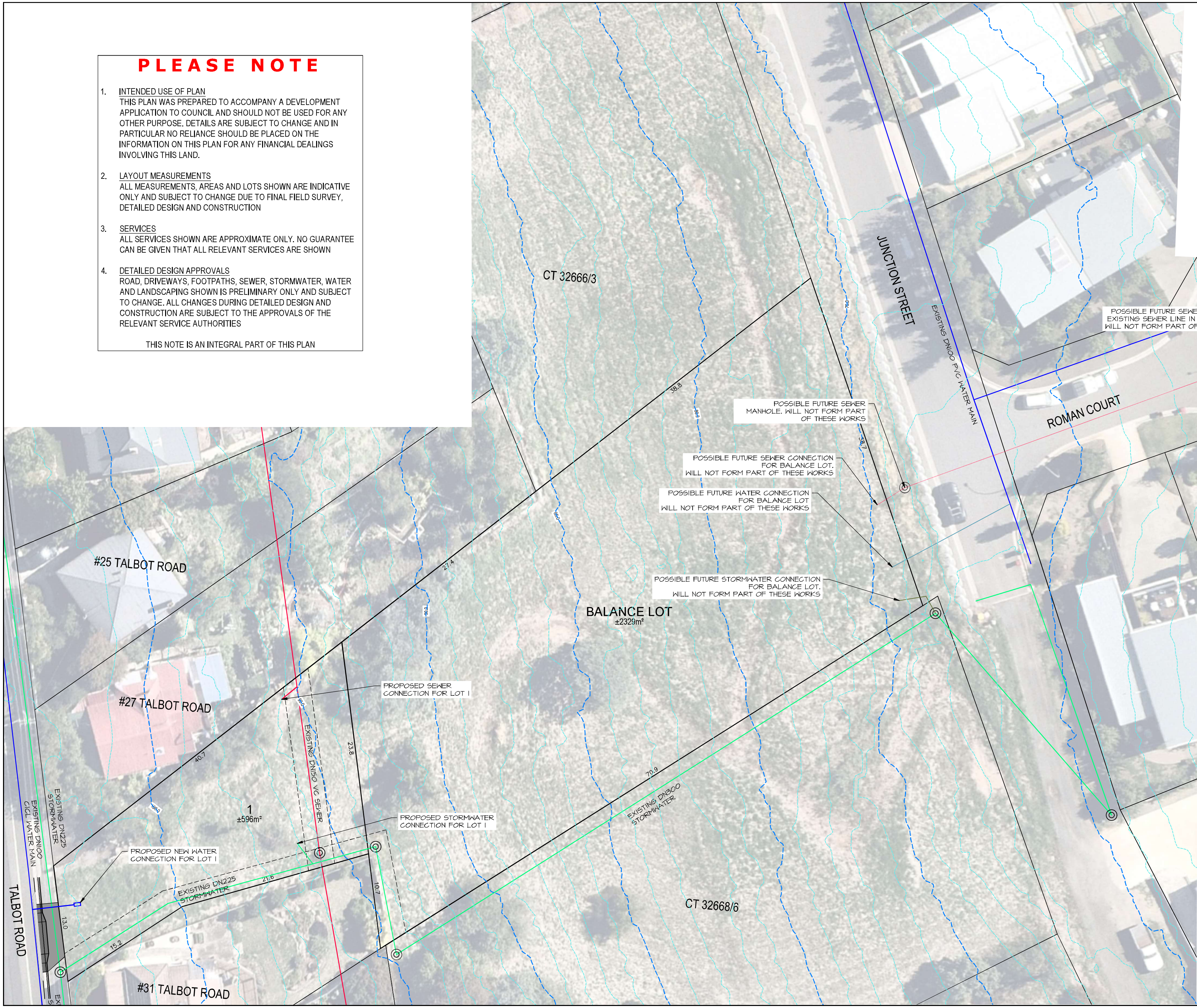

PLEASE NOTE

1. INTENDED USE OF PLAN
THIS PLAN WAS PREPARED TO ACCOMPANY A DEVELOPMENT APPLICATION TO COUNCIL AND SHOULD NOT BE USED FOR ANY OTHER PURPOSE. DETAILS ARE SUBJECT TO CHANGE AND IN PARTICULAR NO RELIANCE SHOULD BE PLACED ON THE INFORMATION ON THIS PLAN FOR ANY FINANCIAL DEALINGS INVOLVING THIS LAND.

2. LAYOUT MEASUREMENTS
ALL MEASUREMENTS, AREAS AND LOTS SHOWN ARE INDICATIVE ONLY AND SUBJECT TO CHANGE DUE TO FINAL FIELD SURVEY, DETAILED DESIGN AND CONSTRUCTION

3. SERVICES
ALL SERVICES SHOWN ARE APPROXIMATE ONLY. NO GUARANTEE CAN BE GIVEN THAT ALL RELEVANT SERVICES ARE SHOWN

4. DETAILED DESIGN APPROVALS
ROAD, DRIVEWAYS, FOOTPATHS, SEWER, STORMWATER, WATER AND LANDSCAPING SHOWN IS PRELIMINARY ONLY AND SUBJECT TO CHANGE. ALL CHANGES DURING DETAILED DESIGN AND CONSTRUCTION ARE SUBJECT TO THE APPROVALS OF THE RELEVANT SERVICE AUTHORITIES

THIS NOTE IS AN INTEGRAL PART OF THIS PLAN

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Architectural
ABP No. CC4874f
Structural / Civil
ABP No. CC1633i

APPROVED COMPANY ISO 9001 QHS Certification Services

PRELIMINARY - NOT FOR CONSTRUCTION

ISSUE	DATE	ISSUED FOR
01	15.06.2020	DRAFT
02	06.07.2020	PLANNING
03	10.08.2020	BALANCE LOT
04	02.09.2020	INDICITIVE FUTURE SERVICES
05	18.09.2020	REVISED FUTURE SERVICES

DIMENSIONS ARE IN MILLIMETRES. DO NOT SCALE. CHECK AND VERIFY ALL DIMENSIONS ON SITE. REFER DISCREPANCIES TO THE SUPERINTENDENT. ALL WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH BUILDING CODE OF AUSTRALIA, APPLICABLE AUSTRALIAN STANDARDS & LOCAL AUTHORITY REQUIREMENTS.

PROJECT: 2 LOT SUBDIVISION

ADDRESS: 29 TALBOT ROAD SOUTH LAUNCESTON, 7249

FOR: DJ BUILDING CONTRACTORS

DRAWING: PROPOSAL PLAN

DESIGNED: J.D.L DRAWN: J.D.L CHECKED: P.M.W.

SCALES: 1:200 AT A1 SIZE DRAWING SHEET

PROJECT No. 20.042 DRAWING No. P01 REV. D

Our Ref: 20.042

Measured form and function

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16 August 2020

Mr Michael Stretton
General Manager
City of Launceston
By email: planning.queries@launceston.tas.gov.au

Dear Michael,

DEVELOPMENT APPLICATION - 2-LOT SUBDIVISION AND VEGETATION REMOVAL - 29 TALBOT ROAD, SOUTH LAUNCESTON

Please find enclosed a development application for a 2-lot subdivision of land located at 29 Talbot Road, South Launceston (the site - refer to Figure 1). The development application includes the following documents:

1. completed permit application form
2. plan of subdivision
3. planning compliance letter
4. certificate of title for the site
5. landslide risk assessment and supplementary letter

This planning compliance letter provides details of the proposed use and development and provides an assessment against the relevant standards of the *Launceston Interim Planning Scheme 2015* ("the Scheme").

1 Planning Overview

Location	29 Talbot Road, South Launceston
Title Information	Certificate of Title Volume 21380 Folio 1
Planning Instrument	*Launceston Interim Planning Scheme 2015 (the Scheme)*
Zoning	10.0 - General Residential zone
Codes	E3.0 - Landslide E4.0 - Road and Railway Assets E6.0 - Parking and Sustainable Transport E10.0 - Open Space
Use	Residential - single dwelling
Development	2-lot subdivision and vegetation removal
Status	Discretionary

2 Site and Adjacent Land

The site is addressed as 29 Talbot Road, South Launceston and is identified by Certificate of Title Volume 21380 Folio 1. It is illustrated in Figure 1 below.

Figure 1 - aerial image of the site.

Source: base image and data from the LIST (www.thelist.tas.gov.au) © State of Tasmania

The site is irregular in shape and has a long axis in a general north-east to south-west alignment. It has 13m of frontage to Talbot Road along its south-western boundary and 38.7m of frontage to Junction Street along its north-eastern boundary. Land contained within the lot falls away from Talbot Road at an average gradient of 16°.

The site is vacant and comprises grass cover and a number of freestanding trees and shrubs. The Talbot Road end of the site adjoins a lot to the north and a lot to the south. Each of these lots have frontage to Talbot Road and contain single dwellings. The Junction Street end of the site adjoins a lot to the north and a lot to the south. These lots are larger in size when compared to the adjoining lots at the Talbot Road end and are vacant. The northern lot has frontage to a made section of Junction Street and the southern lot has frontage to an unmade section of Junction Street.

The site and adjacent land in all directions is zoned General Residential.

3 Proposed Development

The development application is seeking planning approval to subdivide the existing lot into two (2) lots. Details of the proposed lots are provided in the table below:

Lot	Area	Shape	Frontage	Av. Gradient	Av. Width	Av. Depth
1	596m^2	irregular	13m	16°	18.4m	38.7m
Balance	2,329m^2	oblong	38.7m	16°	73.2	68.5m

Proposed Lot 1 will be vacant and will have frontage to Talbot Road along its south-western boundary. It is proposed to construct a new crossover at the frontage boundary. New water, stormwater and sewerage connections will be installed to service the lot.

The proposed balance lot will be retained as balance land. It will be included in a future subdivision development application which will involve the adjoining lot to the north and the adjoining lot to the south which are under the same ownership.

It is proposed to remove some tree and shrub vegetation that is contained on the site. The extent of vegetation clearance is clouded in Figure 2 below where it is located on the site. The vegetation consists of a mixture of native and introduced species. The vegetation is required to be removed primarily to facilitate connections to service infrastructure and future development.

Figure 2 - aerial image identifying vegetation that is proposed to be removed.

Source: base image and data from the LIST (www.thelist.tas.gov.au) © State of Tasmania

4 Planning Assessment

4.1 Categorisation of Use

For the purposes of Clause 8.2.1 of the Scheme, the proposed use and development is categorised within the Residential use class, which is defined as follows in Table 8.2 of the Scheme:

> *Residential*
>
> *use of land for self-contained or shared living to accommodation. Examples include an ancillary dwelling, boarding house, communal residence, home based business, hostel, residential aged care home, residential college, respite centre, retirement village and single or multiple dwellings.*

Proposed Lot 1 will be capable of facilitating future single dwelling use and development. It is proposed to integrate the balance lot into a future subdivision development that will include the adjoining lot to the north and the adjoining lot to the south.

The zone and code standards that apply to the proposed use and development are addressed in Sections 4.2 to 4.7 below. Assessment against the relevant performance criteria is provided under Section 5.

4.2 General Residential Zone

Pursuant to Table 10.3, clauses 10.3.1 to 10.3.5 do not apply to the proposal on the basis that the use and development is categorised into the Residential use class.

Pursuant to Table 10.4, clauses 10.4.1 to 10.4.14 do not apply to the proposal on the basis that no building development is proposed.

10.4 Use Standards			
Standard/Requirement		**Assessment**	**Compliance**
10.4.15 Lot size and dimensions			
A1.1	Each lot, or a lot in a plan of subdivision, must:		Complies with acceptable solution.
	(a) have a minimum area of no less than 500m²; and	Proposed Lot 1 will have an area of 596m² and the balance lot will have an area of 2,329m².	
	(b) be able to contain a rectangle measuring 10m by 15m.	The average width and depth of each proposed lot will enable them to contain a building envelope with the minimum dimensions of 10m by 15m.	
A1.2	Each lot, or a lot proposed in a plan of subdivision, must:		Not applicable.
	(a) be required for public use by the Crown, an agency, or a corporation all the shares of which are held by Councils or a municipality; or	The proposed subdivision is not required for public use.	

10.4 Use Standards			
Standard/Requirement		**Assessment**	**Compliance**
	(b) be required for the provision of public utilities; or	The proposed subdivision is not required for the provision of a public utility.	
	(c) be for the consolidation of a lot with another lot, provided each lot is within the same zone.	The proposed subdivision is not for the consolidation of a lot with another lot within the same land use zone.	
A1.3	Each lot, or a lot proposed in a plan of subdivision, must have new boundaries aligned from buildings that satisfy the relevant acceptable solutions for setbacks.	The site is vacant.	Not applicable.
10.4.16 Frontage and access			
A1	Each lot, or a lot proposed in a plan of subdivision, must have a frontage to a road maintained by a road authority of no less than 3.6m.	Proposed Lot 1 will have 13m of frontage to Talbot Road along its south-western boundary and the balance lot will have 38.7m of frontage to Junction Street along its north-eastern boundary.	Complies with acceptable solution.
A2	No acceptable solution.	There is no acceptable solution.	Relies on performance criteria.
10.4.17 Discharge of stormwater			
A1	Each lot, or a lot proposed in a plan of subdivision, including roads, must be capable of connecting to a public stormwater system.	Proposed Lot 1 will be provided with connection into a DN225 stormwater main which is located inside and parallel to its southern boundary. The balance lot is capable of connecting into an existing DN300 stormwater main which runs parallel to its southern boundary inside the adjoining lot.	Complies with acceptable solution.

10.4 Use Standards			
Standard/Requirement		**Assessment**	**Compliance**
A2	The Council's General Manager has provided written advice that the public stormwater system has the capacity to accommodate the stormwater discharge from the subdivision.	Consent from Council's General Manager that the public stormwater system has the capacity to accommodate stormwater discharge from the proposed subdivision is sought via Council's internal development application assessment process.	Complies with acceptable solution.
10.4.18 Water and sewerage services			
A1	Each lot, or a lot proposed in a plan of subdivision, must be connected to a reticulated water supply.	Proposed Lot 1 will ne provided with a water connection from a DN100 water main which is located within Talbot Road. The balance lot is capable of connecting to a DN100 water main which is located within the Junction Street road reserve.	Complies with acceptable solution.
A2	Each lot, or a lot proposed in a plan of subdivision, must be connected to a reticulated sewerage system.	Proposed Lot 1 will be provided with a connection into a DN150 VC sewer main which will be located approximately 5.5m in from the rear boundary. The balance lot is capable of connecting into a DN150 sewer main which is located downslope at the end of Roman Court.	Complies with acceptable solution.
10.4.19 Integrated urban landscape			
A1	Subdivision does not create any new road, public open space or other reserves.	The proposed subdivision will not create a new road, public open space or other reserves.	Complies with acceptable solution.
10.4.20 Walking and cycling network			
A1	Subdivision does not create any new road, footpath or public open space.	The proposed subdivision will not create a new road, footpath or public open space.	Complies with acceptable solution.

