high or very high plasticity (CH, CV, CE), firm consistency 
		14.83	49.59	12.00	50.50	
		7.28	52.78	0.00	54.00	
		-13.00	54.50	-13.00	50.50	
2		0.00	48.00	11.76	48.00	Silty sand (SM) 
		18.01	48.00	19.21	48.00	
		18.01	48.58	14.83	49.59	
		8.58	49.95	0.00	50.00	
		-13.00	50.50	-13.00	48.49	

Site Geotechnical

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
3		0.00	44.96	23.61	44.87	Clay with high or very high plasticity (CH, CV, CE) firm consistency 
		25.70	44.86	23.61	45.87	
		19.21	48.00	18.01	48.00	
		11.76	48.00	0.00	48.00	
		-13.00	48.49	-13.00	45.10	
4		12.00	50.50	14.83	49.59	Silty sand (SM) 
		18.01	48.58	19.21	48.00	
		23.61	45.87	25.70	44.86	
		41.88	37.05	66.00	32.99	
		66.00	38.00	52.00	40.00	
		42.00	42.00	37.00	44.00	
		31.00	46.00	25.00	48.00	
		23.65	48.39	18.00	50.00	
5		12.00	52.00	7.28	52.78	Silty sand (SM) 
		23.61	44.87	0.00	44.96	
		-13.00	45.10	-13.00	27.99	
		66.00	27.99	66.00	32.99	
		41.88	37.05	25.70	44.86	

Water

Water type : GWT

No.	GWT location	Coordinates of GWT points [m]					
		x	z	x	z	x	z
1		-13.00	38.50	42.00	38.50	66.00	38.50

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1 (stage 1)

Circular slip surface

Slip surface parameters					
Center :	x =	24.43 [m]	Angles :	$\alpha_1 =$	-46.52 [°]
	z =	71.38 [m]		$\alpha_2 =$	15.51 [°]
The slip surface after optimization.					

Site Geotechnical

Slip surface parameters

Radius : R = 26.52 [m]

The slip surface after optimization.

Slope stability verification (Morgenstern-Price)

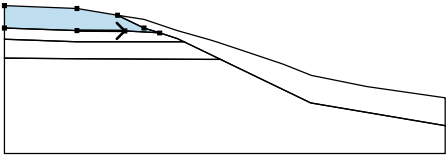
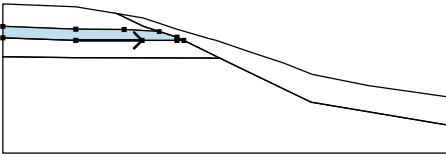
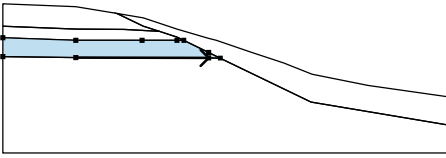
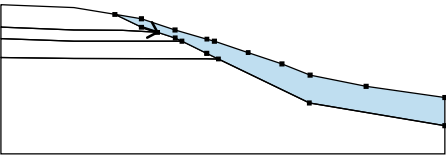
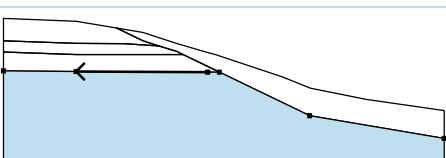
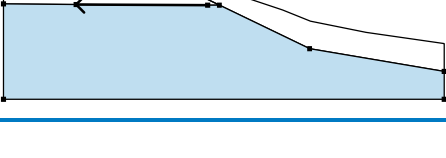
Factor of safety = 1.69 > 1.50

Slope stability **ACCEPTABLE**

Site Geotechnical

Input data (Stage of construction 2)

Assigning and surfaces

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
1		0.00	50.00	8.58	49.95	Clay with high or very high plasticity (CH, CV, CE) firm consistency
		14.83	49.59	12.00	50.50	
		7.28	52.78	0.00	54.00	
		-13.00	54.50	-13.00	50.50	
2		0.00	48.00	11.76	48.00	Silty sand (SM)
		18.01	48.00	19.21	48.00	
		18.01	48.58	14.83	49.59	
		8.58	49.95	0.00	50.00	
3		0.00	44.96	23.61	44.87	Clay with high or very high plasticity (CH, CV, CE) firm consistency
		25.70	44.86	23.61	45.87	
		19.21	48.00	18.01	48.00	
		11.76	48.00	0.00	48.00	
4		-13.00	48.49	-13.00	45.10	Silty sand (SM)
		12.00	50.50	14.83	49.59	
		18.01	48.58	19.21	48.00	
		23.61	45.87	25.70	44.86	
		41.88	37.05	66.00	32.99	
		66.00	38.00	52.00	40.00	
		42.00	42.00	37.00	44.00	
		31.00	46.00	25.00	48.00	
5		23.65	48.39	18.00	50.00	Silty sand (SM)
		12.00	52.00	7.28	52.78	
		23.61	44.87	0.00	44.96	
		-13.00	45.10	-13.00	27.99	
		66.00	27.99	66.00	32.99	
		41.88	37.05	25.70	44.86	

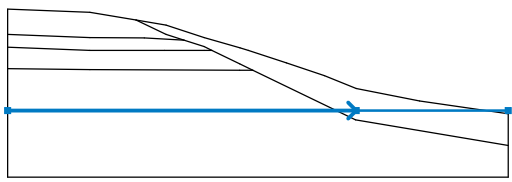
Surcharge

No.	Surcharge		Type	Type of action	Location z [m]	Origin x [m]	Length l [m]	Width b [m]	Slope α [°]	Magnitude		
	new	change								q, q ₁ , f, F, x	q ₂ , z	unit
1	Yes		strip	permanent	on terrain	x = 6.00	l = 12.00		0.00	20.00		kN/m ²

Water

Water type : GWT

Site Geotechnical

No.	GWT location	Coordinates of GWT points [m]					
		x	z	x	z	x	z
1		-13.00	38.50	42.00	38.50	66.00	38.50

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 2)**Analysis 1 (stage 2)****Circular slip surface**

Slip surface parameters						
Center :	x =	24.29 [m]	Angles :	$\alpha_1 =$	-48.96	[°]
	z =	68.18 [m]		$\alpha_2 =$	17.31	[°]
Radius :	R =	23.31 [m]				
The slip surface after optimization.						

Slope stability verification (Morgenstern-Price)

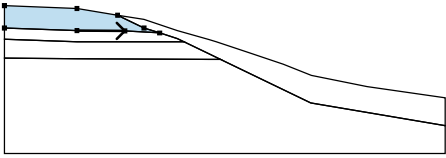
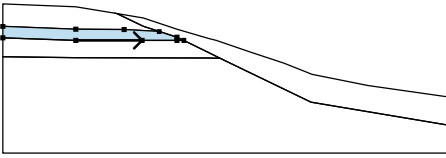
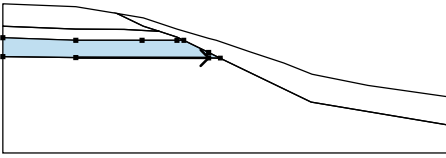
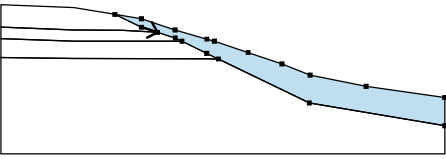
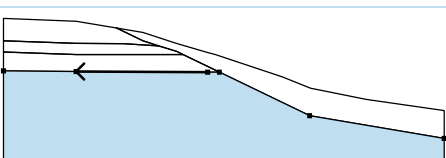
Factor of safety = 1.44 < 1.50

Slope stability NOT ACCEPTABLE

Site Geotechnical

Input data (Stage of construction 3)

Assigning and surfaces

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
1		0.00	50.00	8.58	49.95	Clay with high or very high plasticity (CH, CV, CE) firm consistency
		14.83	49.59	12.00	50.50	
		7.28	52.78	0.00	54.00	
		-13.00	54.50	-13.00	50.50	
2		0.00	48.00	11.76	48.00	Silty sand (SM)
		18.01	48.00	19.21	48.00	
		18.01	48.58	14.83	49.59	
		8.58	49.95	0.00	50.00	
3		0.00	44.96	23.61	44.87	Clay with high or very high plasticity (CH, CV, CE) firm consistency
		25.70	44.86	23.61	45.87	
		19.21	48.00	18.01	48.00	
		11.76	48.00	0.00	48.00	
4		-13.00	48.49	-13.00	45.10	Silty sand (SM)
		12.00	50.50	14.83	49.59	
		18.01	48.58	19.21	48.00	
		23.61	45.87	25.70	44.86	
		41.88	37.05	66.00	32.99	
		66.00	38.00	52.00	40.00	
		42.00	42.00	37.00	44.00	
		31.00	46.00	25.00	48.00	
5		23.65	48.39	18.00	50.00	Silty sand (SM)
		12.00	52.00	7.28	52.78	
		23.61	44.87	0.00	44.96	
		-13.00	45.10	-13.00	27.99	
		66.00	27.99	66.00	32.99	
		41.88	37.05	25.70	44.86	

Anti-Slide piles

No.	Anti-Slide pile new	Point		Length l [m]	Construction type	Depth of beam h [m]	Length of beam l _b [m]	Pile spacing	
		x [m]	z [m]					b _f [m]	b/b _b [m]
1	Yes	20.00	49.43	7.00	standard wall				3.00

No.	Cross-section		Pile bearing capacity		
	[m]		Distribution along the pile	Max. bearing capacity V _u [kN]	Passive force direction
1	d = 0.60		constant	212.43	perpendicular to pile

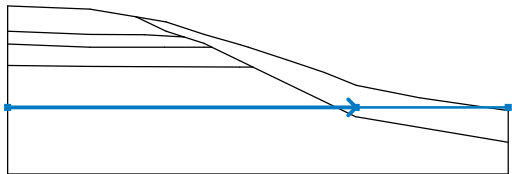
Site Geotechnical

Surcharge

No.	Surcharge		Type	Type of action	Location z [m]	Origin x [m]	Length l [m]	Width b [m]	Slope α [°]	Magnitude		
	new	change								q, q ₁ , f, F, x	q ₂ , z	unit
1	No	No	strip	permanent	on terrain	x = 6.00	l = 12.00		0.00	20.00		kN/m ²

Water

Water type : GWT

No.	GWT location	Coordinates of GWT points [m]					
		x	z	x	z	x	z
1		-13.00	38.50	42.00	38.50	66.00	38.50

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 3)**Analysis 1 (stage 3)****Circular slip surface**

Slip surface parameters					
Center :	x =	24.29 [m]	Angles :	α_1 =	-48.96 [°]
	z =	68.18 [m]		α_2 =	17.31 [°]
Radius :	R =	23.31 [m]			
Analysis of the slip surface without optimization.					

The forces acting on the pile

Anti-Slide Pile No. 1 (20.00; 49.43 [m])

Horizontal active force: 199.63 kN/m

Horizontal passive force: 181.79 kN/m

Depth of slip surface: 4.16 m

The length of pile below terrain: 7.00 m

Slope stability verification (Morgenstern-Price)

Factor of safety = 1.70 > 1.50

Slope stability ACCEPTABLE**Piles verification 1 (stage 3)**

Anti-Slide pile : Anti-Slide Pile No. 1 (20.00; 49.43 [m])

Analysis : Calculation 1 (slip surface circular)

Method : Morgenstern-Price

Site Geotechnical

Analysis of anti-slide pile

Input data

Settings

Standard - safety factors

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)
 Coefficients EN 1992-1-1 : standard
 Steel structures : EN 1993-1-1 (EC3)
 Partial factor on bearing capacity of steel cross section : $\gamma_{M0} = 1.00$

Pressure analysis

Verification methodology : Safety factors (ASD)
 Active earth pressure calculation : Coulomb
 Passive earth pressure calculation : Caquot-Kerisel
 Earthquake analysis : Mononobe-Okabe
 Modulus of subsoil reaction : standard
 Consider reduction of the modulus of subsoil reaction for a braced sheeting
 Pressures below the slip surface : standard

Anchors

Verification methodology : Safety factors (ASD)

Safety factors			
Safety factor for steel strength :	$SF_t =$	1.50	[-]
Safety factor for pull out resistance (soil) :	$SF_e =$	1.50	[-]
Safety factor for pull out resistance (grouting) :	$SF_c =$	1.50	[-]

Geometry of structure

Structure length = 7.00 m

Cross-section name : Pile curtain d = 0.60 m; a = 3.00 m
 Material of pile : concrete
 Computed coefficient of pressure reduction below the ditch = 0.42
 Area of cross-section A = 9.42E-02 m²/m
 Moment of inertia I = 2.12E-03 m⁴/m
 Elastic modulus E = 30000.00 MPa
 Shear modulus G = 12500.00 MPa

Forces above the slip surface

Depth of slip surface $h_{s1} = 4.16$ m
 Input of active horizontal force : residual active force
 Input of passive horizontal force : residual passive force
 Active horizontal force T = 199.63 kN/m
 Passive horizontal force P = 181.79 kN/m

Distribution of active force : triangle
 Distribution of passive force : triangle

Material of structure

Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete: C 20/25

Cylinder compressive strength $f_{ck} = 20.00$ MPa
 Tensile strength $f_{ctm} = 2.20$ MPa
 Elasticity modulus $E_{cm} = 30000.00$ MPa
 Shear modulus G = 12500.00 MPa

Site Geotechnical

Longitudinal steel: B500B

Yield strength $f_{yk} = 500.00 \text{ MPa}$

Transverse steel: B500B

Yield strength $f_{yk} = 500.00 \text{ MPa}$

Modulus of reaction

Modulus of subsoil reaction is computed by method Schmitt.

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m³]	γ_{su} [kN/m³]	δ [°]
1	Silty sand (SM)		29.00	5.00	18.00	8.00	10.00
2	Clay with high or very high plasticity (CH, CV, CE), firm consistency		15.00	5.00	20.50	10.50	5.00

All soils are considered as cohesionless for at rest pressure analysis.

Parameters of soils to compute modulus of subsoil reaction (Schmitt)

No.	Name	Pattern	ν [-]	E_{oed} [MPa]	E_{def} [MPa]
1	Silty sand (SM)		0.30	13.50	-
2	Clay with high or very high plasticity (CH, CV, CE), firm consistency		0.42	7.50	-

Soil parameters

Silty sand (SM)

Unit weight : $\gamma = 18.00 \text{ kN/m}^3$
 Stress-state : effective
 Angle of internal friction : $\varphi_{ef} = 29.00^\circ$
 Cohesion of soil : $c_{ef} = 5.00 \text{ kPa}$
 Angle of friction struc.-soil : $\delta = 10.00^\circ$
 Soil : cohesionless
 Oedometric modulus : $E_{oed} = 13.50 \text{ MPa}$
 Saturated unit weight : $\gamma_{sat} = 18.00 \text{ kN/m}^3$

Clay with high or very high plasticity (CH, CV, CE), firm consistency

Unit weight : $\gamma = 20.50 \text{ kN/m}^3$
 Stress-state : effective
 Angle of internal friction : $\varphi_{ef} = 15.00^\circ$
 Cohesion of soil : $c_{ef} = 5.00 \text{ kPa}$
 Angle of friction struc.-soil : $\delta = 5.00^\circ$
 Soil : cohesionless
 Oedometric modulus : $E_{oed} = 7.50 \text{ MPa}$
 Saturated unit weight : $\gamma_{sat} = 20.50 \text{ kN/m}^3$

Geological profile and assigned soils

Position information

Terrain elevation = 49.43 m

Geological profile and assigned soils

Site Geotechnical

No.	Thickness of layer t [m]	Depth z [m]	Altitude [m]	Assigned soil	Pattern
1	1.76	0.00 .. 1.76	49.43 .. 47.67	Silty sand (SM)	
2	2.88	1.76 .. 4.64	47.67 .. 44.79	Clay with high or very high plasticity (CH, CV, CE), firm consistency	
3	-	4.64 .. ∞	44.79 .. -	Silty sand (SM)	

Excavation

Soil in front of wall is excavated to a depth of 0.09 m.

Ditch bottom shape

No.	Coordinate x [m]	Depth z [m]
1	0.00	0.00
2	-3.35	0.95
3	-4.70	1.34
4	-10.70	3.34
5	-16.70	5.34
6	-21.70	7.34
7	-31.70	9.34
8	-45.70	11.34
9	-46.70	11.34

Origin [0,0] is located at the ditch bottom.

Positive coordinate +z has downward direction.

Terrain profile

No.	Coordinates x [m]	Depth z [m]
1	0.00	0.00
2	0.10	-0.11
3	1.70	-0.57
4	7.70	-2.57
5	12.42	-3.35
6	19.70	-4.57
7	32.70	-5.07
8	33.70	-5.07

Origin [0,0] is located in upper right edge of construction.

Positive coordinate +z has downward direction.

Water influence

GWT behind the structure lies at a depth of 10.93 m

GWT in front of the structure lies at a depth of 10.93 m

Subgrade at the heel is not permeable.

Input surface surcharges

No.	Surcharge new	change	Action	Mag.1 [kN/m ²]	Mag.2 [kN/m ²]	Ord.x x [m]	Length l [m]	Depth z [m]
1	Yes		permanent	20.00		1.70	12.00	on terrain

Global settings

Number of FEs to discretize wall = 100

Minimum pressure is considered as $\sigma_{a,min} = 0.20\sigma_z$

Site Geotechnical

Settings of the stage of construction

Design situation : permanent

Analysis results**Pressure above the slip surface**

Depth [m]	Passive pressure [kPa]	Active pressure [kPa]
0	0.00	0.00
0.09	0.00	2.08
0.09	0.00	2.08
4.16	89.39	96.04

Distribution of pressures acting on the structure (in front and behind the wall) - below the slip surface

Depth [m]	Ta,p [kPa]	Tk,p [kPa]	Tp,p [kPa]	Ta,z [kPa]	Tk,z [kPa]	Tp,z [kPa]
4.16	-10.50	-17.00	-17.00	30.00	34.87	91.66
4.16	-10.52	-17.02	-17.02	30.03	39.74	91.77
4.20	-10.64	-17.15	-17.15	30.23	39.97	92.58
4.55	-11.76	-18.38	-18.38	32.15	42.19	100.13
4.64	-12.04	-18.70	-18.70	32.64	42.76	102.07
4.64	-8.18	-16.69	-85.64	16.28	28.03	272.59
4.90	-8.71	-17.56	-89.64	17.09	29.10	283.37
5.25	-9.42	-18.74	-95.03	18.19	30.55	297.89
5.34	-9.60	-19.05	-96.42	18.47	30.92	301.62
5.60	-10.13	-19.92	-100.42	19.29	32.00	312.40
5.95	-10.85	-21.10	-105.81	20.38	33.45	326.92
6.30	-11.56	-22.28	-111.20	21.48	34.91	341.43
6.65	-12.27	-23.46	-116.58	22.57	36.38	355.95
7.00	-12.99	-24.64	-121.97	23.67	37.85	370.46

Distributions of the modulus of subsoil reaction and internal forces on the structure

Depth [m]	kh,p [MN/m ³]	kh,z [MN/m ³]	Displacement [mm]	Pressure [kPa]	Shear Force [kN/m]	Moment [kNm/m]
0.00	0.00	0.00	-51.33	0.00	-0.00	-0.00
0.07	0.00	0.00	-50.71	1.62	-0.06	0.00
0.09	0.00	0.00	-50.50	2.08	-0.10	0.00
0.35	0.00	0.00	-48.26	2.37	-0.67	0.10
0.70	0.00	0.00	-45.19	2.76	-1.57	0.49
1.05	0.00	0.00	-42.12	3.16	-2.61	1.22
1.40	0.00	0.00	-39.05	3.55	-3.78	2.33
1.75	0.00	0.00	-35.99	3.94	-5.09	3.88
2.10	0.00	0.00	-32.93	4.34	-6.54	5.91
2.45	0.00	0.00	-29.89	4.73	-8.13	8.47
2.80	0.00	0.00	-26.86	5.12	-9.85	11.62
3.15	0.00	0.00	-23.86	5.52	-11.72	15.39
3.50	0.00	0.00	-20.88	5.91	-13.72	19.83
3.85	0.00	0.00	-17.95	6.30	-15.85	25.01
4.13	0.00	0.00	-15.63	6.62	-17.66	29.70
4.15	0.00	0.00	-15.44	6.64	-17.82	30.11
4.16	0.00	0.00	-15.38	13.01	-17.90	30.25

Site Geotechnical

Depth [m]	kh,p [MN/m ³]	kh,z [MN/m ³]	Displacement [mm]	Pressure [kPa]	Shear Force [kN/m]	Moment [kNm/m]
4.20	0.00	0.00	-15.06	13.08	-18.40	30.95
4.55	0.00	0.00	-12.23	13.77	-23.10	38.21
4.90	7.10	0.00	-9.48	-67.78	-7.24	44.54
5.25	7.10	0.00	-6.81	-48.90	13.16	43.32
5.60	7.10	0.00	-4.22	-30.61	27.05	36.09
5.95	7.10	7.10	-1.70	-11.81	34.67	25.11
6.30	7.10	7.10	0.77	23.56	32.59	12.97
6.65	0.00	7.10	3.21	46.93	19.59	3.61
7.00	0.00	7.10	5.65	65.00	0.00	0.00

Maximum shear force = 35.32 kN/m
Maximum moment = 44.92 kNm/m
Maximum displacement = 51.3 mm
Displacement in the depth of slip surface = 15.4 mm

Dimensioning No. 1

Distribution of forces on construction

	Disp. min [mm]	Disp. max [mm]	Shear force min. [kN/m]	Shear force max [kN/m]	Moment min. [kNm/m]	Moment max. [kNm/m]
0.00	-51.33	-51.33	-0.00	-0.00	-0.00	-0.00
0.07	-50.71	-50.71	-0.06	-0.06	0.00	0.00
0.09	-50.57	-50.57	-0.09	-0.09	0.00	0.00
0.09	-50.57	-50.57	-0.09	-0.09	0.00	0.00
0.09	-50.50	-50.50	-0.10	-0.10	0.00	0.00
0.09	-50.50	-50.50	-0.10	-0.10	0.00	0.00
0.35	-48.26	-48.26	-0.67	-0.67	0.10	0.10
0.70	-45.19	-45.19	-1.57	-1.57	0.49	0.49
1.05	-42.12	-42.12	-2.61	-2.61	1.22	1.22
1.40	-39.05	-39.05	-3.78	-3.78	2.33	2.33
1.75	-35.99	-35.99	-5.09	-5.09	3.88	3.88
2.10	-32.93	-32.93	-6.54	-6.54	5.91	5.91
2.45	-29.89	-29.89	-8.13	-8.13	8.47	8.47
2.80	-26.86	-26.86	-9.85	-9.85	11.62	11.62
3.15	-23.86	-23.86	-11.72	-11.72	15.39	15.39
3.50	-20.88	-20.88	-13.72	-13.72	19.83	19.83
3.85	-17.95	-17.95	-15.85	-15.85	25.01	25.01
4.13	-15.63	-15.63	-17.66	-17.66	29.70	29.70
4.15	-15.44	-15.44	-17.82	-17.82	30.11	30.11
4.15	-15.44	-15.44	-17.82	-17.82	30.11	30.11
4.16	-15.38	-15.38	-17.90	-17.90	30.25	30.25
4.16	-15.38	-15.38	-17.90	-17.90	30.25	30.25
4.20	-15.06	-15.06	-18.40	-18.40	30.95	30.95
4.55	-12.23	-12.23	-23.10	-23.10	38.21	38.21
4.90	-9.48	-9.48	-7.24	-7.24	44.54	44.54
5.25	-6.81	-6.81	13.16	13.16	43.32	43.32
5.60	-4.22	-4.22	27.05	27.05	36.09	36.09
5.95	-1.70	-1.70	34.67	34.67	25.11	25.11
6.30	0.77	0.77	32.59	32.59	12.97	12.97
6.65	3.21	3.21	19.59	19.59	3.61	3.61

Site Geotechnical

	Disp. min [mm]	Disp. max [mm]	Shear force min. [kN/m]	Shear force max [kN/m]	Moment min. [kNm/m]	Moment max. [kNm/m]
7.00	5.65	5.65	0.00	0.00	0.00	0.00

Maximum values of internal forces

Maximum displacement = -51.3 mm
 Minimum displacement = 5.7 mm
 Maximum bending moment = 44.92 kNm/m
 Minimum bending moment = 0.00 kNm/m
 Maximum shear force = 35.32 kN/m

Verification of RC cross section (Pile curtain $d = 0.60$ m; $a = 3.00$ m)

All construction stages are taken into the analysis.