10.4 Use Standards			
Standard/Requirement		**Assessment**	**Compliance**
10.4.21 Lot diversity			
A1	Subdivision is for 10 lots or less.	The proposed subdivision is for 2 lots.	Complies with acceptable solution.
10.4.22 Solar orientation of lots			
A1	Any lot for residential use with an area of less than 500m², in a subdivision of 10 or more lots, must have the long access between 30 degrees west of north and 30 degrees east of north.	Proposed Lot 1 will have an area of 596m^2 and the balance lot will have an area of 2,329m^2. Further, the proposed subdivision is for less than 10 lots.	Not applicable.
10.4.23 Neighbourhood road network			
A1	Subdivision does not create any new road.	The proposed subdivision will not create a road.	Complies with acceptable solution.
10.4.24 Public transport network			
A1	Subdivision does not create any new road.	The proposed subdivision will not create a road.	Complies with acceptable solution.

4.3 Landslip Code

E3.6 Development Standards			
Standard/Requirement		**Assessment**	**Compliance**
E3.6.1 Development on Land Subject to Risk of Landslip			
A1	No acceptable solution.	There is no acceptable solution.	Relies on performance criteria.

4.4 Road and Railway Assets Code

The Code is applicable to the extent that proposed Lot 1 will require a new vehicle crossover off Talbot Road. The site not located within 50m of a Utilities zone that is part of an existing or future railway network or a Category 1 of Category 2 Road.

E4.5 Use Standards			
Standard/Requirement		**Assessment**	**Compliance**
E4.5.1 Existing road accesses and junctions			
A3	The annual average daily traffic (AADT) of vehicle movements, to and from a site, using an existing access or junction, in an area subject to a speed limit of 60km/h or less, must not increase by more than 20% or 40 vehicle movements per day, whichever is the greater.	The RTA Guide to Traffic Generating Developments[1] identifies that single dwellings can be expected to generate up to 9 daily vehicle trips per day. On this basis, the new cross over for proposed Lot 1 can be expected to generate 9 vehicle movements per day at each crossover. The balance lot will not be provided with a physical access onto Junction Street.	Complies with the acceptable solution.

E4.6 Development Standards			
Standard/Requirement		**Assessment**	**Compliance**
E4.6.2 Road accesses and junctions			
A2	No more than one access providing both entry and exit, or two accesses providing separate entry and exit, to roads in an area subject to a speed limit of 60km/h or less.	The single crossover for proposed Lot 1 will provide both entry and exit access.	Complies with the acceptable solution.

4.5 Parking and Sustainable Transport Code

Clause E6.2.1 of the Scheme identifies that the code applies to all use and development. On the other hand, the application does not seek approval to establish a residential use or any other use for that matter. The parking requirements relevant to proposed Lot 1 will be determined in conjunction with specific proposals for future use and development. The current application does not affect issues dealt with by the Code directly, and it does not apply to the subdivision in accordance with clause 7.4.2(b) of the Scheme.

4.6 Scenic Management Code

[1] RTA Guide to Traffic Generating Developments Version 2.2 October 2002

E7.6 Development Standards			
Standard/Requirement		**Assessment**	**Compliance**
E7.6.2 Scenic management areas			
A2	No vegetation is to be removed.	It is proposed to remove some trees and shrubs.	Relies on performance criteria.
A3	Subdivision is in accordance with a specific area plan.	The site is not subject to a specific area plan.	Relies on performance criteria.

4.7 Open Space Code

It is anticipated that Council will determine that no land will be required for public open space as part of the proposed subdivision but rather require a payment in lieu of public open space in accordance with the *Local Government (Building and Miscellaneous Provisions) Act 1993*. On this basis, the proposed subdivision is exempt from the Code in accordance with Clause E10.4.1(a) of the Scheme.

5 Relevant Performance Criteria

5.1 Clause 10.4.16 Frontage and access - Performance Criteria P2.

The objective of the standard is:

To ensure that lots provide:

(a) appropriate frontage to a road; and

(b) safe and appropriate access suitable for the intended use.

The performance criteria states:

Each lot, or a lot proposed in a plan of subdivision, is capable of being provided with reasonable vehicular access to a boundary of a lot or building area on the lot, if any, having regard to:

(a) the topography of the site.

(b) the distance between the lot or building area and the carriageway;

(c) the nature of the road and the traffic;

(d) the character of the area; and

(e) the advice of the road authority.

Response

Building areas are not intended to be located on each proposed lot for inclusion on a sealed plan nor is physical access proposed between Junction Street and the frontage boundary of the balance lot. However, proposed Lot 1 is capable of being provided with reasonable vehicle access to its frontage boundary having regard to the following:

(a) proposed Lot 1 has direct frontage to Talbot Road. From the frontage boundary, land slopes away from the frontage boundary, gradually at first before becoming steeper. The slope will not unreasonably constrain the ability to provide a crossover to the frontage of proposed Lot 1 which is currently level between the kerb of the road and the frontage boundary.

(b) the frontage boundary of proposed Lot 1 adjoins the back of the footpath of Talbot Road and a future building area is likely to be forward on the lot due to the topography of the site. Accordingly, the distance between the lot and/or building envelope and Talbot Road is likely to be minimal and commensurate to others lots within the surrounding area.

(c) Talbot Road is identified as a sub-arterial road. The section of Talbot Road adjacent to the site consists of split level lanes. The western lane of Talbot Road is on the high side and provides for northbound traffic movement. The eastern lane is on the low side of Talbot Road and provides for southbound traffic movement. The two lanes are separated by a vertical concrete retaining wall.

The site is adjacent to the eastern lane. The speed limit of Talbot Road in this section is 60km/h. The eastern lane of the section of Talbot Road that is split level directly serves the prevailing residential land use and indirectly serves as sub-arterial access between Launceston and Kings Meadows. The access arrangement for proposed Lot 1 will be consistent with the established nature and traffic volume of Talbot Road.

(d) access arrangements for proposed Lot 1 will be consistent with the prevailing residential character of the area.

(e) it is anticipated that the road authority will review the proposed access arrangements and impose any relevant conditions on the permit.

5.2 Clause E3.6.1 Development on land subject to risk of landslip - Performance Criteria P1.

The objective of the standard is:

To ensure that development is located and constructed to manage landslide risk through suitable measures to avoid the risk of injury to, or loss of human life, or damage to land, property and public infrastructure.

The performance criteria states:

Human life, land, property and public infrastructure is protected from landslide risk, having regard to:

(a) the level of risk identified in a landslide risk management assessment;

(b) any declaration of a landslip area under Part 9A of the <u>Mineral Resources Development Act 1995</u>;

(c) measures proposed to mitigate the risk;

(d) the nature, degree, practicality and obligation for any management activities to mitigate the risk;

(e) the need for and permanency of any on-site or off-site maintenance arrangements;

(f) the responsibility for and the permanency of any on-site or off-site maintenance arrangements;

(g) impacts on public infrastructure; and

(h) the impact of any mitigation works on the character of the area.

Response

The landslide risk assessment determined that the proposed subdivision is suitable for the level of risk, having regard to the following:

(a) the landslide risk assessment determined that the risk profile for the proposed subdivision is low.

(b) the site is not identified as a declared landslip area under Part 9A of the *Mineral Resources Development Act 1995*.

(c) Section 7 of the landslide risk assessment contains a list of recommendations that are capable of being adhered to where they are relevant to the proposed subdivision. In this regard, proposed Lot 1 will be provided with stormwater and sewage connections. Vegetation that is proposed to be removed is largely required to accommodate proposed and future development. The site will be retained under grass cover and each lot is capable of being landscaped in association with future development.

(d) the nature, degree, practicality and obligation of risk management and mitigation activities are not unreasonable for the intended use. Proposed Lot 1 will be provided with stormwater and sewage connections which is required for the underlying General Residential land use zone. Risk management and mitigation associated with building design and construction methodology can be incorporated into future development drawings.

(e) apart from certain design requirements for future buildings and structures, no other permanent onsite or offsite maintenance arrangements are required for the site to manage and mitigate landslip risk.

(f) responsibility for the design requirements for future buildings and structures will lie jointly with the landowner, designer, structural engineer and geotechnical engineer.

(g) no impacts on public infrastructure have been identified by the landslide risk assessment.

(h) risk management and mitigation works will be residential in nature and character.

5.3 Clause E7.6.2 Scenic management areas - Performance Criteria P2.

The objective of the standard is:

The siting and design of development is to be unobtrusive in the landscape and complement the character of the scenic management areas.

The performance criteria states:

Development that involves only the clearance or removal of vegetation must have regard to:

(a) the scenic management precinct existing character statement and management objectives in clause E7.6.3;

(b) the physical characteristics of the site;

(c) the location of existing buildings;

(d) the type and condition of the existing vegetation;

(e) any proposed revegetation; and

(f) the options for management of the vegetation.

Response

Clearance of the identified vegetation will be unobtrusive in the landscape, having regard to the following:

(a) proposed Lot 1 is capable of being revegetated in conjunction with future development.

(b) removal of the identified vegetation will not impact the physical characteristics of the site.

(c) the site is vacant.

(d) the vegetation to be removed is a mixture of native and exotic species. The Vegetation is required to be removed to accommodate a future building area on the site and to assist with the installation of services.

(e) no revegetation is proposed at this stage.

(f) the vegetation is not significant enough to warrant management.

5.4 Clause E7.6.2 Scenic management areas - Performance Criteria P3.

The objective of the standard is:

The siting and design of development is to be unobtrusive in the landscape and complement the character of the scenic management areas.

The performance criteria states:

Subdivision must have regard to:

(a) the scenic management precinct existing character statement and management objectives in clause E7.6.3;

(b) the size, shape and orientation of the lot;

(c) the density of potential development on lots created;

(d) the need for the clearance or retention of vegetation;

(e) the need to retain existing vegetation;

(f) the requirements for any hazard management;

(g) the need for infrastructure services;

(h) the specific requirements of the subdivision;

(i) the extent of works required for roads or to gain access to sites, including any cut and fill;

(j) the physical characteristics of the site and locality;

(k) the existing landscape character;

(l) the scenic qualities of the site; and

(m) any agreement under s.71 of the Act affecting the land.

Response

The proposed subdivision will be unobtrusive in the landscape and complement the character of the surrounding area, having regard to the following:

(a) the site is located within a 37ha segment the Central Hills scenic management area (the “precinct”). The precinct encompasses the residential area located along the ridgeline of the hillside to the east of the central Launceston area which runs along the spine of High Street and Talbot Road. It is dominated by skyline development and forms the backdrop for South Launceston, Newstead and central Launceston.

The segment of the precinct is predominately linear and extends between Mary Street to the north and McKellar Road to the south. The site is located centrally within the segment. It is located on the face of the eastern aspect of the hillside and is visible from Newstead and the eastern suburbs further afield.

The precinct is primarily characterised by small lots located adjacent to the spine road that dissects the segment and larger lots located on the lower slopes. Lots that are adjacent to the spine road predominately contain single dwellings.

The site is currently atypical of the area. It is vacant. All other lots on the eastern side of the spine road within the precinct are developed.

The proposed subdivision will be consistent with the management objectives of the precinct, having regard to the following:

a. the proposed subdivision will maintain the predominate vegetation cover that is contained within the site which is exotic grassland. Future development of proposed Lot 1 is capable of incorporating new landscaping.

b. future residential development on proposed Lot 1 will bring the site into greater conformity with the adjoining lots to the north and east to the extent that it will fill a gap in the skyline when viewed from Newstead and other eastern suburbs further afield.

c. the driveway to a future building area on proposed Lot 1 will not be visible when viewed from the east.

d. future development on proposed Lot 1 is likely to be consistent with existing development on adjacent lots to the north and south. This is primarily due to the topography of the site which falls away from the frontage. Residential density is likely to be limited to single dwelling development only due to the size and physical constraints of the site. Accordingly, future development is likely to be in keeping with the established pattern of development which is characterised by dwellings located in the western half of similar lots with the eastern half of the same lots able to contain landscaping.

e. no development within public parklands is proposed.

(b) the size, shape and orientation of proposed Lot 1 will be compatible with surrounding lots that have direct frontage off Talbot Road to the north and south of the location of the site:

Address	Size	Shape	Orientation
17 Talbot Road	608m^2	rectangle	east
19 Talbot Road	608m^2	rectangle	east
21 Talbot Road	742m^2	oblong	east
23 Talbot Road	850m^2	oblong	east
25 Talbot Road	671m^2	oblong	east
27 Talbot Road	911m^2	oblong	east
31 Talbot Road	558m^2	oblong	east
33 Talbot Road	593m^2	oblong	east
35 Talbot Road	600m^2	oblong	east
36 Talbot Road	922m^2	square	west
32 Talbot Road	561m^2	rectangle	west
30 Talbot Road	557m^2	rectangle	west
28 Talbot Road	571m^2	rectangle	west
26 Talbot Road	613m^2	oblong	west
24 Talbot Road	979m^2	rectangle	west
22 Talbot Road	464m^2	oblong	west
20 Talbot Road	786m^2	oblong	west
18 Talbot Road	873m^2	oblong	west
16 Talbot Road	596m^2	oblong	west
14 Talbot Road	417m^2	square	west

Of the lots identified in the table, the average size is 674m^2, the smallest size is 417m^2 and the largest size is 979m^2. All lots have a general east to west alignment. Proposed Lot 1 will be rectangular in shape, have an area of 596m^2 and will have an easterly aspect. It will therefore be in keeping with the average lot size and orientation within the identified area.

(c) proposed Lot 1 will produce a likely density of one (1) dwelling per 596m^2 which will be compatible with established residential density within the surrounding area. Residential density is likely to be limited to single dwelling development only due to the size and physical constraints of the site.

(d) vegetation removal or retention will be inconsequential to the precinct.

(e) the predominate vegetation cover (grassland) will be retained.

(f) the site is not located within a bushfire prone area. Landslide risk management and mitigation will comprise connecting proposed Lot 1 to reticulated stormwater and sewer service infrastructure.

(g) proposed Lot 1 will utilise existing infrastructure services including road access and reticulated water, stormwater and sewer infrastructure.

(h) the proposed subdivision is reasonably uncomplicated and does not require specific engineering design requirements for its facilitation.

(i) minimal works are required to install the crossover to proposed Lot 1.

(j) the physical characteristics of the site and service infrastructure enable proposed Lot 1 to be subdivided with relative ease. To this effect, the site has direct frontage to Talbot Road and stormwater and sewer infrastructure is downslope of a future building area which enables a gravity connection.

(k) the size, shape and orientation of proposed Lot 1 approximates the density and pattern of development within the general location of the precinct. Proposed Lot 1 will therefore share a similar visual characteristic and be read as part of the established skyline of the precinct.

(l) the proposed subdivision will not detract from the scenic qualities of the area.

(m) The site is not subject to an agreement pursuant to Section 71 of the *Land Use Planning and Approvals Act 1993*.

6 Conclusion

The proposal involves a 2-lot subdivision of land located at 29 Talbot Road, South Launceston.

The proposal complies with the applicable Scheme acceptable solutions in the General Residential zone and relevant code standards including the following performance criteria:

- **Clause 10.4.16 Frontage and access - Performance Criteria P2**
- **Clause E3.6.1 Development on land subject to risk of landslip - Performance Criteria P1**
- **Clause E7.6.2 Scenic management areas - Performance Criteria P2**
- **Clause E7.6.2 Scenic management areas - Performance Criteria P3**

It is therefore submitted that a permitted permit can be issued in accordance with clause 8.8.1 of the Scheme and section 51 and 57 of the *Land Use Planning and Approvals Act 1993*.

Please do not hesitate to contact me should you have any queries on this application.

Yours faithfully
6ty° Pty Ltd

George Walker
Director/Planning Consultant

TASMAN geotechnics

7 August 2020

DJ Building Contractors
C/- 6ty
Tamar Suite 103 The Charles
287 Charles Street
LAUNCESTON TAS 7250

Attention: David Crack

RE: Supplementary Report
Proposed Subdivision
29 Talbot Road, South Launceston

Tasman Geotechnics has previously carried out a Landslide Risk Assessment to identify possible building sites and support a subdivision application at 29 Talbot Road, South Launceston (report TG18231/1 – 01report, dated 15 January 2020).

We understand the current proposal is for a 2 lot subdivision of lot 21380/2: one lot of about 596m^2 fronting onto Talbot Road, and the balance of about 2329m^2, fronting onto Junction Street.

Having reviewed the subdivision layout, it is our assessment that the proposed subdivision layout is consistent with the recommendations of our report.

The Launceston Interim Planning Scheme stipulates (Clause E3.6.1) that for development on land subject to landslide risk, that:

"…development is located and constructed to manage landslide risk through suitable measures to avoid the risk of injury to, or loss of human life, or damage to land, property and public infrastructure"

and that:

Human life, land, property and public infrastructure is protected from landslide risk, having regard to:

(a) the level of risk identified in a landslide risk management assessment;
(b) any declaration of a landslip area under Part 9A of the Mineral Resources Development Act 1995*;*
(c) measures proposed to mitigate the risk;
(d) the nature, degree, practicality and obligation for any management activities to mitigate the risk;
(e) the need for and permanency of any on-site or off-site maintenance arrangements;
(f) the responsibility for and the permanency of any on-site or off-site maintenance arrangements;
(g) impacts on public infrastructure; and
(h) the impact of any mitigation works on the character of the area.

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The Australian Geomechanics Society Landslide Risk Management Guidelines (AGS, 2007c) suggests a Moderate risk profile as a tolerable level of risk for property loss for existing slopes as well new development and existing landslide.

The risk assessment report shows that the risk profile for the proposed development is Low (Section 6.3 of the report). If the Moderate risk profile is adopted as the tolerable level of risk, then the risk assessment in our report shows that incorporating the recommendations of Section 7, "*a tolerable level of risk can be achieved for the type, form, scale and duration of development*".

Similarly, AGS (2007c) suggests the tolerable loss of life for individual most at risk should be 10^{-5}/annum for new constructed slopes or new development, and 10^{-4}/annum for existing slopes. The calculated risk to life is 3.6×10^{-8}/annum (section 6.4 of the report), and lower than the tolerable loss of life for an existing slope.

Therefore, provided the development is carried out in accordance with the recommendations of the landslide report, the development meets the requirements of Code E3.

Should you require further information or clarification of any details, please do not hesitate to contact undersigned.

For and on behalf of Tasman Geotechnics Pty Ltd

Dr Wayne Griffioen

Principal Geotechnical Engineer

Attachments: None

TASMAN geotechnics

LANDSLIDE RISK ASSESSMENT
PROPOSED SUBDIVISION
29 TALBOT ROAD, SOUTH LAUNCESTON

Prepared for:	**DJ Building Contractors**
Date:	15 January 2020
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1 INTRODUCTION

Tasman Geotechnics was commissioned by DJ Building Contractors to carry out a Landslide Risk Assessment for a proposed development at 29 Talbot Road, South Launceston (title references are 21380/2, 32666/3 and 32668/6).

The site is approximately 7500m^2 and Tasman Geotechnics understands the proposed development concept is for subdivision into several lots of about 1000 to 1500m^2 each. As no definite plans are available, the recommendations from this report will drive the subdivision layout.

The assessment is required for the Planning Approval process as the majority of the site is mapped within a Class 4 landslip area on the 1:25,000 Launceston Advisory Zones (Prospect Sheet).

Our scope of work consisted of:

- Searching the MRT database for previously published reports for the site, or nearby sites;
- Carrying out a site walkover to note geomorphological features associated with landslide activity;
- Engaging an excavator contractor to construct access tracks to all borehole locations;
- Drilling of four boreholes (BH1 to BH4) using hollow stem augers and HQTT diamond core drilling techniques to determine subsurface conditions;
- Obtaining disturbed split spoon samples and undisturbed samples (U63) at regular depth intervals in each borehole;
- Collecting recovered core samples in core trays;
- Installation of two monitoring wells in BH2 and BH4 for groundwater level measurements;
- Laboratory testing for soil classification and field moisture content by Tasman Geotechnics and triaxial testing by Chadwick Geotechnics;
- Performing a Landslide Risk Assessment.

The assessment is consistent with the Landslide Risk Assessment guidelines published by the Australian Geomechanics Society (2007).

2 BACKGROUND INFORMATION

2.1 Regional Setting

The site is located within the central part of the Tamar Graben, a narrow (~5km wide) but elongated (~60km long) north-west/south-east trending basin. The basin contains a relatively thick sequence of generally poorly consolidated Tertiary aged sediments and basalt, generally overlying Jurassic aged dolerite. The dolerite is exposed on the flanks of the central axis of the basin as a series of stepped discontinuous ridges, separated by areas of shallower Tertiary and/or Quaternary deposits.

The graben faults were active in the early Tertiary (circa 70 million years before present) and created the basin which was subsequently filled in by fluvial (stream) and lacustrine (lake) sediments. The clay, sand and gravels filling the basin are collectively referred to as the Launceston Group.

Within this broader setting, the site is located on the north-eastern flank of Talbot Ridge, a three kilometer long NNW to SSE trending ridge rising to a maximum height of about 11m AHD in the central part of the basin. The majority of Talbot Ridge is composed of Launceston Group rocks.

2.2 Geology

The Mineral Resources Tasmania (MRT) 1:25,000 Series Digital Geological map, Launceston Sheet, shows the surface geology of the site and surrounding areas to the north, east and south to be mapped as Tertiary aged sediments described as, "*Poorly consolidated clay, silt and clayey labile sand with rare gravel and lignite; some iron oxide-cemented layers and concretions; some leaf fossils.*". These sediments overlie the Jurassic dolerite basement and are the most commonly occurring materials in the Launceston group.

Relatively small exposures of Jurassic dolerite are mapped sporadically along the (concealed) graben fault to the east of the site. The nearest of these is approximately 300m away from the site. These exposures, coupled with deep diamond drilling by CSIRO and others help to define the position of the underlying dolerite.

To the west of the site, a different Launceston Group unit is mapped. This is a discrete zone described as "*Brown-grey plastic clay, minor silt, clayey sand and ironstone at South Launceston.*". This unit is mapped from the crest of the ridge on Talbot Road and extending down the western flank of the ridge. This unit is spatially associated with landsliding at South Launceston (see section 2.4).

An extract of the MRT geology map is presented on Figure 1.

2.3 Landslide Mapping

The most recent landslide maps of the area published by MRT are the *"Tasmanian Landslide Map Series"* published in 2013. The *"Launceston – Landslide Inventory"* and *"Launceston – Slide Susceptibility"* maps are relevant to our study area. An extract of the Launceston Slide Inventory Map is shown in Figure 2. Also relevant is the now superseded Prospect Advisory Landslide Zoning Map produced by MRT in 2001.

There are a number of landslides mapper near the site. These are:

Landslide 2081, Junction Street

The Junction Street landslide is described as a soil slide on unknown status and is mapped over an area about 600m wide and 130m from toe to headscarp on the eastern flank of Talbot Ridge. The site is located on this landslide. There are no specific reports relating to this landslide, but it appears on a Tamar Valley Landslip Zone Map produced by W.L. Matthews in 1974 as a Class IV landslide, which is described as '*old landslips and adjacent areas*'. The map produced by Matthews (1974) was used in the compilation of the Prospect Advisory Landslide Zoning Map and the landslide appears on that sheet as a Class IV landslide.

There are at least 18 houses on the Junction Street landslide, and no damage has been recorded in this area associated with landslide movement.

Landslide 2002, Effingham Street

The Effingham Street landslide is located approximately 200m south-west of the site, on the western flank of Talbot Ridge. It is mapped as a recent or active landslide, with dimensions of 95m (width) by 140m length (scarp to toe). Ezzy and Mazengarb (2007) report that the landslide has a displaced volume of about 19,000m^3. The MRT landslide damage point database indicates the landslide caused catastrophic damage (leading to demolition) of three houses prior to 1984, and lesser damage to both Effingham Street and Lawrence Vale Road.

Landslide 1006, Powena Street

The Powena Street landslide is located approximately 450m south west of the site, on the western flank of Talbot Ridge. It is mapped as a recent or active landslide, with dimensions of 60m (width) by 90m length (scarp to toe). Ezzy and Mazengarb (2007) report that the landslide has a displaced volume of 27,912m^3. Although the surface area is considerably smaller than that of the Effingham Street landslide, the displaced volume is larger due to a greater depth of failure.

The MRT landslide damage point database indicates the landslide caused catastrophic damage (leading to demolition) of three houses prior to 1971, and lesser damage to both Curena Street and Legana Street.

Landslide 1005, Lawrence Vale Road

The Lawrence Vale landslide is located approximately 600m south west of the site, again on the western flank of Talbot Ridge. It is mapped as a recent or active landslide, with dimensions of 210m (width) by 170m length (scarp to toe). Ezzy and Mazengarb (2007) report that the landslide covers an area of about 36,000m^2, and involved the displacement of about 214,000m^3 of soil at about 12m depth. The Lawrence Vale Landslide occurred progressively from the early 1950's to early 1960's and is a combination of translational and rotational failure. While the exact magnitude of landslide movement could not be precisely determined, Ezzy and Mazengarb classify the rate of movement as Extremely Slow (<15mm/yr) using the Cruden and Varnes (1996) scale.

The MRT landslide damage point database indicates the landslide caused catastrophic damage (leading to demolition) of thirty-eight houses, commencing in about 1950. Ezzy and Mazengarb (2007) state that "*Recent ground cracking in the heascarp area of the Lawrence Vale Landslide indicates that the landslide has not totally stabilised.*" The majority of the slide is now covered with trees, and only a small number of dwellings stand within the mapped area of the landslide.

2.4 Landslide Susceptibility

In addition to mapping of pre-existing landslides, MRT also produced maps of landslide susceptibility. Susceptibility zones for first time failures were developed by MRT by statistical analysis of slope geometry and geological material of known landslides, and are mapped as possible source, regression and runout areas associated with potential landslide movement. For the Tertiary sediments, threshold values of source, regression and runout areas are 7°, 7° and 8° respectively.

The Launceston Landslide Susceptibility Map shows that the Junction Street site is located entirely on potential source areas, with source areas extending both upslope and downslope of the site. An extract of the Launceston Slide Susceptibility map is presented on Figure 3.

2.5 MRT Reports

A search was made of the Mineral Resources Tasmania website for previous investigations at or near the site. Thirty reports were identified that discuss landslides in the Launceston area, five of these relate to the Lawrence Vale Landslide. No report was identified to relate specifically to the current site, but elements of reports on surrounding sites are relevant.

In September 1969, **Jennings (1971)** carried out a site inspection of a (mud) slide at Meredith Crescent, which is located at the toe of the Lawrence Vale landslide. The slide was reported to consist "*of a wedge of Tertiary clay and sand, heavily charged with groundwater lying on the top side of Meredith Crescent, which has moved downslope to partially block the road. Along the edge of the road is a zone of heave and in order to maintain service, the top of the slip has been trimmed back off the road several times*" (Jennings, 1971). One of the recommendations was to construct two slots, deep enough to intersect the sliding plane, up the center of the landslide, to act as subsoil drains.

In a subsequent report by **Stevenson and Jennings (1971)** it is noted that there was no disturbance (i.e. damage) to Meredith Crescent from the (mud) slide, although it was covered on several occasions by debris. Stevenson and Jennings refer to observations in 2 trenches excavated in October 1969. The southern trench was excavated to a depth of about 5.5m below ground level. The material in the lower 1.8m of the trench was described as "*dry medium-grained sandstone which could be crumpled easily in the fingers*" while the upper part was "*in moist plastic brown-grey and red mottled clay*". There was no visible discontinuity or sliding surface apparent in the trench, nor was there significant water inflow. Similarly, the northern trench showed no visible discontinuities or water inflow. Scattered soft patches occurred mainly in the upper 1.8m. It is not clear from Stevenson and Jennings (1971) if the trenches were simply backfilled or constructed as subsoil drains as recommended by Jennings (1971).