Partial factor on load = 1.00

Verification of cross section in bending:

Reinforcement - 10 pc bars 16.0 mm; cover 20.0 mm

Type of structure (reinforcement ratio) : beam

Reinforcement ratio $\rho = 0.356 \% > 0.130 \% = \rho_{\min}$

Load : $M_{Ed} = 134.76$ kNm

Bearing capacity : $M_{Rd} = 207.93$ kNm

Designed pile reinforcement is SATISFACTORY

Verification of cross section in shear:

Shear reinf. - profile 12.0 mm; spacing 500.0 mm

$A_{sw} = 2 \times 226.2 = 452.4$ mm²

Ultimate shear force: $V_{Rd} = 212.43$ kN > 105.97 kN = V_{Ed}

Cross-section is SATISFACTORY.

Overall verification: Cross-section is SATISFACTORY

Appendix G – Important Information About Your Geotechnical Engineering Report

INTRODUCTION

The purpose of this document is related to subsurface conditions, and to address the variable nature of soil and rock materials when used as a foundation or construction material. This information should be of benefit to Owners, Developers, Geotechnical, Design and Construction personnel.

Early recognition of geotechnical problems during the design stage is still the best way to reduce the risk of geotechnical construction problems and thereby bid prices. This normally means conducting an adequate desktop study and subsurface investigation in advance of final design for a particular project. The complete disclosure of available subsurface information in the contract documents is also an important factor in both preventing contractor claims and in obtaining fair bids for the work to be performed. Matters which could influence the project may include, however may not be limited to, easements, site features, slope stability, acid sulphate soils (ASS), mining subsidence and earthquakes. Undertaking a desktop study, such as a review of management overlays, may recognise potential problems associated with the site which may require particular attention. The amount of desktop study and subsurface information actually presented and the method of presentation in the geotechnical report can vary depending on client requirements and the complexity of the project. It should be noted that not all the information provided here is necessarily relevant to all types of our reports and that Geoenvironmental concerns are not covered.

ENGINEERING REPORTS

Professional judgments and recommendations are presented in this report. They are based partly on evaluation of the technical information gathered, partly on historical reports (where obtained) and partly on our general experience with subsurface conditions in the area. It should be noted that the borings may not represent potentially unfavourable subsurface conditions between borings. If during construction soil conditions are encountered that vary from those discussed in this report or other reports or if design loads and/or configurations change, we should be notified immediately in order that we may evaluate effects, if any, on foundation performance. The recommendations presented in this report are applicable only to this specific site. The data provided should not be used for other purposes, where the report has been prepared for a specific design proposal as the information and interpretation may not be relevant. Nevertheless Site Geotechnical will be pleased to review the report and the sufficiency of the investigation work for other purposes, and discuss any further information which may be required.

ENGINEERING LOGS

The engineering logs are an interpretation of the subsurface condition, and their reliability will depend to some extent on the frequency of sampling and the method of excavation. The descriptions of the soils found closely follow those outlined in AS1726-1993, Geotechnical Site Investigations.

FILL

The presence of fill materials can often be determined by the visual inspection of foreign objects (i.e. building rubble) or by distinctly unusual smell, texture or colour. Where natural soils similar to those at the site are used for fill, it may be difficult to readily determine the extent of fill, and test pits are often preferred over boreholes to determine their extent. The presence of fill is normally regarded with caution as it is often associated with high variation in strength and density and potential for differential settlement which can often be associated with higher construction costs to minimise its effect to a particular project unless it can be proven and/or documented that the fill materials have been placed under controlled conditions.

POTENTIAL FOR DIFFERING SITE CONDITIONS

Subsurface conditions at a particular site are the result of natural geologic processes modified in time by physical events, such as erosion, or by man.

Site Geotechnical Pty Ltd routinely provides subsurface information to their clients in good faith to permit a general appraisal of below ground conditions. However unanticipated latent ground conditions can and do occur.

SHOULD DIFFERING SITE CONDITIONS BE ENCOUNTERED

During the progress of the work, if subsurface or physical conditions are encountered at the site differing materially from those indicated in the geotechnical report or if unknown physical conditions of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in the work provided for the project are encountered at the site, the party discovering such conditions shall promptly notify Site Geotechnical Pty Ltd in writing of the specific differing conditions before the site is disturbed and before the affected work is performed.

Changes in ground such as filling, nearby construction or by natural events such as flooding which has occurred after the engineering logs were completed, are an example of a differing site condition at or above ground level, in which case Site Geotechnical should be contacted before applying the report to determine if it is still relevant. A minor amount of additional investigation could prevent major problems. Site Geotechnical Pty Ltd will not be responsible for any financial losses (consequential or otherwise) that may result from required changes and / or revised report recommendations.

KEEP IN TOUCH WITH YOUR CONSULTANT (SITE GEOTECHNICAL PTY LTD)

Recommendations provided within our report are not necessarily final. It is often found with the passage of time that more information is gathered related to a specific site or project and it is often beneficial to have a geotechnical engineer available to undertake construction observations and undertake meetings with design members and contractors to minimise misinterpretation and risk related to geotechnical issues.

56B Hazel Road, Kalimna	
Sheet Number	Sheet Title
A 0.00	COVER PAGE, NOTES, AERIAL VIEW & PHOTOS
A 0.01	EXISTING AND PROPOSED SITE PLANS
A 1.01	PROPOSED FLOOR PLAN AND ROOF PLAN
A 2.01	PROPOSED ELEVATIONS - HOUSE
A 2.02	PROPOSED ELEVATIONS - CARPORT AND SHED

Site Description

Area: 3621m²
Lot and Planning Number: Lot 2 / PS821630
The subject site at 56B Hazel Road, Kalimna is located within the East Gippsland Shire. The site is classified as General Residential Zone (GRZ) - Schedule 1 (GZ1). The following planning overlays apply:

- Development Development Overlay (DDO)
- Development Development Overlay - Schedule 13 (DDO13)
- Erosion Management Overlay (EMO)
- Erosion Management Overlay Schedule (EMO)

The subject site is currently vacant.

Land Survey Note

Refer to the accompanying survey for all levels, heights, title locations, existing buildings, existing trees, context and services.

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3 3D Render
REF: SCALE : NTS

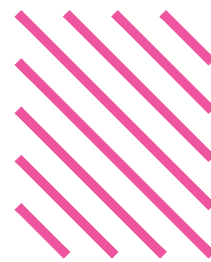
B	11.05.2026	TOWN PLANNING - REVISED
A	22.04.2026	TOWN PLANNING
REV.	DATE	AMENDMENT

HAZEL & GLENN REIMERS

CLIENT

56B HAZEL ROAD
KALIMNA 3909

PROJECT



sessionarchitecture

level 2, 88 bourke street melbourne 3000
ACN: 638 841 488 sessionarchitecture.com.au

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Nick Johnston 0438 565 711 nick@sessionarchitecture.com.au

COVER PAGE, PLANNING NOTES
SITE CONTEXT AND PHOTOS

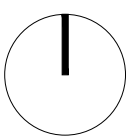
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TOWN PLANNING