Of the reports discussing the Lawrence Vale Landslide, the most recent and comprehensive investigation was by **Ezzy and Mazengarb (2007)**.

The extent of the landslide feature and the location of houses damaged/destroyed by the landslide are shown in Figure 2.

Based on fieldwork, Ezzy and Mazengarb identified two lithographic units that are involved with the landslip:

- *LF1, medium to high plastic clays with banded silt, fine clayey sand and ironstone (dominant colours grey and reds) and*
- *LF2, dominantly clayey sand layers with banded gravel, ironstone, clay and silt (dominant colours grey and yellowish brown).*

The LF1 unit is the upper layer and about 10m thick, while the underlying LF2 unit can be more than 20m thick. GIS modelling resulted in a contour map showing the thickness of the LF1 unit. The extent of the LF1 unit corresponds with the Tsam unit on the geology map (see Figure 1), and is spatially associated with the Powena, Effingham and Lawrence Vale landslides.

Underlying the LF2 unit was "*claystone and sandstone with banded coal, silty sand and clay*" (labelled LF3). Ezzy and Mazengarb concluded that the "*sediments are locally dipping westward and are a critical factor in the development of the landslides at Lawrence Vale*". The dip angle was inferred from boreholes drilling to dip between 10° and 20° to the west. Thus, west-facing slopes have a higher susceptibility to landslip than east-facing slopes, all other factors being equal.

In addition, the build-up of pore pressures in LF2 (a semi-confined aquifer) underlying LF1, a clay unit of high plasticity and low shear strength, was considered a significant factor contributing to the Lawrence Vale Landslide. Monitoring of groundwater levels in 11 piezometers allowed the development of a hydrogeological model for the Lawrence Vale area. The monitoring showed a rapid rise of groundwater level in the semi-confined aquifer in response to rainfall events. Groundwater recharge occurs where the aquifer is exposed at the surface (i.e. the crest of the ridge at Talbot Road) and potentially via fissures in the overlying clay unit.

2.6 Proposed Development

The subdivision is in early stages of design and is, to some extent, dependent upon the recommendations of this report. The concept is for subdivision into relatively large (e.g. 1000 to 1500m^2) lots. This would theoretically allow for approximately 6 lots.

We understand that the lots will be connected to deep sewerage and stormwater, and that the development will have a design life of at least 50 years.

3 FIELD INVESTIGATION

The fieldwork was conducted in several stages and comprised:

- A site walkover by a Geotechnical Engineer and Engineering Geologist from Tasman Geotechnics on 19 December 2018 to note any features relevant to landslide activity. Slope angles were measured using a hand held inclinometer. Photographs of the site were taken for reference purposes.
- Subsurface investigations were commenced on 12 March 2019 and involved:
  - Drilling four boreholes with a Hanjin D&B 8D track mounted drill as follows:
    - BH1 to a depth of 31.1m, with a combination of hollow stem auger drilling and diamond coring,
    - BH2 to a depth of 17.5m, with hollow stem auger drilling,
    - BH3 to a depth of 21.3m, with a combination of hollow stem auger drilling and diamond coring, and
    - BH4 to a depth of 15.0m, with hollow stem auger drilling.
  - Collecting disturbed and undisturbed soil samples at regular intervals from the boreholes.

- Installation of piezometers in two of the boreholes (BH2 and BH4) to enable monitoring of groundwater levels.
- Periodic monitoring of groundwater levels.

The borehole logs are presented in Appendix A and the borehole locations are shown on Figure 4.

Several soil samples were tested by Tasman Geotechnics for Atterberg Limits, particle size distribution and moisture content. The results are discussed in Section 4.4.

4 RESULTS

4.1 Surface Conditions

The 7500m^2 site has frontages on both Talbot Road and Junction Street.

The frontage at Talbot Road is about 15m and there is no crossover. Set back about 10m from the road edge appear to be footings, suggesting that there was once a small building on the site. The part of the site close to Talbot Road is gently sloping, with a break in slope about 30m from the road. The remainder of the site (below the break in slope) is more steeply sloping.

Overall the site slope averages about 17.5°, with a range of slopes between about 5 and 30°. While there are some undulations in the ground surface, they are interpreted to be unrelated to landslide movement.

The frontage on Junction Street is about 120m. There is a crossover at the northern end but no vehicular access is possible (the site is too steep). Vehicular (4WD) access is available from Junction Street at the southern end of the site. There is a 70m long mass block wall along the boundary with Junction Street. The wall is mostly two courses high, and was constructed in late 2010 or early 2011 when the sealed section of Junction Street was extended and Roman Court was constructed.

Historic aerial imagery indicates that there has never been formal development on the site.

4.2 Subsurface Conditions

In order to develop a geotechnical model for the site, four boreholes were drilled. Boreholes BH1, BH2 and BH3 were located in a line perpendicular to the contours to assist with generating a geotechnical cross section for the site. Borehole BH4 was located about 50m north of the cross section line.

The boreholes encountered sequences of high plasticity clay, medium plasticity sandy clays and clayey sands. Cemented sands were encountered in BH1 from about 29m below ground level.

Further discussion of geotechnical conditions is found in Section 4.5.

4.3 Groundwater

No groundwater inflow was observed in boreholes.

Upon construction of the groundwater monitoring wells at BH2 and BH4, the groundwater level was checked on several occasions. The observations are summarized in Table 1.

Table 1. Groundwater observations

	BH2	BH4
Depth of monitoring well	**15m**	**15m**
Date		
16/04/2019	Dry	Dry
18/06/2019	Dry	Dry
27/08/2019	Dry	Dry

The absence of groundwater concurs with the observations by Ezzy and Mazengarb that rainfall on the top of the ridge (near Talbot Road) recharges the local (unconfined aquifers) that flow toward the west. Strong correlation between phreatic water levels and rainfall were observed at Lawrence Vale road. No groundwater flows are expected toward Junction Street.

4.4 Laboratory Results

Laboratory testing was carried out by Tasman Geotechnics for properties such as Atterberg Limits, particle size distribution analysis and field moisture content. Although not a NATA accredited laboratory, the tests were carried out in accordance with Australian Standard methods. The laboratory test results are presented in Appendix B.

The soils are typically medium to high plasticity clays and clayey sands. Figure 5 shows the variation of Liquid Limit and Plastic Limit with depth of the boreholes, as well as the field moisture content of samples from BH1. The results show that the soil is dry, being close to or at the Plastic Limit.

Two undisturbed U63 samples were forward to Chadwick Geotechnics' NATA accredited laboratory in Victoria for Triaxial testing (Consolidated Undrained with Pore Pressure measurement, CUPP). Copies of the triaxial test certificates are also presented in Appendix B.

4.5 Geotechnical Model

The geotechnical model for the site consists of a continuous sequence of clays, sands and mixtures of clay and sand of Tertiary age. Ezzy and Mazengarb (2007) concluded that the sediments dip toward the west, between 10° and 20°. As the present site is in similar geological setting, we developed the geotechnical model on the same assumption. Figure 6 shows the sequence of materials (all Tertiary sediments) dipping toward the west.

The materials encountered in the present investigation are consistent with LF2 identified by Ezzy and Mazengarb (2007). The surficial clay identified in our boreholes is interpreted to be part of the LF1 sequence. No soil corresponding to LF3 was encountered in our boreholes.

There was no groundwater observed in the two monitoring wells. Therefore, the permanent groundwater table is at least 15m below ground level at BH3/BH4, and dipping toward the west.

5 SLOPE STABILITY ANALYSIS

5.1 General

A slope stability analysis gives a numerical value for the Factor of Safety (FOS) against failure of a nominated failure surface. In simple terms the FOS is a ratio of sliding (activating) forces to resisting forces along the failure surface. Activating forces are generally weight of soil at the high end of a slope, while resisting forces derive from the shear strength of the materials intersected by the failure surface, and the weight of material at the toe of a slope. A FOS of 1.0 represents a condition of incipient failure or limiting equilibrium. A FOS of greater than 1.0 indicates that resisting forces are greater than activating forces and thus the slope is not likely to fail, while a FOS of less than 1.0 indicates that failure is likely to occur.

The aim of the slope stability analysis presented here is to assess the current stability of the slope and the relative impacts of development.

5.2 Geotechnical Model

The major elements of a geotechnical model for slope stability analysis are:

- Ground surface topography and soil layers
- Shear strengths of subsurface layers (Strength Profile)
- Groundwater profile
- Loading due to house construction

Ground surface topography: The contour information was taken from LIDAR data. The soil layers were based on the dip of the layers. A sequence of clayey sands and sandy clays was adopted as shown in Figure 6. The materials outside the site are described as *"uncharacterised sediments"*. The material strengths are described below.

Shear strengths profile: Table 2 summarises the model strata and the strengths adopted for the geotechnical model.

Table 2. Model Strata and Strength Parameters

Stratum Description	Density (kN/m^3)	Friction angle (°)	Cohesion (kPa)
Clay	16	11	0
Sandy clay	17	34	0
Clay sand	18	34	0
Uncharacterised sediments	17	23	0

The triaxial testing was carried out on 2 sandy clay samples (see grading results in Appendix B). Using Critical State Soil Mechanics principles, the soil friction angle was calculated to be 34°. This value is the same as adopted in the stability analysis presented in Ezzy and Mazengarb (2007) for LF2. Thus, a value of 34° was adopted for the sandy clay.

Although a higher friction angle might be expected for clayey sand, we conservatively adopted the same friction angle as the sandy clay.

The friction angle of the clay was taken to be 11°, which is the same as adopted in the stability analysis presented in Ezzy and Mazengarb (2007) for LF1.

The strength of the uncharacterised sediments was assumed to be the geometric average of the sandy clay an clayey sand: atan(tan(34°) + tan(11°)) = 23°.

Groundwater profile: No groundwater was detected in the two monitoring wells. The groundwater level was assumed to at least 15m below ground level below the site at BH3/BH4, and becoming shallower to the east.

Loading: This was approximated by assuming houses are 15m wide and apply a net load of 15kPa (vertical). Three houses were assumed: one at the top of the site, one in the middle and one a sort distance uphill of the gabion wall along Junction Street.

5.3 Stability Analysis

Slope stability analyses were undertaken using the 2D, limit equilibrium computer program Rocscience SLIDE version 5. Graphical output of the stability analyses are shown in Appendix C.

Three scales of sliding can be identified on the graphical results: i) shallow slide near crest of site, ii) deep seated slide to base of slope and iii) medium scale slide near Junction Street.

Table 3 summarises the FOS from the slope stability modelling for two scenarios: existing conditions (no dwellings on subdivision) and post-development (houses at top, middle and bottom of site).

Table 3. Summary of FOS

	Development Condition		
Landslide scale	**Existing conditions**	**Post-Development**	**Comment**
Shallow slide near crest	1.71	1.83	Moderate increase in FOS due to loading from house near toe of slide
Deep-seated	1.86	1.84	FOS decrease slightly due to loading from houses
Medium scale near Junction Street	2.03	1.87	FOS decreases due to load from house above road

From Table 3 and the graphical results, we make the following conclusions:

- A relatively low FOS (around 1.1) was calculated for short sections of slope. These results suggest there may be small scale slides where slopes are locally steep.
- The FOS for a shallow slide near the crest is slightly lower than a deep seated landslide. The FOS for a shallow slide can be increased if a house is built across the toe of the slide. As the final location of a house is variable, the apparent increase should be ignored.
- The calculated extent of the deep seated slide is from near Talbot Road to Amy Street, a distance of approximately 220m, and much larger than the mapped landslide (about 130m). The depth of sliding is calculated to be about 30m. Further investigation and model refinement would be required to match the calculated slide to the mapped slide. Such refinement is not necessary, as the impact of houses within the proposed subdivision does not significantly impact the FOS of a deep-seated slide.
- The FOS for a medium scale slide at the gabion wall near Junction Street reduces by about 8% due to construction of a house. If loading of the house is taken to a depth below the potential sliding surface, there would be no effective loading on the wall, and the FOS would remain unchanged.

6 LANDSLIDE RISK ASSESSMENT

6.1 General

Risk assessment and management principles applied to slopes can be interpreted as answering the following questions;

- What might happen? (HAZARD IDENTIFICATION).
- How likely is it? (LIKELIHOOD).
- What damage or injury might result? (CONSEQUENCE).
- How important is it? (RISK EVALUATION).
- What can be done about it? (RISK TREATMENT).

The risk is a combination of the likelihood and the consequences for the hazard in question. Thus both likelihood and consequences are taken into account when evaluating a risk and deciding whether treatment is required.

The qualitative likelihood, consequence and risk terms used in this report for risk to property are given in Appendix D and are based on the Landslide Risk Management Guidelines, published by Australian Geomechanics Society (AGS, 2007). The risk terms are defined by a matrix that brings together different combinations of likelihood and consequence. Risk matrices help to communicate the results of risk assessment, rank risks, set priorities and develop transparent approaches to decision making.

6.2 Potential Hazards

Ordinarily, landslide risk assessments are performed relative to a specific development proposal, which for a subdivision may include a specific proposed layout. Since this proposal is still in the early stage of design, the identified landslide hazards are relatively general in nature.

The following landslide hazards are identified for the site:

Deep seated failure of the hillside. Deep-seated landslide features describe failures along shear surfaces that extend well below any surficial soil horizons into deeply weathered regolith and/or underlying geological units. The depth of these features is thought to usually exceed 5m. A landslide of this size could involve 100,000's of m^3 and would move extremely slowly, probably less than 20mm/yr. The likelihood of a deep seated landslide at or affecting this site under current climatic conditions is assessed to be Rare.

Shallow slides on natural slopes. Landslides have not been observed at or near the site. Although the slope stability modelling suggests shallow slides may occur, the construction of services, such as stormwater and sewerage will intercept shallow groundwater. In addition, maintaining effective ground cover, such as mulch or vegetation, will also reduce the likelihood of shallow slides. Therefore, the likelihood of such slides affecting the proposed subdivision under current climatic conditions is assessed to be Unlikely.