STATUS

VARIES NJ

SCALE AT A1 DRAWN/CHECKED



NORTH

B

REV



1 Aerial View
REF: SCALE : NTS

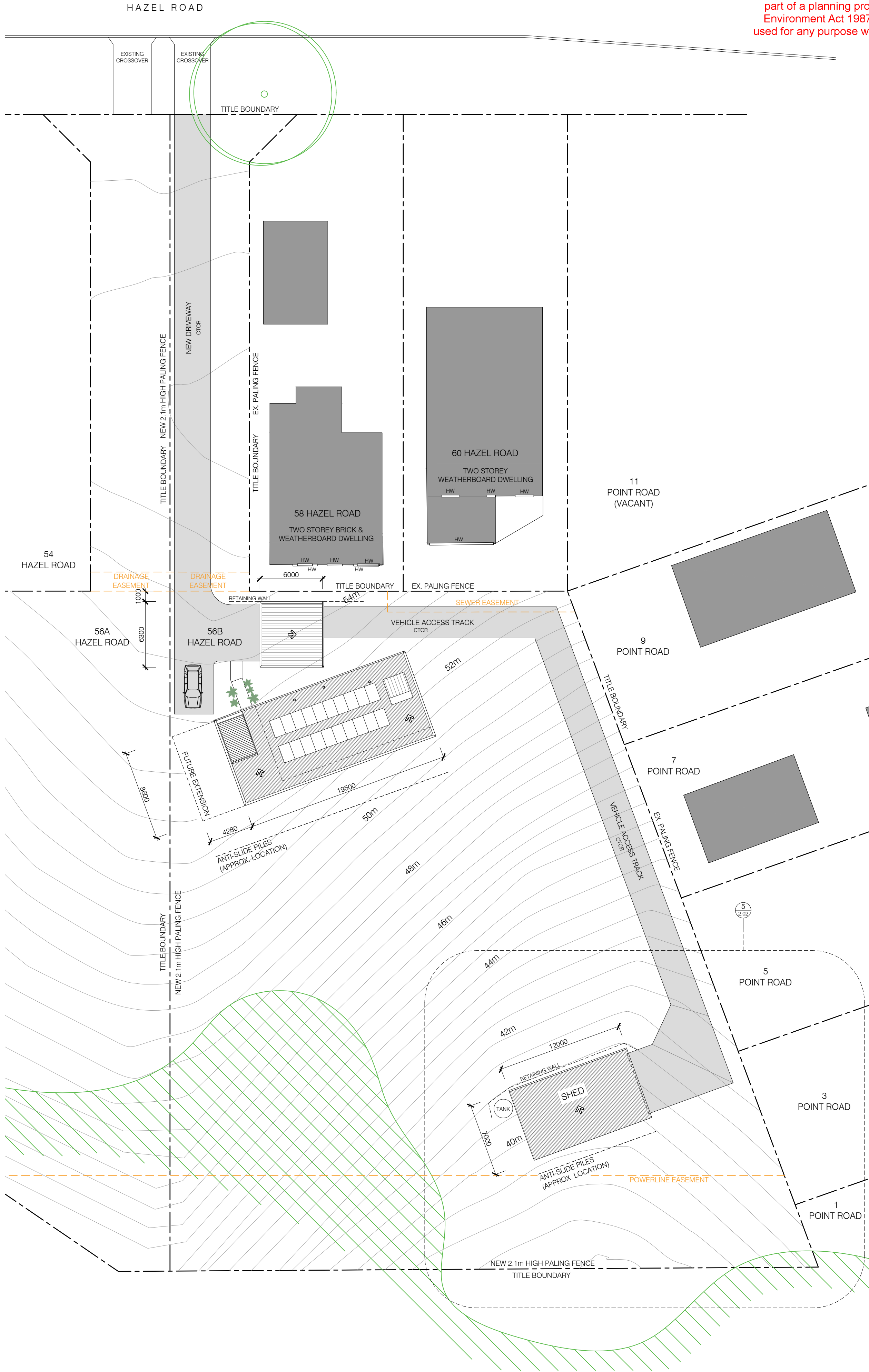


2 Existing Site Photos
REF: SCALE : NTS





1 Existing Site Plan
REF: SCALE : 1:250 (A1)



2 Proposed Site Plan
REF: SCALE : 1:250 (A1)

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GENERAL NOTES
This plan is to be read in conjunction with General Notes, refer to Cover Page A0.00.
Only with all hold points identified in the schedules and Specification, works are not permitted to proceed until sample points are approved by the Council.
DRAWINGS LEGEND
EXISTING BUILDINGS
CONTOURS
TREES AND BUSHES
ELECTRICITY, SEWER AND WATER CONNECTIONS NOTE
Mains electricity, and mains water and sewer, to be connected to all proposed structures, including the carport, house, and shed.
GEOTECH REPORT AND ANTI-SLIDE PILES NOTE
Refer to accompanying "Geotechnical Investigation & Landslide Risk Assessment" Report for information relating to the erosion management overlay and anti-slide piles to be installed onsite.
Note, the locations and the designs of all proposed anti-slide piles is preliminary only, pending further assessment and refinement by a suitably qualified engineer.
TAGS LEGEND
AC - Air Conditioner
CW - Roof Cowl
CTCR - Cementitious Treated Crushed Rock
DP - Downpipe
EX - Existing
FFL - Finished floor level
FSL - Finished surface level
FW - Floor Waste
HWU - Hot Water Unit (Solar)
PV - Solar Panel
SL - Skylight

B	11.05.2026	TOWN PLANNING - REVISED
A	22.04.2026	TOWN PLANNING
REV.	DATE	AMENDMENT

HAZEL & GLENN REIMERS

CLIENT

56B HAZEL ROAD KALIMNA 3909

PROJECT



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melbourne 3000
ACN: 638 841 488
sessionarchitecture.com.au

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EXISTING SITE PLAN PROPOSED SITE PLAN

DRAWING TITLE

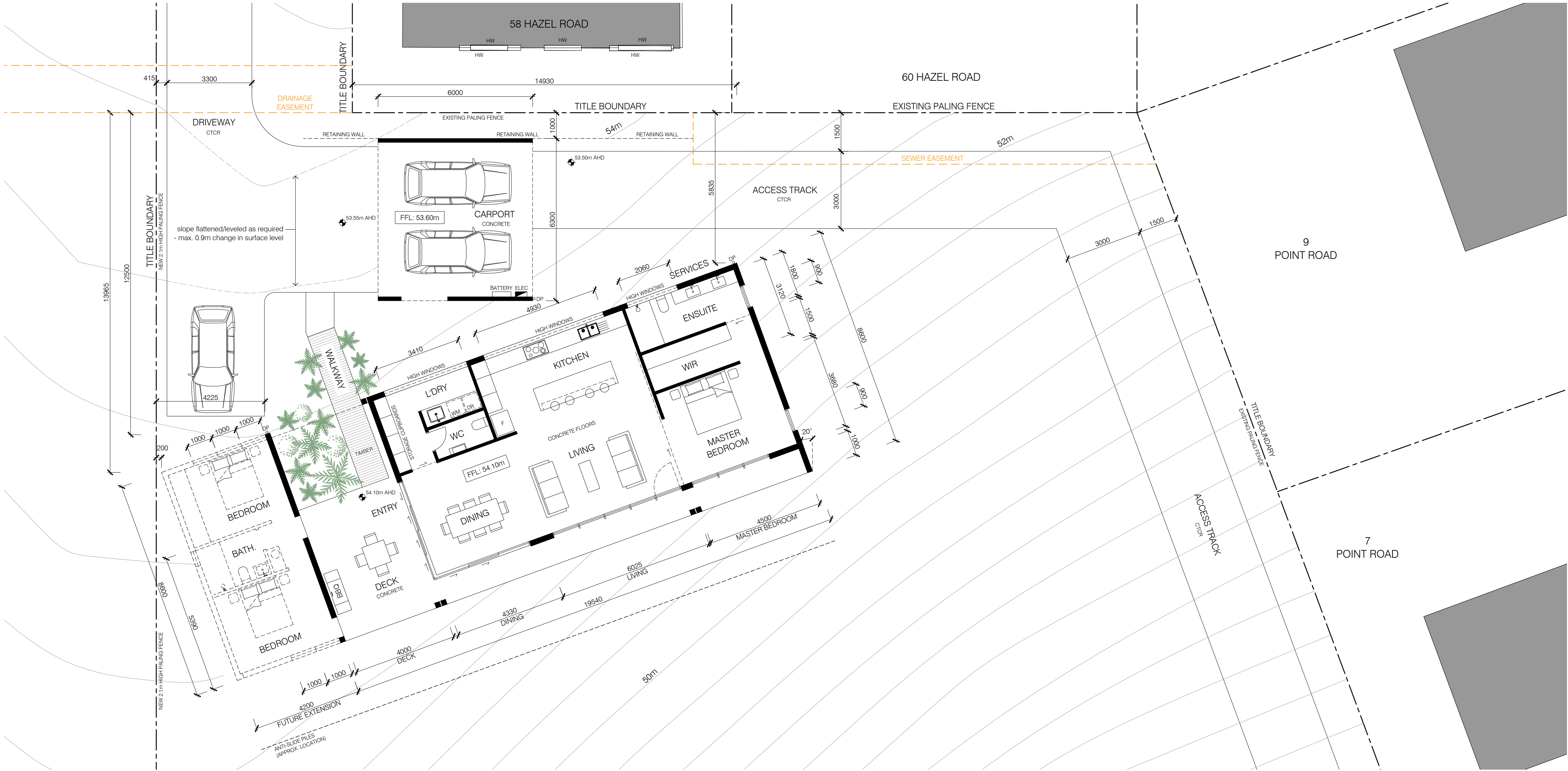
TOWN PLANNING

STATUS

1:250 NJ

SCALE AT A1 DRAWN/CHECKED NORTH

B
REV



1 Ground Floor Plan
REF: SCALE: 1:100 (A1)



2 Roof Plan
REF: SCALE: 1:100 (A1)

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GENERAL NOTES
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Only with all hold points identified in the schedules and specification. Works are not permitted until hold points are approved by the Architect.

EXISTING BUILDINGS - UNCHANGED
PROPOSED WALLS & WINDOWS
FUTURE EXTENSION (STAGE 2)

ELECTRICITY, SEWER AND WATER CONNECTIONS NOTE
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GEOTECH REPORT AND ANTI-SLIDE PILES NOTE
Refer to accompanying "Geotechnical Investigation & Landslide Risk Assessment" Report for information relating to the erosion management overlay and anti-slide piles to be installed onsite.

Note, the locations and the designs of all proposed anti-slide piles is preliminary only, pending further assessment and refinement by a suitably qualified engineer.

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CW - Roof Cowl
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DP - Downpipe
EX - Existing
FFL - Finished floor level
FSL - Finished surface level
FW - Floor Waste
HWU - Hot Water Unit (Solar)
PV - Solar Panel
SL - Skylight

B	11.05.2026	TOWN PLANNING - REVISED
A	22.04.2026	TOWN PLANNING
REV.	DATE	AMENDMENT

HAZEL & GLENN REIMERS
CLIENT

**56B HAZEL ROAD
KALIMNA 3909**
PROJECT



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**PROPOSED FLOOR PLAN
PROPOSED ROOF PLAN**

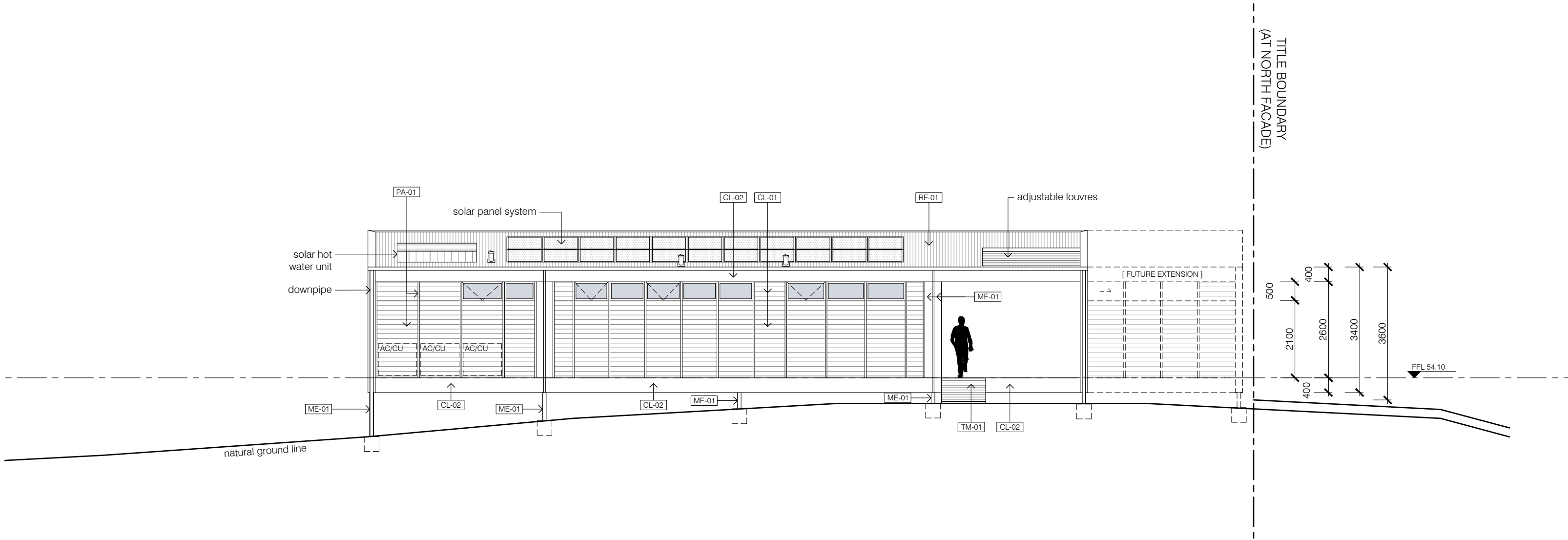
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TOWN PLANNING
STATUS

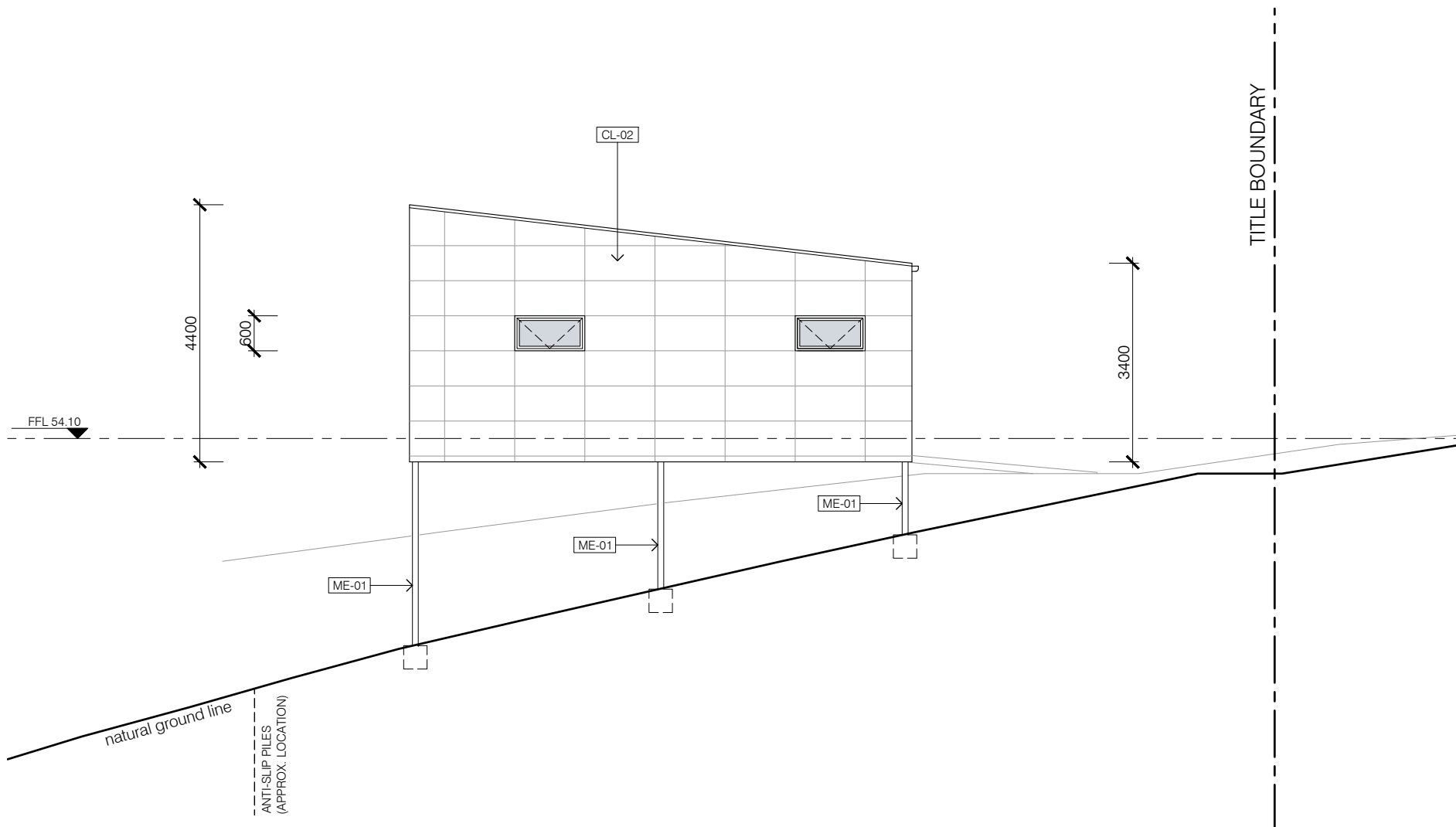
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REV

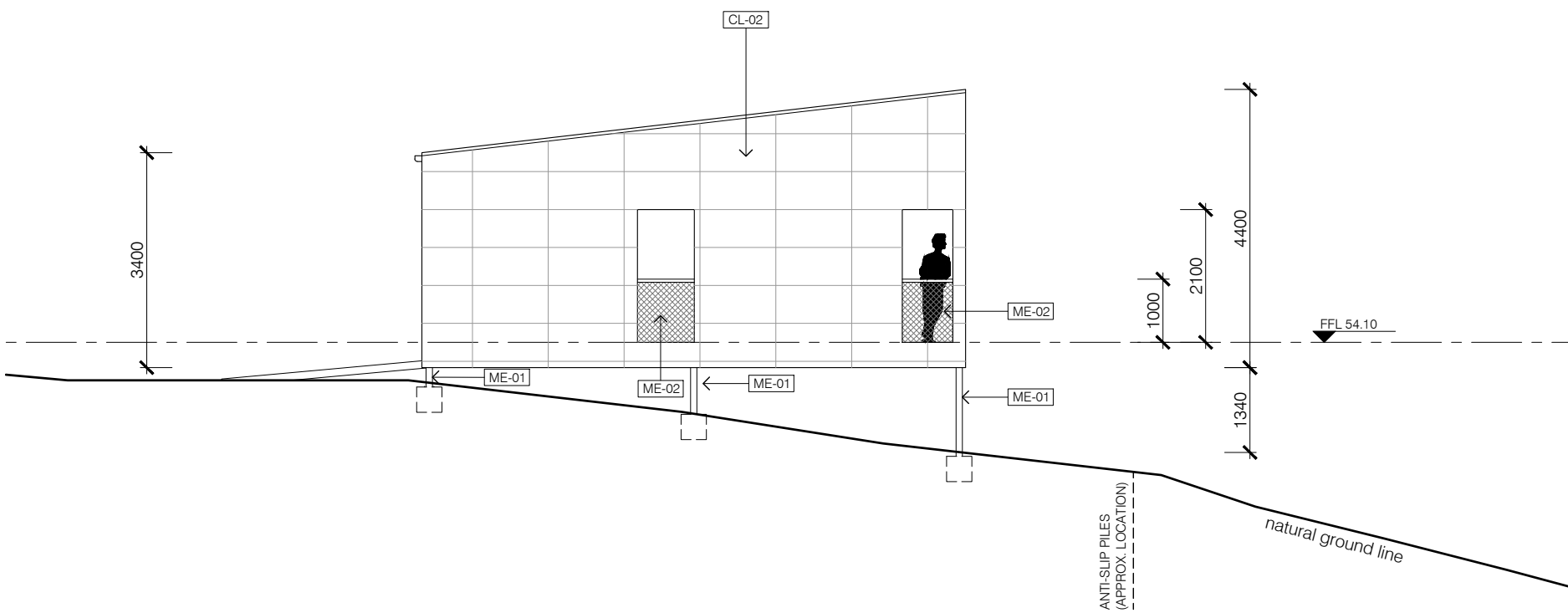
Printed 20/07/2026
Page 108 of 111
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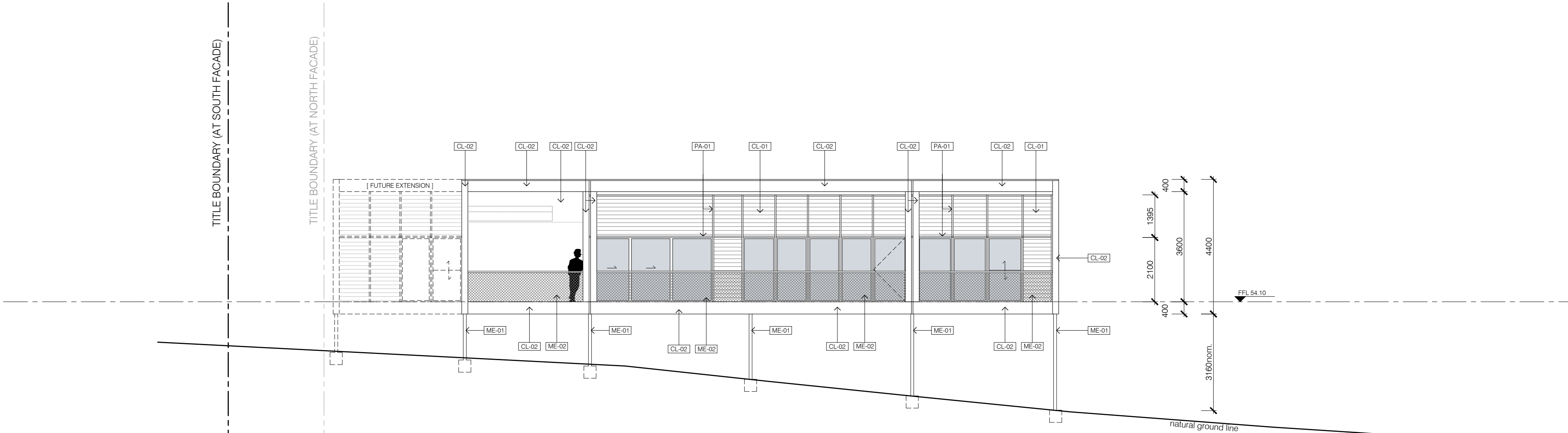
1 North Elevation
REF: SCALE : 1:100 (A1)



2 East Elevation
REF: SCALE : 1:100 (A1)



3 West Elevation
REF: SCALE : 1:100 (A1)



4 South Elevation
REF: SCALE : 1:100 (A1)

MATERIALS SCHEDULE



- CL-01**
- Cement/Concrete Panelling
- Grey Fascia Finish
- CL-02**
- Cement/Concrete Panelling
- Grey Fascia Finish
- PA-01**
- Timber Battens
- Painted White/Light Grey
- RF-01**
- Custom Orb Roofing
- Light Grey
- RF-02**
- Kliplok Roofing
- Light Grey
- ME-01**
- Steel Structure
- Zincalume
- ME-02**
- Permeable Metal Mesh
- LOUVRE ROOFING**
- Adjustable louvre roofing
- TM-01**
- Timber Decking (entry ramp)

- WINDOWS/DOORS**
- Aluminium Framing (grey)
- Clear Glazing

GENERAL NOTES
This plan is to be read in conjunction with General Notes, refer to Cover Page A0.00.
Only with all hold points identified in the schedules and Specification works are not permitted to proceed until sample works are submitted and approved by the Architect.

TAGS LEGEND
D - Door
W - Window
BL - Blockwork
CO - Concrete
CTCR - Cementitious Treated Crushed Rock
DP - Downpipe
FC - Fibre Cement Sheet
GL - Glazing
ME - Metal work
PA - Paint
RF - Roofing
TM - Timber
ST - Stone Cladding

ELECTRICITY, SEWER AND WATER CONNECTIONS NOTE
Mains electricity, and mains water and sewer, to be connected to all proposed structures, including the carport, house, and shed.

GEOTECH REPORT AND ANTI-SLIDE PILES NOTE
Refer to accompanying "Geotechnical Investigation & Landslide Risk Assessment" Report for information relating to the erosion management overlay and anti-slide piles to be installed onsite.

Note, the locations and the designs of all proposed anti-slide piles is preliminary only, pending further assessment and refinement by a suitably qualified engineer.