Small scale slides due to development. Small scale slides can also occur where slopes have been steepened due to earthworks (e.g. cut or fill), or localized soil erosion (e.g. from poor control of surface runoff) or locally elevated groundwater levels (e.g. seepage water collected in fill embankment). Footings for houses above the gabion wall along Junction Street should be founded below the zone of influence of the wall to limit additional loading. By using good hillside practices, the likelihood of a small scale slide due to development is assessed to be Unlikely.

The identification of the potential hazards considers both the site and nearby properties, and is necessary to address stability issues that may negatively impact upon the site and influence the risk to property.

6.3 Risk to Property

The following table summarizes the risk to property of the landslide events in relation to the proposed development, **assuming limitations in Section 7 are incorporated.**

Table 4. Landslide risk profiles

Scenario	Likelihood	Consequence	Risk Profile
Deep seated landslide	Rare: Likely to be very slow moving	Minor: could cause limited damage to roads or future dwellings	Very Low
Shallow slides in natural slope	Unlikely	Insignificant: if precautions are taken	Very Low
Small scale slips due to development	Unlikely	Minor: could cause limited damage to roads or retaining walls	Low

The assessment shows that the risk profile for the proposed development is Low to Very Low, **provided the limitations listed in Section 7 are incorporated in the design.**

6.4 Risk to Life

The calculation of risk to life requires a quantitative assessment. Here, we have used an event tree approach to assess the risk to life for the person most at risk, a resident in one of the houses.

An event tree showing a possible sequence of events is presented in Appendix E for a deep-seated landslide and shallow slide which is most likely to present a risk to life. The risk assessment shows that the Risk to Life for a deep-seated landslide and shallow slide assuming management measures are incorporated in the design and construction of the subdivision, is 3.6 x 10^{-8}/annum.

AGS (2007c) suggests the tolerable loss of life for individual most at risk should be 10^{-5}/annum for new constructed slopes or new development.

7 RECOMMENDATIONS

In order to ensure the proposed development does not change the risk profile above Low, it is recommended that the following limitations be adopted:

- Fill should be limited to no more than 0.8m above the current ground level, unless approved by a Geotechnical Engineer. Fill should be compacted and fill batters should be battered to be no steeper than 1V:3H, or retained with an engineer designed retaining system. Alternatively, light weight fill (such as polystyrene or EPS) may be used as fill.
- Retaining walls should be designed to withstand at-rest earth pressures ($K_o = 1-\sin\phi$). A friction angle of 34° should be assumed for natural soil. Allowance should also be made for sloping backfill and provision of drainage behind any walls.
- Retaining walls over 1.5m high in cut slopes should be constructed using top-down methods, such as soldier pile walls or soil nail walls, as these do not require excavation prior to building the retaining system. In addition, such walls generally have a small footprint. Thus, gravity retaining walls (such as gabion walls and mass bloc) are not recommended.
- Stormwater from roofs and paved areas should be piped to the council stormwater system. If roof runoff is collected in tanks, the overflow from the tank should be piped to the council stormwater system.
- Where possible, vegetation should be maintained on the slopes to prevent erosion of surface soils. As a minimum, vegetation should comprise grass. If trees are planted on the slope, then the site should be managed such that when the trees reach maturity and are removed, they are replaced with new (young) trees.
- Maintenance of surface runoff, vegetation, retaining structures and other measures described above are the responsibility of the site owner.
- Our preference is to have deep-sewerage provided to dwellings in Zone1. If on-site wastewater disposal is required, we recommend using Aerated Wastewater Treatment Systems (AWTSs) with shallow subsurface irrigation, not septic tanks with conventional trenches.
- Good hillside construction practices should be followed. A copy of Some Guidelines for Hillside Construction are presented in Appendix F.

A possible subdivision layout with some internal roads is shown in Figure 7. Further design of subdivision roads and turning circles will be required to determine driveway grades and likely retaining wall heights.

We recommend the above limitations are incorporated in a legal document, such as a Part 5 agreement, so future owners of the lots will be aware of development potential. Proposals for specific dwelling development will require individual landslide risk assessments, unless they are deigned in accordance with the above recommendations.

8 REFERENCES

Ezzy A.R & Mazengarb C., 2007, *Lawrence Vale Landslide Investigations: implications for landslide hazard assessment in Launceston*, Tasmanian Geological Survey Record 2007/04, 105 pages

Jennings I.B. 1971, "*Landslip, Lawrence Vale area, Launceston*", TR14_82_84

Stevenson, P.C. and Jennings I.B. 1971, "*Further report on a landslip in the Lawrence Vale area*", TG_14_84_88

TASMAN geotechnics

Important information about your report

These notes are provided to help you understand the limitations of your report.

Project Scope

Your report has been developed on the basis of your unique project specific requirements as understood by Tasman Geotechnics at the time, and applies only to the site investigated. Tasman Geotechnics should be consulted if there are subsequent changes to the proposed project, to assess how the changes impact on the report's recommendations.

Subsurface Conditions

Subsurface conditions are created by natural processes and the activity of man.

A site assessment identifies subsurface conditions at discrete locations. Actual conditions at other locations may differ from those inferred to exist, because no professional, no matter how qualified, can reveal what is hidden by earth, rock and time.

Nothing can be done to change the conditions that exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, the services of Tasman Geotechnics should be retained throughout the project, to identify variable conditions, conduct additional investigation or tests if required and recommend solutions to problems encountered on site.

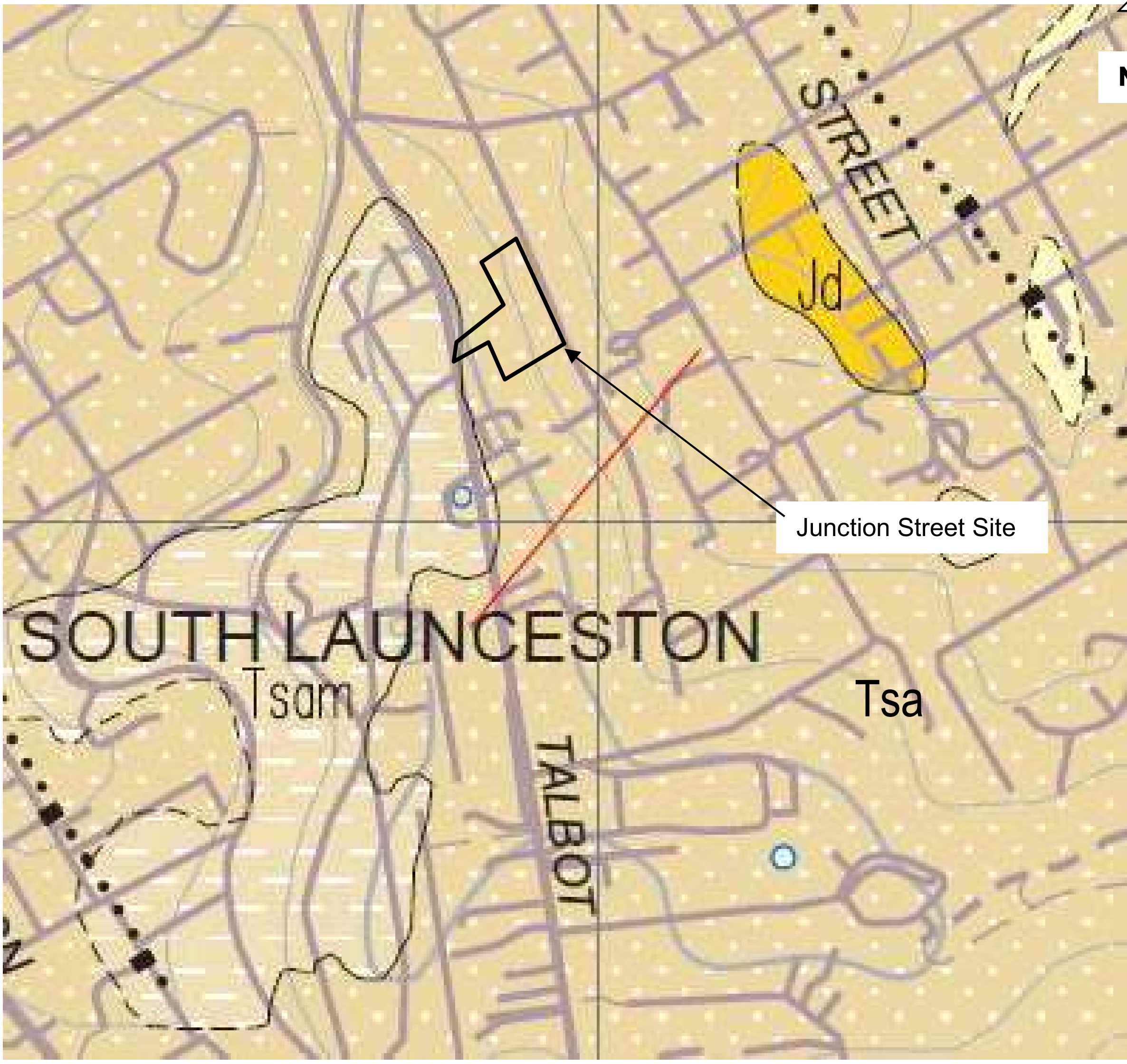
Advice and Recommendations

Your report contains advice or recommendations which are based on observations, measurements, calculations and professional interpretation, all of which have a level of uncertainty attached.

The recommendations are based on the assumption that subsurface conditions encountered at the discrete locations are indicative of an area. This can not be substantiated until implementation of the project has commenced. Tasman Geotechnics is familiar with the background information and should be consulted to assess whether or not the report's recommendations are valid, or whether changes should be considered.

The report as a whole presents the findings of the site assessment, and the report should not be copied in part or altered in any way.

NORTH



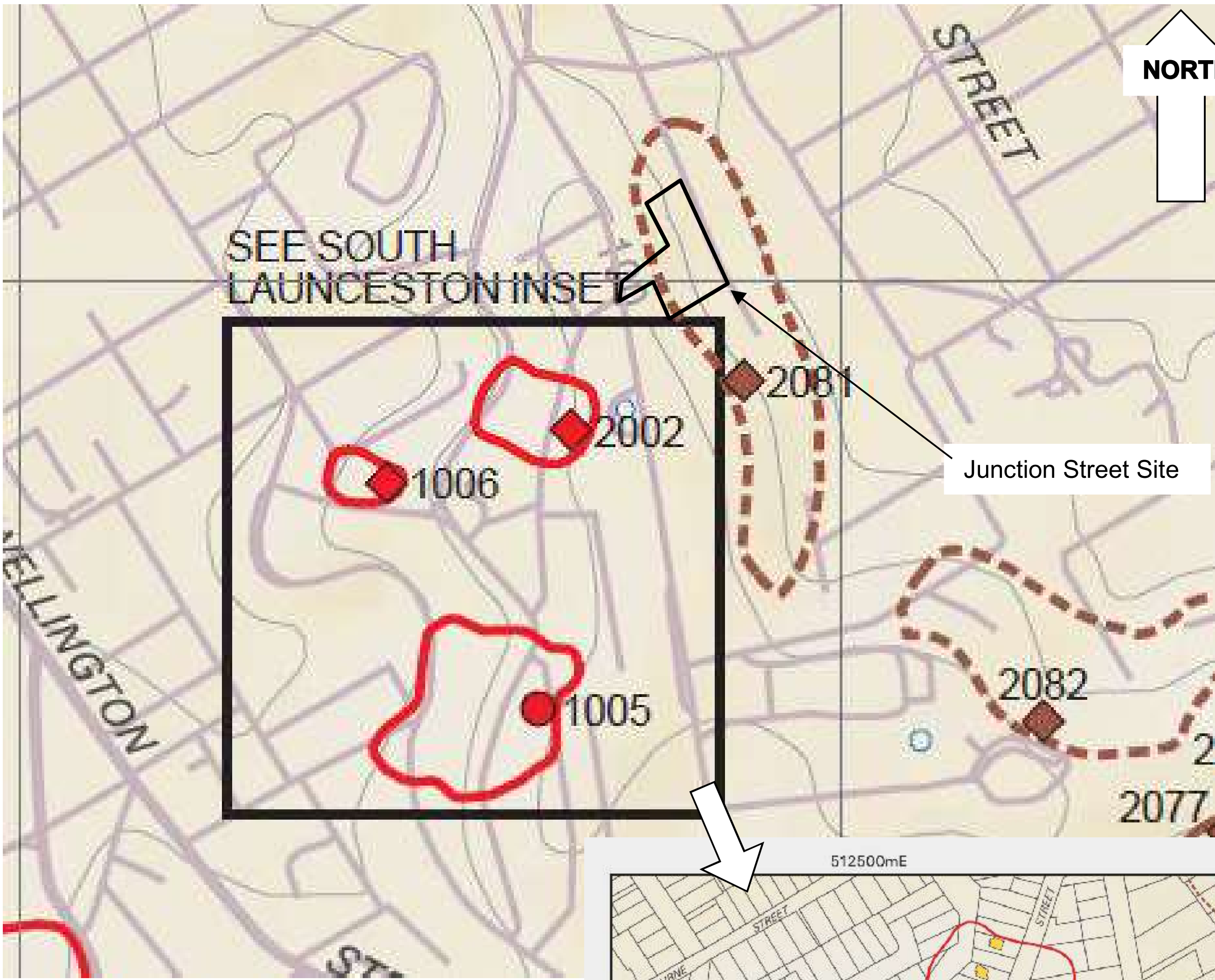
Legend

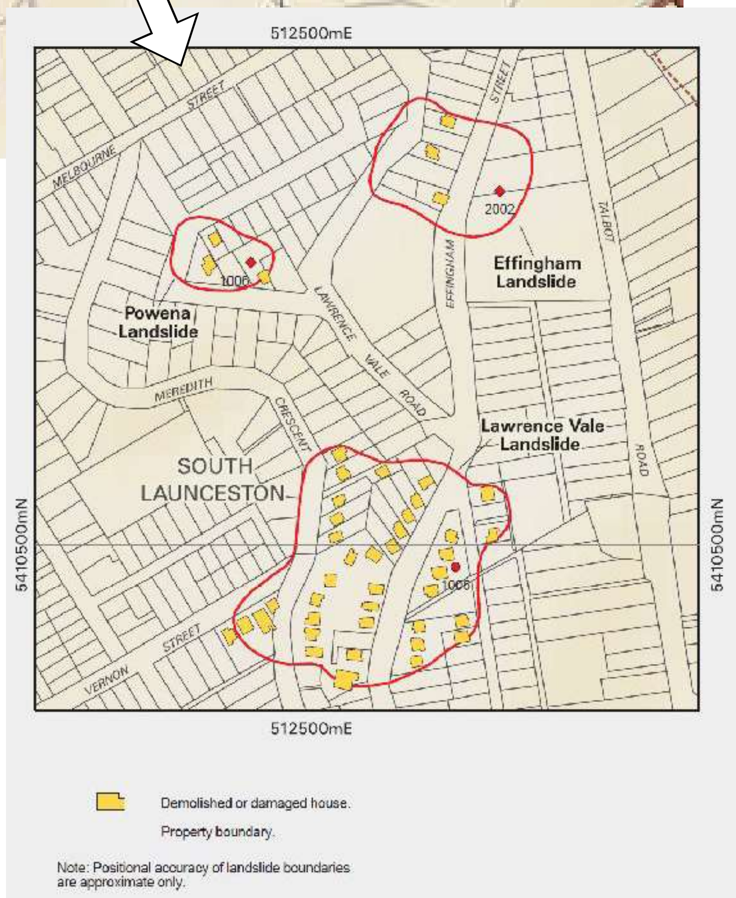
Jd: Jurassic dolerite

Tsam: Cenozoic *"Brown-grey plastic clay, minor silt, clayey sand and ironstone at South Launceston"*

Tsa: Cenozoic *"Partly consolidated clay, silt, and clayey labile sand with rare gravel and lignite; some iron oxide-cemented layers and concretions; some leaf fossils"*

drawn	**WG**	TASMAN geotechnics	client:	**DJ Building Contractors**
approved	**WG**		project:	**Landslide Risk Assessment, Junction Street, Newstead**
date	**20/12/2019**			
scale	**NTS**		title:	**MRT Geology Map Extract**
original size	**A4**		project no: **TG18231/1 – 01report**	figure no: **FIGURE 1**

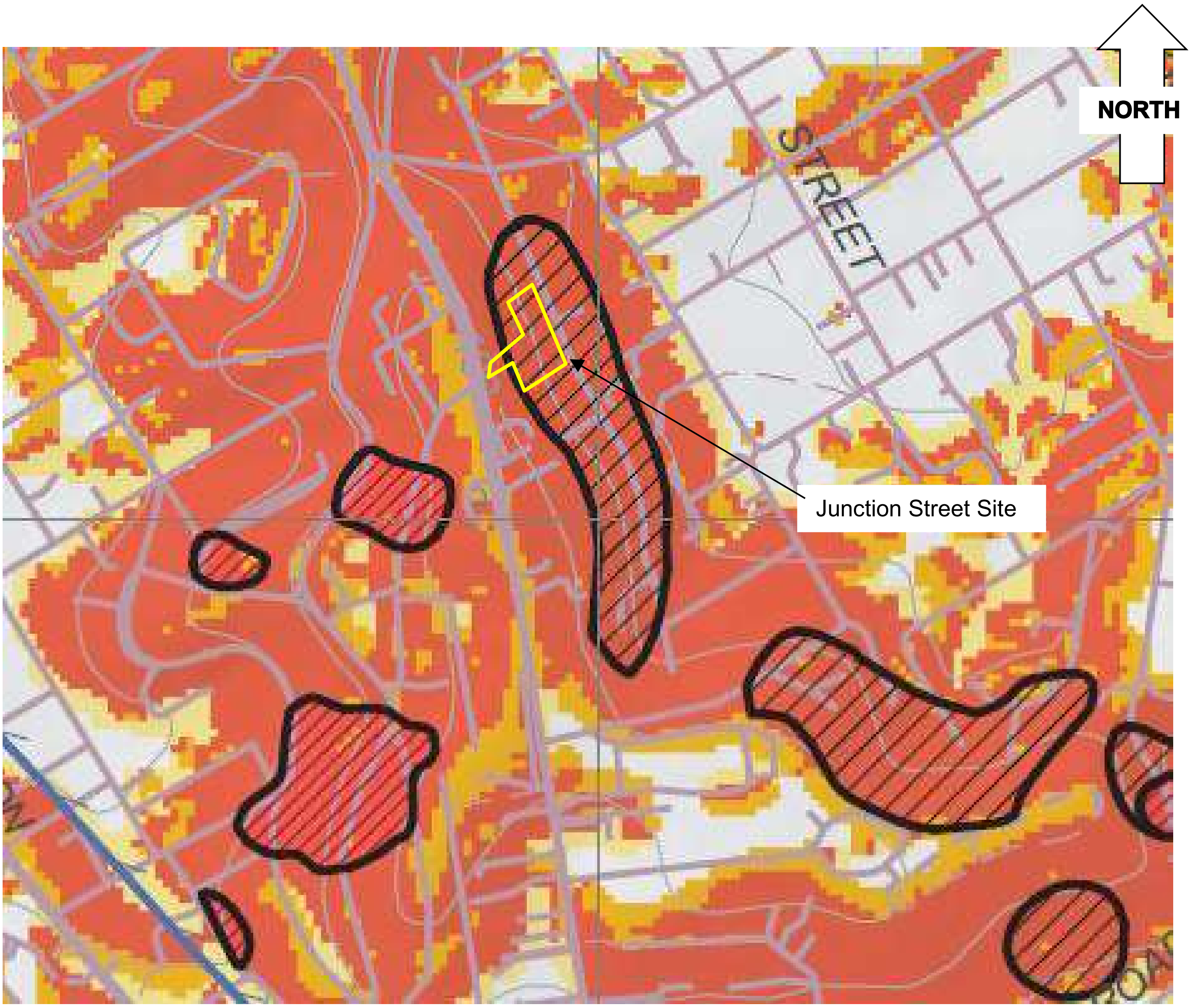




Landslide Polygons

- Recent or active landslides, position approximate
- Landslide Zone recent or active, position approximate
- Fossil or old dormant landslide, position approximate
- Landslide Zone fossil or old dormant, position approximate

drawn	**WG**	TASMAN geotechnics	client:	**DJ Building Contractors**
approved	**WG**		project:	**Landslide Risk Assessment, Junction Street, Newstead**
date	**20/12/2019**			
scale	**NTS**		title:	**MRT Landslide Inventory Map Extract**
original size	**A4**		project no: **TG18231/1 – 01report**	figure no: **FIGURE 2**



Landslide, recent or active.	Regression area.
Landslide, activity unknown.	Source area.
Possible landslide, activity unknown.	Runout area.

drawn	**WG**	TASMAN geotechnics	client:	**DJ Building Contractors**
approved	**WG**		project:	**Landslide Risk Assessment, Junction Street, Newstead**
date	**20/12/2019**			
scale	**NTS**		title:	**MRT Slide Susceptibility Map Extract**
original size	**A4**		project no: **TG18231/1 – 01report**	figure no: **FIGURE 3**

Legend:

- Boreholes
- Point Features
  - Ground Slope
- Linear Features
  - Slope Break, Concave Rounded
  - Slope Break, Concave Sharp
  - Crest of cut or bank
  - Scarp
  - Slope Break, Convex Rounded
  - Slope Break, Convex Sharp
  - Ridge Crest, Sharp
  - Ridge Crest, Rounded
  - Boundary
  - Intermittent Drainage
  - Drainage

Drawn:	DG
Approved:	WG
Date:	10/1/2019
Scale:	1:750
Size:	A3

TASMAN geotechnics

client: DJ Building Contractors

project: Landslide Risk Assessment
Proposed Subdivision
29 Talbot Road, South Launceston

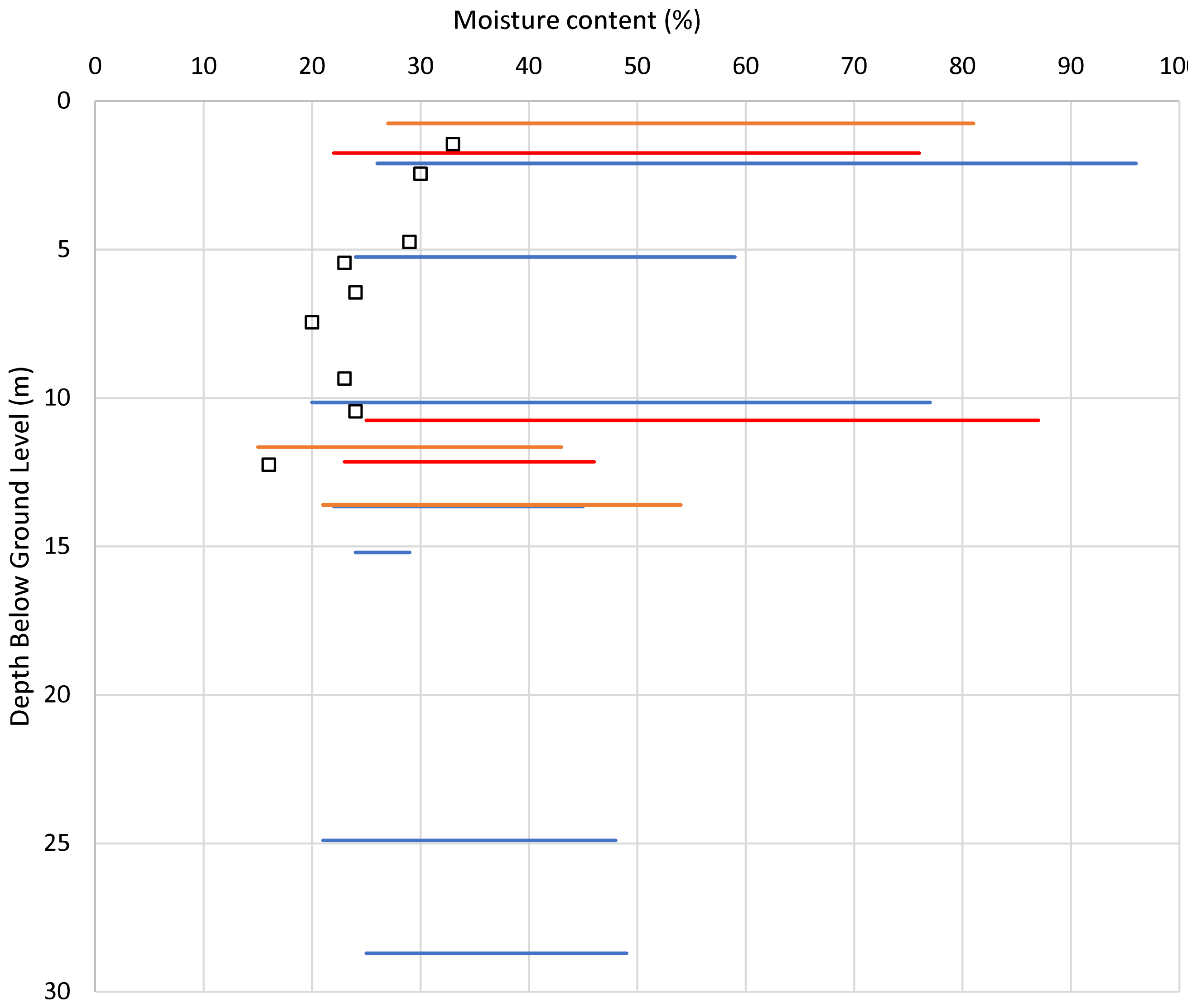
title: Site Layout and Borehole Locations

project no: TG18231/1 - 01report

figure no: FIGURE 4

Note: basemap airphoto and cadastral boundaries are from TheLIST Web Services (http://services.thelist.tas.gov.au) and were retrieved on the date shown above. Current site conditions may differ from this plan. TheLIST data is copyright of TheLIST, and use is subject to terms found at: http://listdata.thelist.tas.gov.au/public/LISTWebServicesTermsConditions.pdf