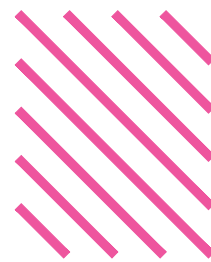
B	11.05.2026	TOWN PLANNING - REVISED
A	22.04.2026	TOWN PLANNING
REV.	DATE	AMENDMENT

HAZEL & GLENN REIMERS

CLIENT

56B HAZEL ROAD
KALIMNA 3909

PROJECT



sessionarchitecture

level 2, 88 bourke street melbourne 3000 ACN: 638 841 488 sessionarchitecture.com.au

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Nick Johnston 0438 565 711 nick@sessionarchitecture.com.au

ELEVATIONS

DRAWING TITLE

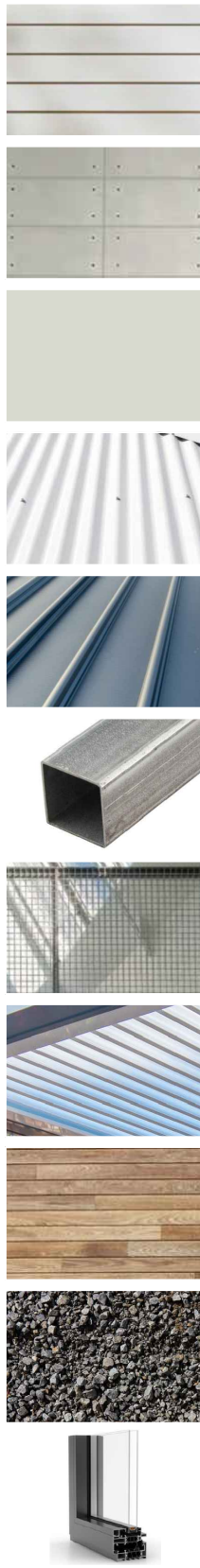
TOWN PLANNING

STATUS

1:100 NJ
SCALE AT A1 DRAWN/CHECKED NORTH

B
REV

MATERIALS SCHEDULE



- CL-01**
- Horizontal Cladding
 - Painted White/Light Grey
- CL-02**
- Cement/Concrete Panelling
 - Grey Fascia Finish
- PA-01**
- Timber Battens
 - Painted White/Light Grey
- RF-01**
- Custom Orb Roofing
 - Light Grey
- RF-02**
- Kliplok Roofing
 - Light Grey
- ME-01**
- Steel Structure
 - Zincalume
- ME-02**
- Permeable Metal Mesh
- LOUVRE ROOFING**
- Adjustable louvre roofing
- TM-01**
- Timber Decking (entry ramp)
- CTCR**
- Cementitious Treated Crushed Rock
 - Driveway and Access Track
- Aluminium Framing (grey)
 - Clear Glazing

GENERAL NOTES
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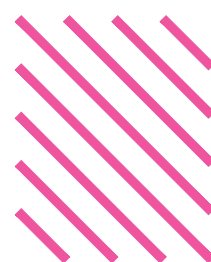
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HAZEL & GLENN REIMERS

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ELEVATIONS

DRAWING TITLE

TOWN PLANNING

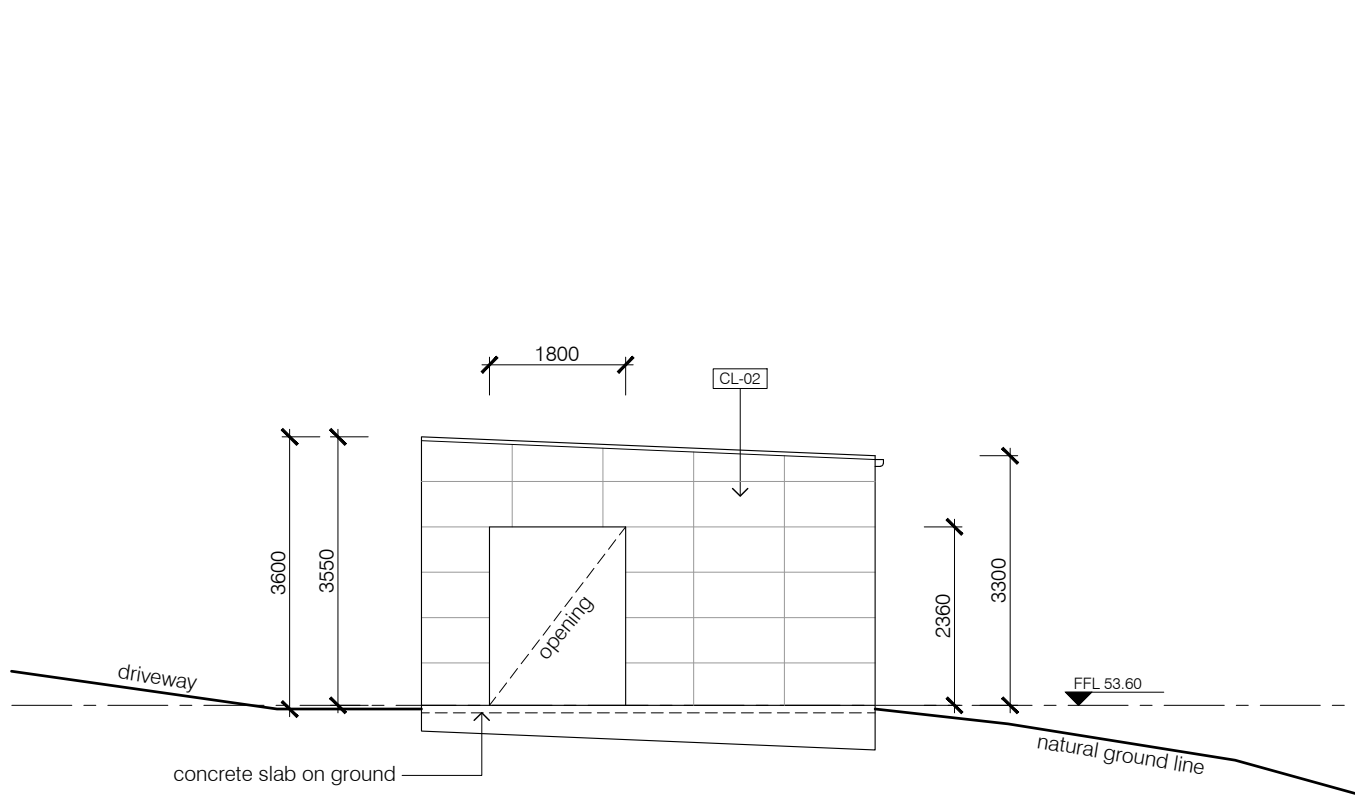
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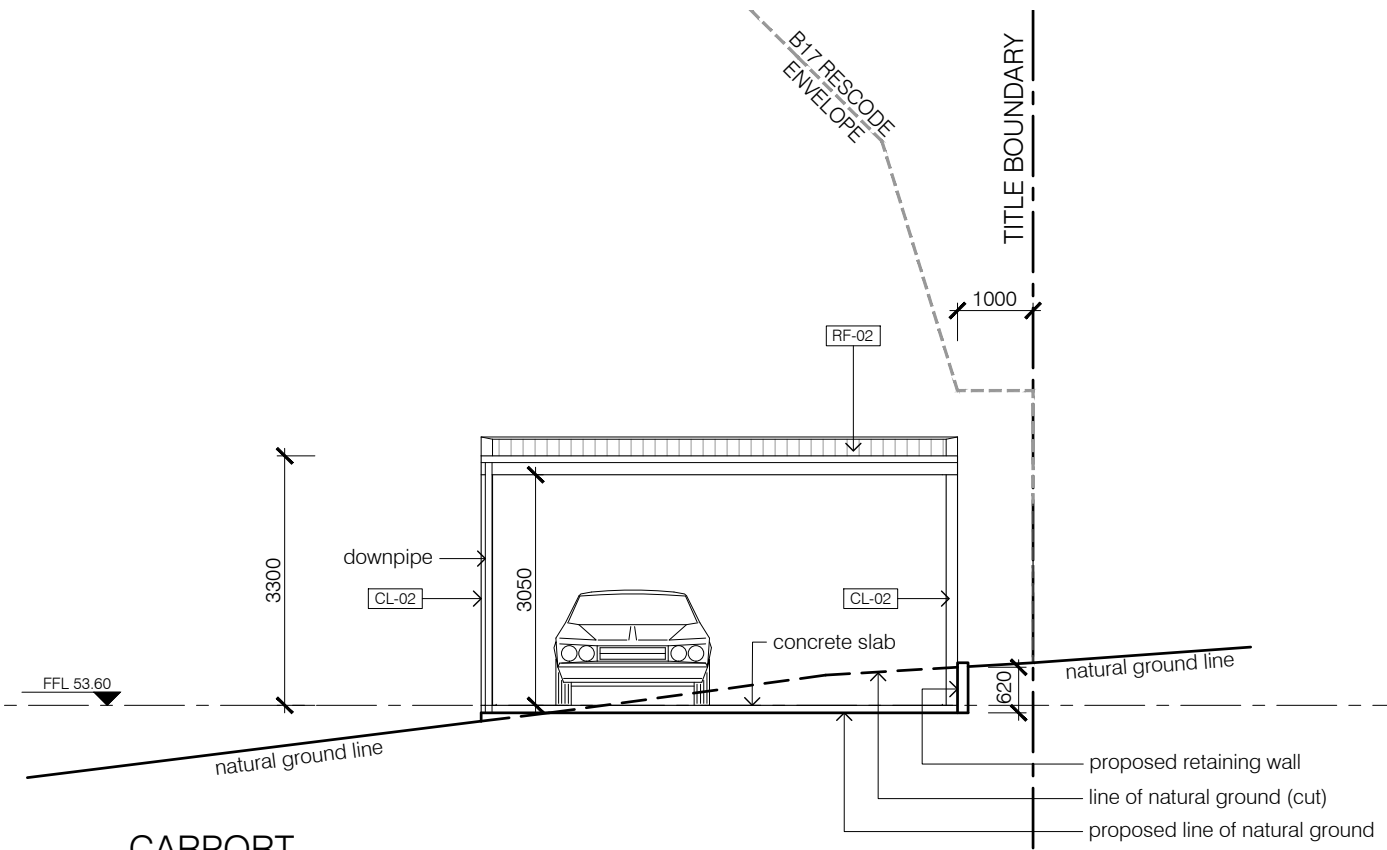
B
REV

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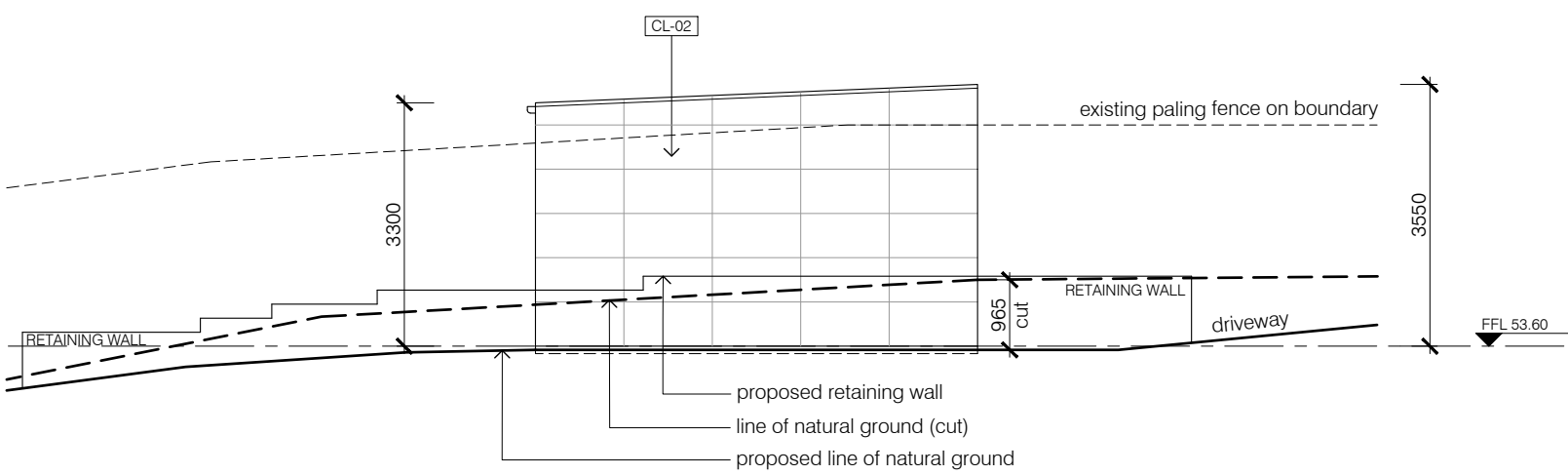
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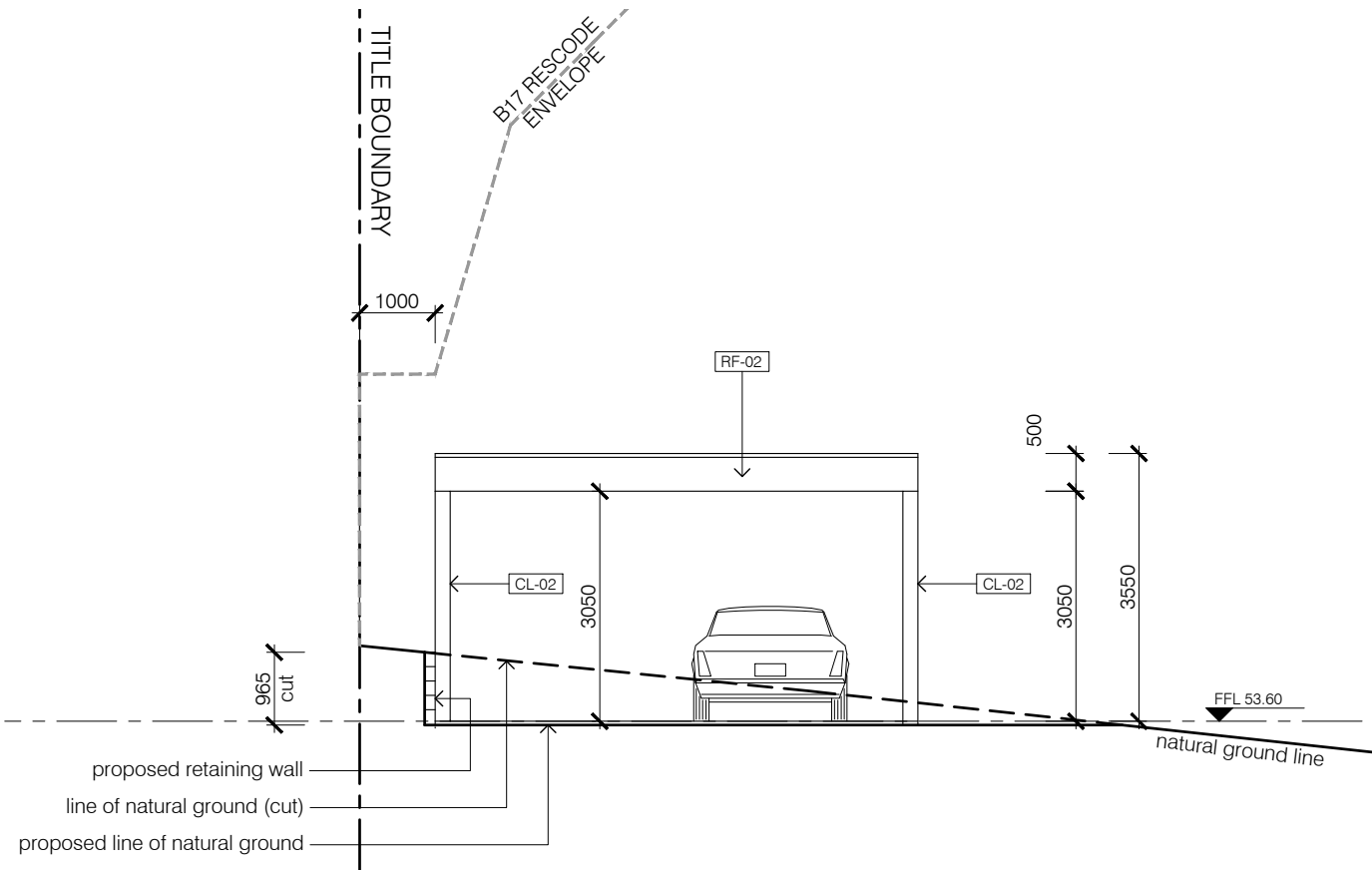
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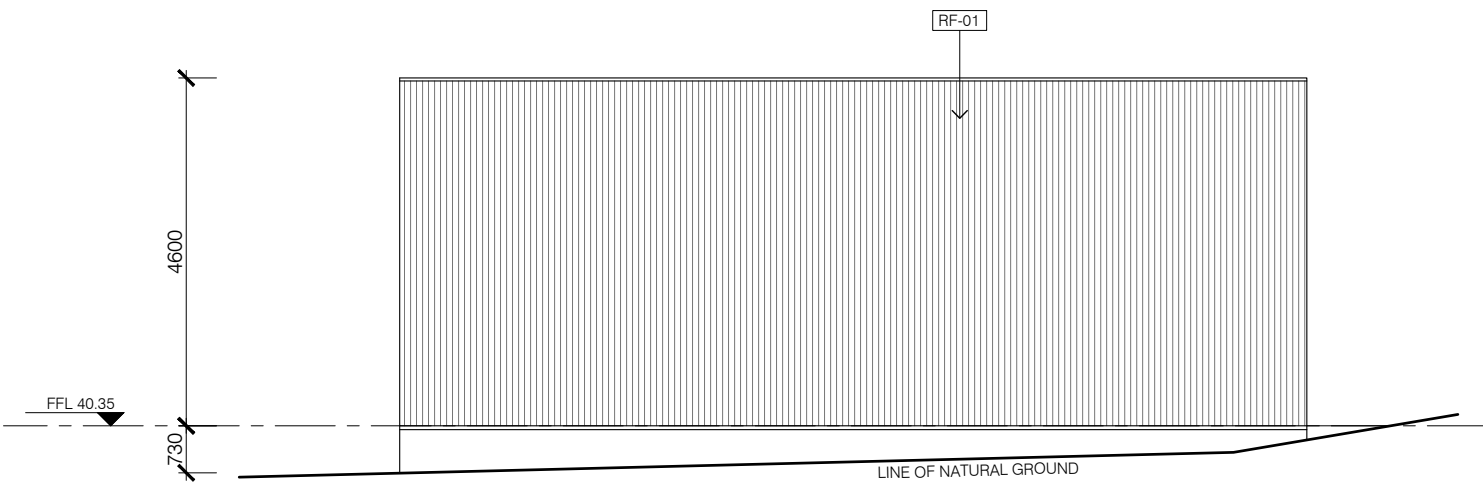
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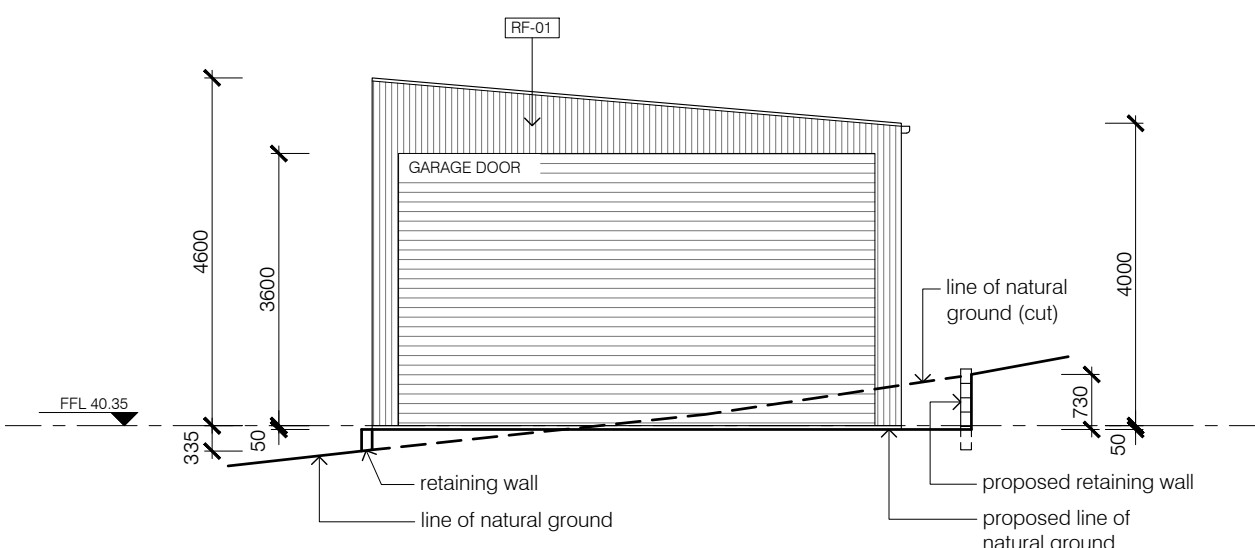
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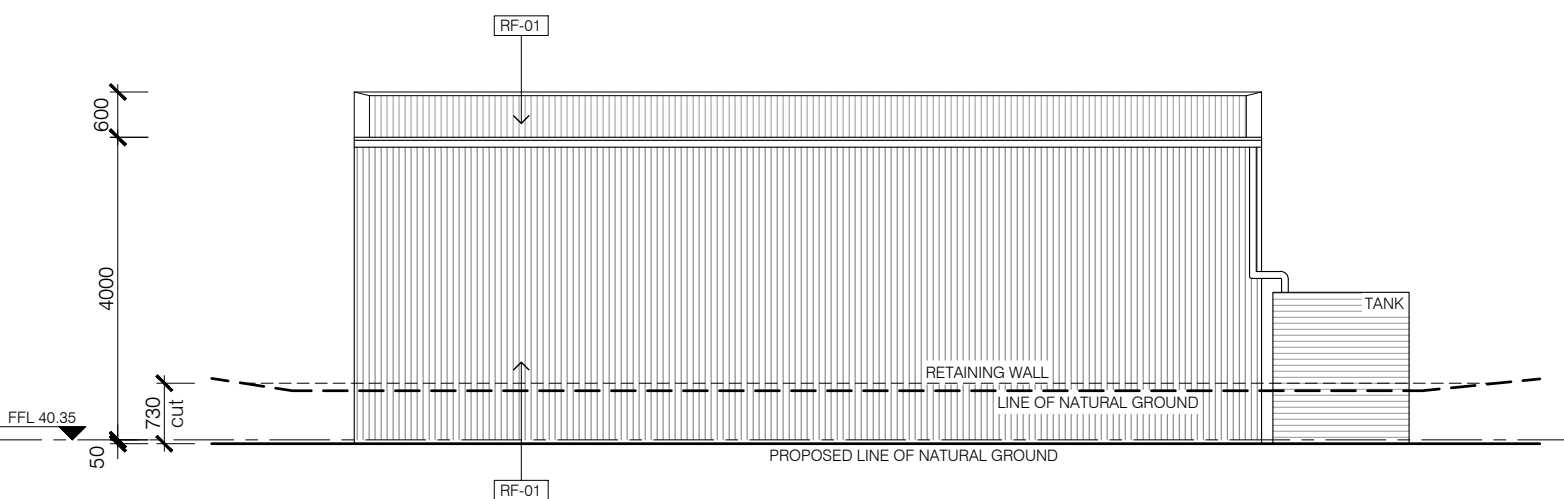
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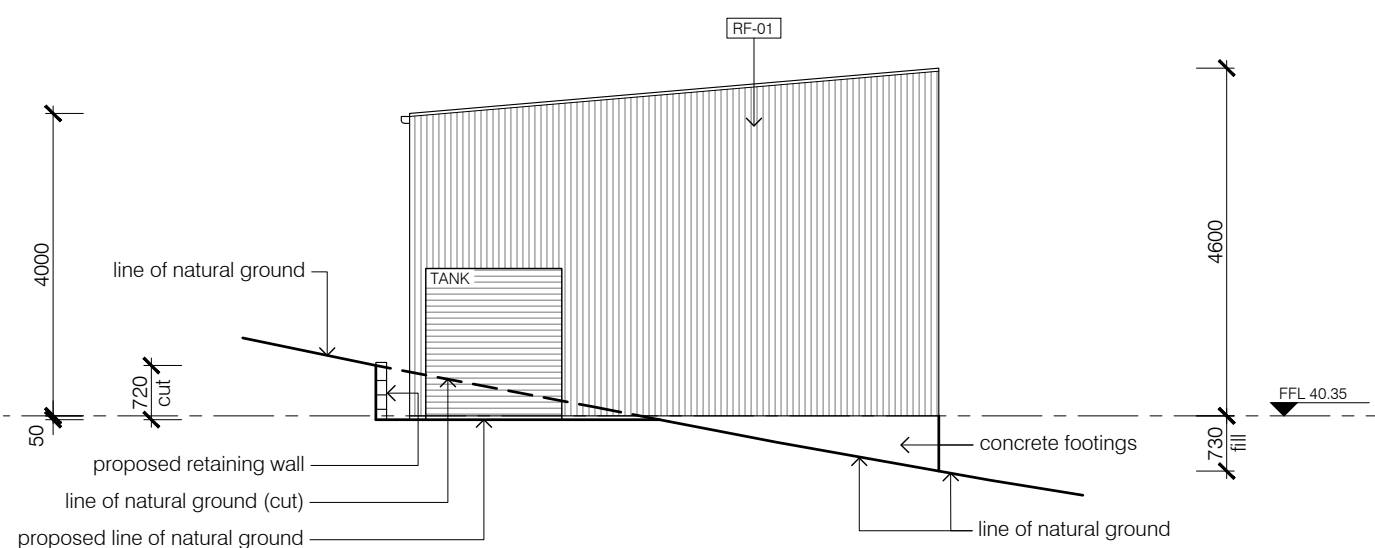
6 SHED South Elevation
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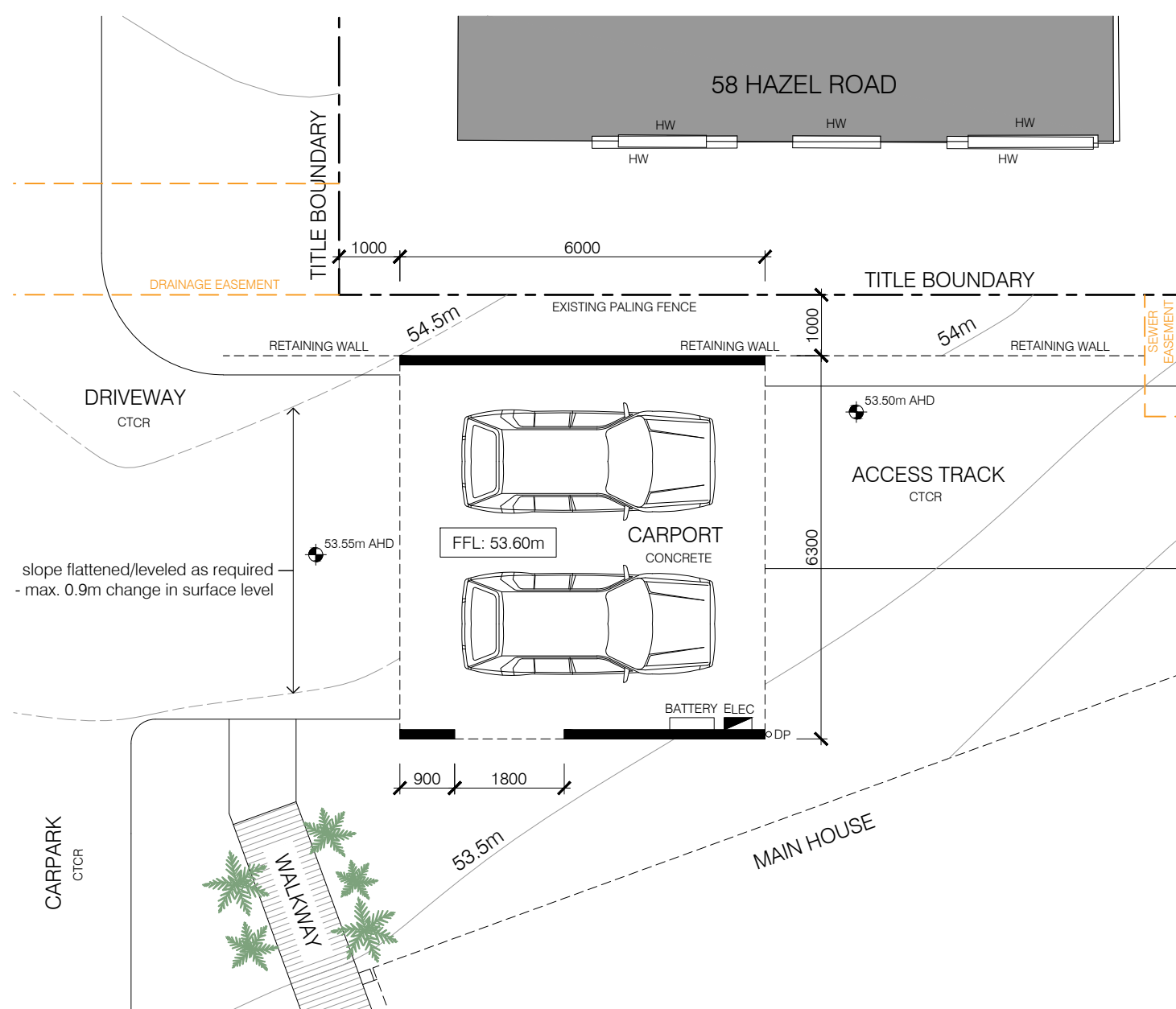
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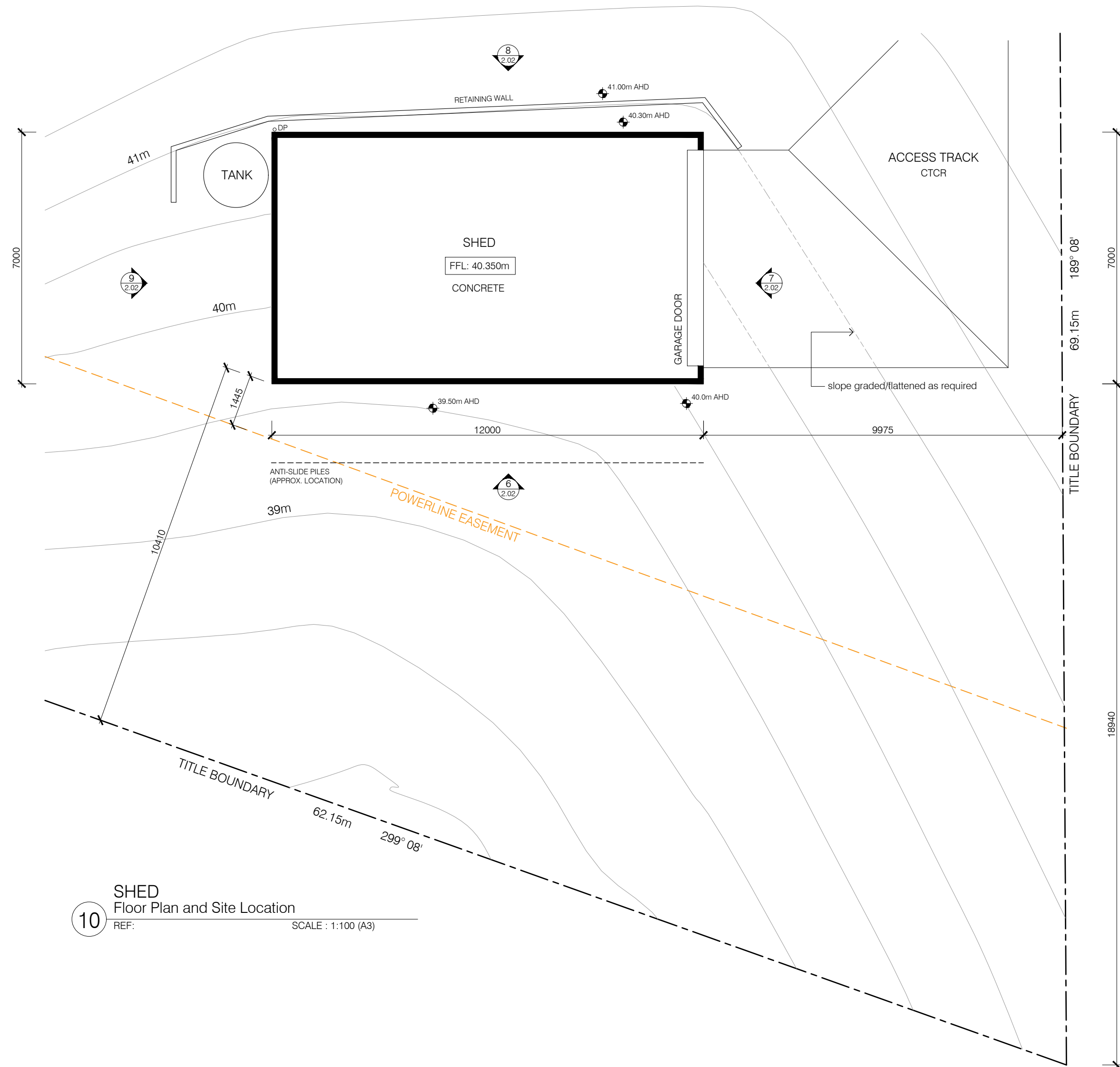
8 SHED North Elevation
REF: SCALE : 1:100 (A3)