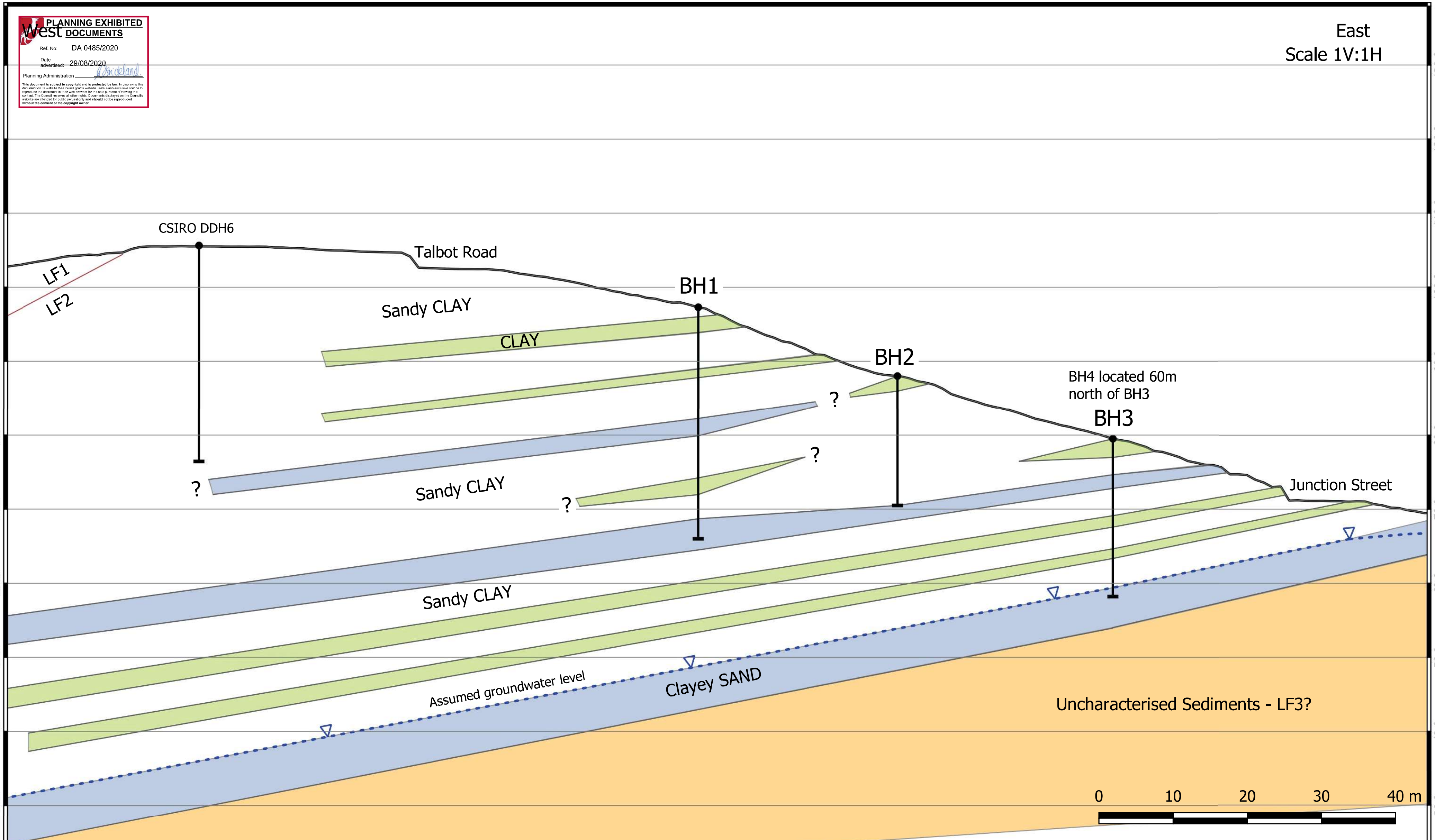
512750.0
512800.0
512850.0



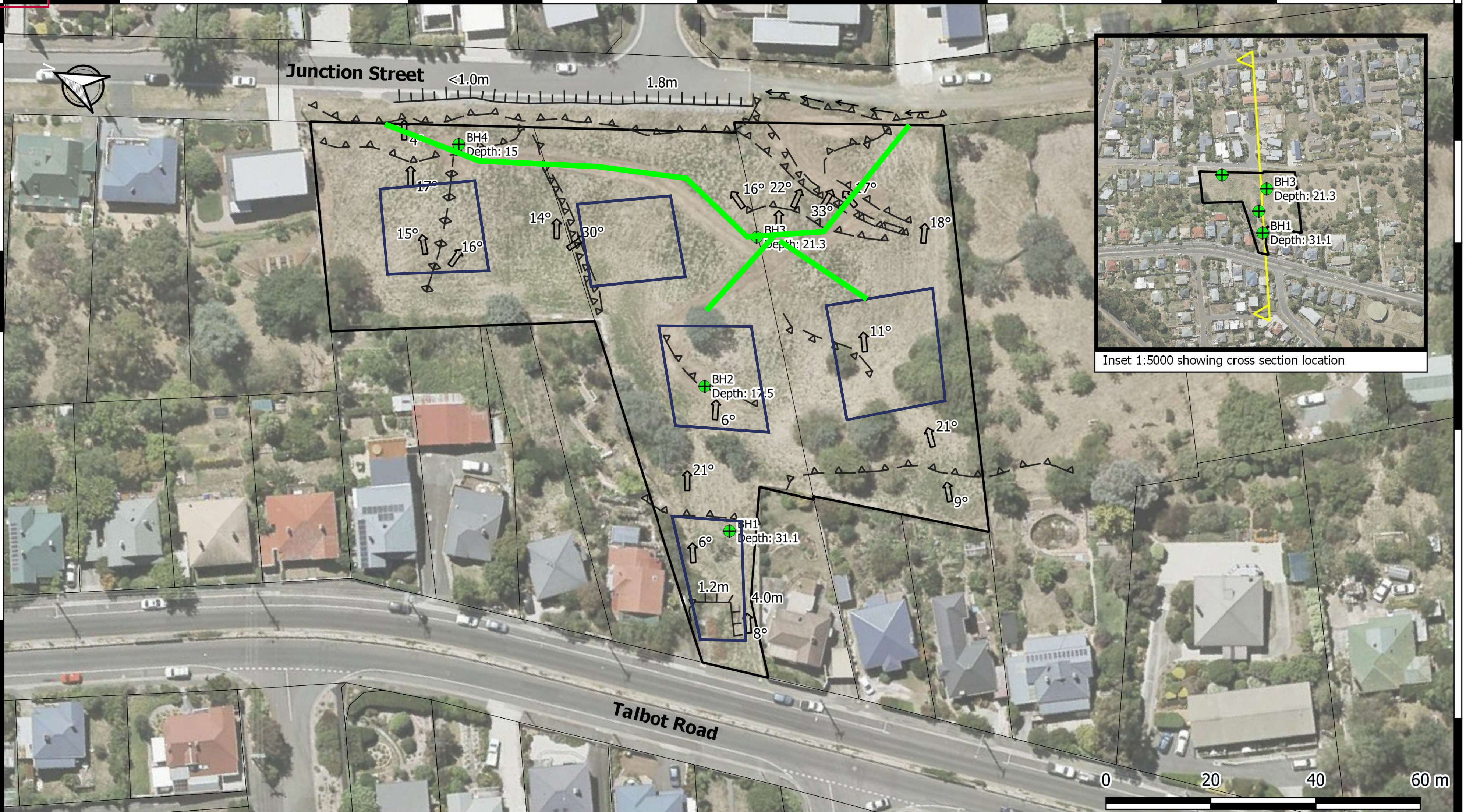
Legend

- Moisture content from BH1
- Liquid Limit - Plastic Limit range BH1
- Liquid Limit - Plastic Limit range BH2
- Liquid Limit - Plastic Limit range BH3

Drawn	WG	TASMAN geotechnics	**Client**	DJ Building Contractors
Approved	WG		**Project**	Landslide Risk Assessment
Date	20/12/2019			Junction Street Newstead
Scale	NTS		**Title**	Laboratory Results
Original size	A4		**Project No:** TG18035/1 - 01 report	**Figure:** Figure 5



Drawn:	DG	TASMAN geotechnics	client: DJ Building Contractors
Approved:	WG		project: Landslide Risk Assessment 29 Talbot Road, South Launceston
Date:	10/1/2019		
Scale:	1:500		title: Cross Section
Size:	A3		project no: TG18231/1 - 01report · figure no: FIGURE 6



Boreholes	Slope Break, Concave Sharp	Ridge Crest, Sharp	Drawn:	DG
Point Features	Crest of cut or bank	Ridge Crest, Rounded	Approved:	WG
Ground Slope	Scarp	Boundary	Date:	10/1/2019
Linear Features	Slope Break, Convex Rounded	Intermittent Drainage	Scale:	1:750
Slope Break, Concave Rounded	Slope Break, Convex Sharp	Drainage	Size:	A3

TASMAN geotechnics

client: DJ Building Contractors

project: Landslide Risk Assessment
Proposed Subdivision
29 Talbot Road, South Launceston

title: Possible Subdivision Layout

project no: TG18231/1 - 01report | figure no: FIGURE 7

Note: basemap airphoto and cadastral boundaries are from TheLIST Web Services (http://services.thelist.tas.gov.au) and were retrieved on the date shown above. Current site conditions may differ from this plan. TheLIST data is copyright of TheLIST, and use is subject to terms found at: http://listdata.thelist.tas.gov.au/public/LISTWebServicesTermsConditions.pdf

Appendix A

Engineering Borehole Logs

TASMAN geotechnics

SOIL DESCRIPTION EXPLANATION SHEET

Soils are described in accordance with the Unified Soil Classification System (UCS), as shown in the following table.

FIELD IDENTIFICATION

					DRY STRENGTH	DILATANCY	TOUGHNESS
COARSE GRAINED SOILS	more than 65% of material less than 63mm is larger than 0.075mm	GRAVELS	GW	Well graded gravels and gravel-sand mixtures, little or no fines			
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines			
		GRAVELLY SOILS	GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines			
			GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines			
		SANDS	SW	Well graded sands and gravelly sands, little or no fines			
			SP	Poorly graded sands and gravelly sands, little or no fines			
		SANDY SOILS	SM	Silty sand, sand-silt mixtures, non-plastic fines			
			SC	Clayey sands, sand-clay mixtures, plastic fines			
FINE GRAINED SOILS	more than 35% of material less than 63mm is less than 0.075mm	SILT & CLAY, liquid limit less than 50%	ML	Inorganic silts, very fine sands or clayey fine sands	None to low	Quick to slow	None
			CL	Inorganic clays or low to medium plasticity, gravelly clays, sandy clays and silty clays	Medium to high	None to very slow	Medium
			OL	Organic silts and organic silty clays of low plasticity	Low to medium	Slow	Low
		SILT & CLAY, liquid limit greater than 50%	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts	Low to medium	Slow to none	Low to medium
			CH	Inorganic clays of high plasticity, fat clays	High	None	High
			OH	Organic clays of medium to high plasticity	Medium to high	None to very slow	Low to medium
PEAT			Pt	Peat muck and other highly organic soils			

Particle size descriptive terms

Name	Subdivision	Size
Boulders		>200mm
Cobbles		63mm to 200mm
Gravel	coarse	20mm to 63mm
	medium	6mm to 20mm
	fine	2.36mm to 6mm
Sand	coarse	600µm to 2.36mm
	medium	200µm to 600µm
	fine	75µm to 200µm

Minor Components

Term	Proportions	Observed properties
'Trace of'	Coarse grained: <5% Fine grained: <15%	Presence just detectable by feel or eye. Soil properties little or no different to general properties of primary component.
'With some'	Coarse grained: 5-12% Fine grained: 15-30%	Presence easily detected by feel or eye. Soil properties little different to general properties of primary component.

Density of granular soils

Term	Density index
Very loose	<15%
Loose	15 to 35%
Medium Dense	35 to 65%
Dense	65 to 85%
Very dense	>85%

Consistency of cohesive soils

Term		Undrained strength	Approximate Pocket Penetrometer Reading	Field guide
Very soft	VS	<12kPa	25kPa	A finger can be pushed well into soil with little effort
Soft	S	12 - 25kPa	25-50kPa	Easily penetrated several cm by fist
Firm	F	25 - 50kPa	50-100kPa	Soil can be indented about 5mm by thumb
Stiff	St	50-100kPa	100-200kPa	Surface can be indented but not penetrated by thumb
Very stiff	VSt	100-200kPa	200-400kPa	Surface can be marked but not indented by thumb
Hard	H	>200kPa	>400kPa	Indented with difficulty by thumb nail
Friable	Fb	-	-	Crumbles or powders when scraped by thumb nail

Moisture Condition

Dry (D)	Looks and feels dry. Cohesive soils are hard, friable or powdery. Granular soils run freely through fingers.
Moist (M)	Soil feels cool, darkened in colour. Cohesive soils are usually weakened by moisture presence, granular soils tend to cohere.
Wet (W)	As for moist soils, but free water forms on hands when sample is handled

Cohesive soils can also be described relative to their plastic limit, ie: <Wp, =Wp, >Wp. The plastic limit is defined as the minimum water content at which the soil can be rolled into a thread 3mm thick.

ENGINEERING BOREHOLE LOG

Borehole no: BH1

Client: DJ Building Contractors
Project: Landslide Risk Assessment
Location: 29 Talbot Road, South Launceston
Drill model: Hanjin D&B 8D
Hole diameter:
Slope: **Bearing:**

TASMAN geotechnics

Sheet no. 1 of 5
Job no. TG18231/1
Date: 12/03/2019
Logged By: TS
Easting: 512874 **Northing:** 5411202
Elevation: 97.4

Method	Penetration (1 2 3 4)	Notes Samples Tests	Water	Depth	Graphic Log	Classification	Material Description	Moisture Condition	Consistency density, index	Structure, additional observations
HSA		SS		0	X	ML	Sandy SILT, medium liquid limit, brown, with some gravel, fine grained	D	Fb	Topsoil, grasses, glass fragments
						CI	Sandy CLAY, medium plasticity, brown, with a trace of gravel, sub-rounded, fine to medium grained	D	Fb	
				0.5			becoming brown/orange	=Wp	St	
		SS		1			Sandy CLAY, medium plasticity, orange, with some gravel, fine to coarse grained, sub-angular	>Wp	St	50% recovery Band of ironstone
				1.5		CH	CLAY, medium to high plasticity, pale brown/grey	=Wp	St	Disturbed sample taken
		SS		2			dark grey/brown mottled orange with clasts of silt, white	>Wp	VSt	
				2.5			dark grey with brown/orange mottles	=Wp		Disturbed sample taken
		SS		3			dark grey/brown	D	H/Fb	
				3.5		CI	Partially lithified Sandy CLAY, medium plasticity, red, fine grained			Rock texture
		SS		4			becomes soil-like at 4.2m, dark brown, poor recovery			Sample fell out of split
		SS		4.5						
		SS		5			CLAY, medium plasticity, dark red/brown, with some sand, fine grained	=Wp	St	
						SC	Clayey SAND, fine to medium grained, orange/brown, medium plasticity fines	D	MD	Disturbed sample taken
				5.5		CI	Sandy CLAY, medium plasticity, dark brown and red, fine grained	≥Wp	St/VSt	
		SS		6			becoming brown	≤Wp	VSt	
				6.5			with some red mottles			
		SS		7			brown			
				7.5		SW	SAND, cemented, fine to coarse grained, with mica flecks,			
				8		CI	with some clay, medium plasticity	≥Wp	St/VSt	

method
DT Diatube
AS Auger screwing
AH Auger drilling
RR Roller/tricone
CB Claw/blade bit
NMLC NMLC core
NQ, HQ Wireline core
HA Hand auger

water
17/03/18 water level on date shown
water inflow
partial drill fluid loss
complete drill fluid loss

Moisture Condition
Dry (D)
Moist (M)
Wet (W)
Cohesive soils can also be described relative to their plastic limit, ie:
<Wp
=Wp
>Wp

Consistency
VS Very soft
S Soft
F Firm
St Stiff
VSt Very stiff
H Hard
Fb Friable

ENGINEERING BOREHOLE LOG

Borehole no: BH1

Client: DJ Building Contractors
Project: Landslide Risk Assessment
Location: 29 Talbot Road, South Launceston
Drill model: Hanjin D&B 8D
Hole diameter:
Slope: **Bearing:**

TASMAN geotechnics

Job no. TG18231/1
Date: 12/03/2019
Logged By: TS
Easting: 512874 **Northing:** 5411202
Elevation: 97.4