9 SHED West Elevation
REF: SCALE : 1:100 (A3)



5 CARPORT Floor Plan
REF: SCALE : 1:100 (A3)

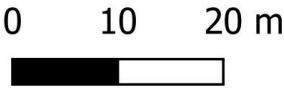


10 SHED Floor Plan and Site Location
REF: SCALE : 1:100 (A3)

Bushfire Management Plan – 56B HAZEL ROAD, KALIMNA



PLAN REF: 21505 BMP V1



Crowther & Sadler Pty Ltd.

LICENSED SURVEYORS & TOWN PLANNERS

- | | |
|-------------------|--------------------|
| PARCEL_VIEW | Proposed Driveway |
| Subject Land | 10,000lt Watertank |
| Proposed Dwelling | Defendable Space |
| Proposed Shed | Google Satellite |
| Proposed Carport | |

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Bushfire Protection Measures

Mandatory Condition

The bushfire protection measures forming part of this permit, shown on the endorsed plans, including those relating to construction standards, defendable space, water supply and access, must be maintained to the satisfaction of the responsible authority on a continuing basis. This condition continues to have force and effect after the development authorised by this permit has been completed.

a) Defendable Space

Defendable space is provided for a distance of 39 metres around the building or to the property boundary whichever is the lesser and managed in accordance with the following:

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

b) Construction Standard

The building must comply to a minimum Bushfire Attack Level of BAL – 29

c) Water Supply

The following requirements apply:

- An effective capacity of 10,000 litres.
- Be stored in an above ground water tank constructed of concrete or metal.
- Have all fixed above ground water pipes and fittings required for firefighting purposes made of corrosive resistant metal.
- Include a separate outlet for occupant use.

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

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

d) Access

Access Required: No ☐
Yes ☒

The following design and construction requirements apply:

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

Length of access is greater 100 metres: Yes ☐ No ☒

Where length of access is greater than 100 metres the following design and construction requirements apply:

- A turning circle with a minimum radius of eight metres, or
- A driveway encircling the building, or
- The provision of other vehicle turning heads – such as a T or Y Head – which meet the specification of Austroad Design for an 8.8 metre Service Vehicle.

Length of driveway is greater than 200 metres: Yes ☐ No ☒

Where length of access is greater than 200 metres the following design and construction requirement applies:

- Passing bays are required at least every 200 metres that are a minimum 20 metres long and a minimum trafficable width of 6 metres.