Method	Penetration 1 2 3 4	Notes Samples Tests	Water	Depth	Graphic Log	Classification	Material Description	Moisture Condition	Consistency density, index	Structure, additional observations
		SS		8			Sandy CLAY, medium plasticity, brown, fine grained	≥Wp	St/VSt	
						SC	red/brown	D/M	MD/D	Sandstone cobble
				8.5		CH	Clayey SAND, fine grained, orange/brown, medium plasticity fines	≤Wp	VSt/H	
		SS		9			CLAY, medium to high plasticity, grey/orange, becoming partially lithified orange clay with some gravel, fine to medium grained sub-angular and a trace of sand, fine grained from 8.45	>Wp	St/VSt	
				9.5		SP	Sandy CLAY, medium to high plasticity, dark brown/brown, fine grained			Cobble?
						CH	Iron stained SAND, cemented, orange and dark red/brown at 9.48m	>Wp	St/VSt	
		SS		10			CLAY, high plasticity, brown, with some sand, very fine grained			
				10.5			with a trace of gravel, fine to medium grained			
		SS		11		CI	Sandy CLAY, medium plasticity, brown, fine grained, little to no gravel		VSt/H	
				11.5						
		SS		12			becoming Sandy CLAY/Clayey SAND, medium plasticity fines, fine to medium grained, brown	M/>Wp	H/D	
				12.5		SC	Clayey SAND, fine to medium grained, pale brown, medium plasticity fines	D/M	D	
				13			Hole switched to HQTT at 12.48m			
				13.5						
				14						
				14.5						
				15						
				15.5						
				16						

method
DT Diatube
AS Auger screwing
AH Auger drilling
RR Roller/tricone
CB Claw/blade bit
NMLC NMLC core
NQ, HQ Wireline core
HA Hand auger

water
17/03/18 water level on date shown
water inflow
partial drill fluid loss
complete drill fluid loss

Moisture Condition
Dry (D)
Moist (M)
Wet (W)
Cohesive soils can also be described relative to their plastic limit, ie:
<Wp
=Wp
>Wp

Consistency
VS Very soft
S Soft
F Firm
St Stiff
VSt Very stiff
H Hard
Fb Friable

ENGINEERING CORED BOREHOLE LOG

Client: DJ Building Contractors
Project: Landslide Risk Assessment
Location: 29 Talbot Road, South Launceston
Drill model: Hanjin D&B 8D
Barrel type: HQTT
Fluid:
Inclination: **Bearing:**

TASMAN geotechnics

Borehole no: BH1

Job no. TG18231/1
Date: 12/03/2019
Logged By: TS
Easting: 512874
Northing: 5411202
Elevation: 97.4

Method	Case-lift	Water	Depth	Graphic Log	Substance Description (rock type, grain characteristics, colour, structure, minor components)	Weathering	Strength (see notes)	Recovery %	RQD %	Spacing (mm)	Defect Description (thickness, type, inclination, planarity, roughness, coating)
			8.5 – 12.48		Continued from augers at 12.48m						
			12.5		Clayey SAND, fine to medium grained, brown/orange, medium plasticity fines						
	●–●		13.5		with some grey banding and white granules						
			14		mostly orange						
			14.5		with lenses of dark grey/black silt						
					red/orange						
	●–●		15		orange						
			15.5		red and orange						
			16		black and red banding						

PLANNING EXHIBITED DOCUMENTS
Ref. No: DA 0485/2020
Date advertised: 29/08/2020
Planning Administration [signature]

method
DT Diatube
AS Auger screwing
AD Auger drilling
RR Roller/tricone
CB Claw or blade bit
NMLC NMLC core
NQ, HQ, PQ Wireline core
HQ Conv. Conventional core

core-lift
casing used
barrel withdrawn

graphic log/core recovery
core recovered graphic symbols indicate material
no core recovered

water
17/03/18 water level on date shown
water inflow
partial drill fluid loss
complete drill fluid loss
25 water pressure test result (lugeons) for depth interval shown

weathering
FR fresh
SW slightly weathered
MW moderately weathered
HW highly weathered
XW extremely weathered
DW distinctly weathered (covered MW and HW)

strength
1 = VL very low
2 = L low
3 = M medium
4 = VH high
5 = EH extremely high

defect type
JT joint
PT parting
SM seam
SZ sheared zone
SS sheared surface
CS crushed seam

planarity
PL planar
CU curved
UN undulating
ST stepped
IR irregular

roughness
VR very rough
RO rough
SO smooth
SL slickensided

coating
CN clean
SN stained
VN veneer
CO coating

ENGINEERING CORED BOREHOLE LOG

Client: DJ Building Contractors
Project: Landslide Risk Assessment
Location: 29 Talbot Road, South Launceston
Drill model: Hanjin D&B 8D
Barrel type: HQTT
Fluid:
Inclination: **Bearing:**

TASMAN geotechnics

Borehole no: BH1
Sheet no. 4 of 5
Job no. TG18231/1
Date: 12/03/2019
Logged By: TS
Easting: 512874
Northing: 5411202
Elevation: 97.4

Depth	Substance Description (rock type, grain characteristics, colour, structure, minor components)
	medium grained
	becoming red/orange
16.5	cemented sand and ironstone nodules, orange/grey and red, fine to medium grained
17	occasional ironstone nodule
17.5	SAND, fine to medium grained, orange/brown to white/grey with a trace of medium plasticity fines
19	CLAY, high plasticity, grey
	Ironstone, orange/brown
19.5	SAND, fine to medium grained, brown/orange with grey mottles, with a trace of medium plasticity fines
20.5	Ironstone lenses, fine to medium grained, orange/brown
	SAND, fine to medium grained, orange/brown and pale yellow with a trace of medium plasticity fines
21	LOSS: SAND, very soft, minimal downforce required, no recovery
22.5	LOSS: No recovery, very soft
24	Sandy CLAY, medium plasticity, fine to

Method: HQTT

Column headings: Drilling information (Method, Case-lift, Water, Depth); Rock substance (Graphic Log, Substance Description, Weathering, Strength (see notes) 1 2 3 4, Recovery % 25 50 75); Rock mass defects (RQD % 25 50 75, Spacing (mm) 10 100 1000, Defect Description thickness, type, inclination, planarity, roughness, coating — particular, general)

Depth scale: 16.5, 17, 17.5, 18, 18.5, 19, 19.5, 20, 20.5, 21, 21.5, 22, 22.5, 23, 23.5, 24

method
DT Diatube
AS Auger screwing
AD Auger drilling
RR Roller/tricone
CB Claw or blade bit
NMLC NMLC core
NQ, HQ, PQ Wireline core
HQ Conv. Conventional core

core-lift
casing used
barrel withdrawn

graphic log/core recovery
core recovered graphic symbols indicate material
no core recovered

water
17/03/18 water level on date shown
water inflow
partial drill fluid loss
complete drill fluid loss
25 water pressure test result (lugeons) for depth interval shown

weathering
FR fresh
SW slightly weathered
MW moderately weathered
HW highly weathered
XW extremely weathered
DW distinctly weathered (covered MW and HW)

strength
1 = VL very low
2 = L low
3 = M medium
4 = VH high
5 = EH extremely high

defect type
JT joint
PT parting
SM seam
SZ sheared zone
SS sheared surface
CS crushed seam

planarity
PL planar
CU curved
UN undulating
ST stepped
IR irregular

roughness
VR very rough
RO rough
SO smooth
SL slickensided

coating
CN clean
SN stained
VN veneer
CO coating

ENGINEERING CORED BOREHOLE LOG

Client: DJ Building Contractors
Project: Landslide Risk Assessment
Location: 29 Talbot Road, South Launceston
Drill model: Hanjin D&B 8D
Barrel type: HQTT
Fluid:
Inclination: **Bearing:**

TASMAN geotechnics

Borehole no: BH1
Sheet no. 5 of 5
Job no. TG18231/1
Date: 12/03/2019
Logged By: TS
Easting: 512874
Northing: 5411202
Elevation: 97.4

Drilling information				Rock substance						Rock mass defects		
Method	Case-lift	Water	Depth	Graphic Log	Substance Description rock type, grain characteristics, colour, structure, minor components	Weathering	Strength (see notes) 1 2 3 4	Recovery % 25 50 75	RQD % 25 50 75	Spacing (mm) 10 100 1000	Defect Description thickness, type, inclination, planarity, roughness, coating — particular	general
					coarse grained, brown/orange with red/brown and grey banding							
			24.5									
			25		Ironstone, red/brown, fine to medium grained							
					Sandy CLAY, medium to high plasticity, grey/orange, fine to medium grained							
	●●		25.5		CLAY, high plasticity, grey							
					Sandy CLAY, medium to high plasticity, grey, fine to medium grained							
			26		Clayey SAND, fine to medium grained, brown/orange with medium plasticity fines							
					becoming grey with some orange and brown grains							
			26.5		Ironstone lens, orange/brown, fine to medium grained							
					Sandy CLAY, medium to high plasticity, grey, with some orange mottles							
	●●		27		Ironstone, fine to medium grained, red/brown							
					Sandy CLAY, medium to high plasticity, grey with orange mottles, fine to medium grained							
			27.5		becoming very stiff/hard							
			28		Sandy CLAY, medium to high plasticity, orange, fine to medium grained with some gravel, ironstone, medium grained							
					grey/brown, becoming red with ironstone lenses/cobbles							
	●●		28.5		Sandy CLAY, high plasticity, grey with some orange/brown mottles and ironstone cobbles/gravels							
			29		becoming Clayey SAND, fine to medium grained, grey, brown and black, medium plasticity fines							
					becoming orange with occasional red mottles							
			29.5		Cemented SAND/SANDSTONE, fine to medium grained, orange							
					orange with red grains							
	●●		30		banded, sub-horizontal, orange/red/grey							
					becoming grey/orange from 30m							
					becoming red ironstone band							
			30.5		Sandy CLAY, medium plasticity, grey, with ironstone bands							
	●●		31		Clayey SAND, fine to medium grained, orange, pale yellow amd grey with some white grains							
			31.5		Hole terminated at 31.1m, still going							
			32									

method
DT Diatube
AS Auger screwing
AD Auger drilling
RR Roller/tricone
CB Claw or blade bit
NMLC NMLC core
NQ, HQ, PQ Wireline core
HQ Conv. Conventional core

core-lift
casing used
barrel withdrawn

graphic log/core recovery
core recovered graphic symbols indicate material
no core recovered

water
17/03/18 water level on date shown
water inflow
partial drill fluid loss
complete drill fluid loss
25 water pressure test result (lugeons) for depth interval shown

weathering
FR fresh
SW slightly weathered
MW moderately weathered
HW highly weathered
XW extremely weathered
DW distinctly weathered (covered MW and HW)

strength
1 = VL very low
2 = L low
3 = M medium
4 = VH high
5 = EH extremely high

defect type
JT joint
PT parting
SM seam
SZ sheared zone
SS sheared surface
CS crushed seam

planarity
PL planar
CU curved
UN undulating
ST stepped
IR irregular

roughness
VR very rough
RO rough
SO smooth
SL slickensided

coating
CN clean
SN stained
VN veneer
CO coating

ENGINEERING BOREHOLE LOG

Borehole no: BH2

Client: DJ Building Contractors
Project: Landslide Risk Assessment
Location: 29 Talbot Road, South Launceston
Drill model: Hanjin D&B 8D
Hole diameter:
Slope: **Bearing:**

TASMAN geotechnics

Sheet no. 1 of 3
Job no. TG18231/1
Date: 16/04/2049
Logged By: TS
Easting: 512897 **Northing:** 5411218

Depth (m)	Classification	Material Description	Moisture Condition	Consistency density, index	Structure, additional observations
0 – 0.3	CI	Sandy/Silty CLAY, medium plasticity, brown, with traces of gravels, fine grained.	D	Fb	Grasses @ surface.
0.3 – 1.75	CH	Silty CLAY, medium to high plasticity, orange/brown, with traces of fine to coarse grained sand.	>Wp	St	
1.75 – 2.5		Sandy CLAY, medium to high plasticity, orange/brown, fine to medium grained.	>Wp	St	
2.5 – 2.6	SC	Clayey SAND, fine to medium grained,orange, medium plasticity fines.	D/M	MD	
2.6 – 3.2	CI	Sandy CLAY, medium plasticity, orange/brown-orange, fine to medium grained.	>Wp	St	
3.2 – 3.5	SC	Clayey SAND, fine to medium grained, orange with white fleckes.	M	MD	No pocket penetrometer reading was taken in tube as it is too sandy.
3.5 – 4.7	CH	Sandy CLAY, medium to high plasticity, brown, fine to medium grained.	>Wp	VSt	Lens of sand, fine to medium grained, orange (50mm thick).
4.7 – 5.5	SC	Clayey SAND, fine to medium grained, orange/brown, medium plasticity fines.	D/M	MD	
5.5 – 5.7	CI	Sandy CLAY, medium plasticity, brown, fine to medium grained.	=Wp	VSt	
5.7 – 6.3	SC	SAND, fine to medium grained, orange, with some medium plasticity fines.	D/M	MD	
6.3 – 7.3	CI	Sandy CLAY, medium plasticity, brown, fine to medium grained.	>Wp	VSt	
7.3 – 7.7	SC	Clayey SAND, fine to medium grained, brown and pale yellow, becoming brown.	D/M	MD	
7.7 – 8	CI	Sandy CLAY, medium plasticity, brown, fine to medium grained.	>Wp	VSt	

Notes / Samples / Tests

Depth (m)	Sample
0.5 – 1.0	SS
1.5 – 2.0	SS
2.5 – 3.0	SS
3.0 – 3.4	U63
3.4 – 4.0	SS
4.5 – 5.0	SS
5.0 – 5.5	U63
5.5 – 6.0	SS
6.5 – 7.0	SS
7.0 – 7.5	SS

Penetration: 1 2 3 4

method
DT Diatube
AS Auger screwing
AH Auger drilling
RR Roller/tricone
CB Claw/blade bit
NMLC NMLC core
NQ, HQ Wireline core
HA Hand auger

water
17/03/18 water level on date shown
water inflow
partial drill fluid loss
complete drill fluid loss

Moisture Condition
Dry (D)
Moist (M)
Wet (W)
Cohesive soils can also be described relative to their plastic limit, ie:
<Wp
=Wp
>Wp

Consistency
VS Very soft
S Soft
F Firm
St Stiff
VSt Very stiff
H Hard
Fb Friable

ENGINEERING BOREHOLE LOG

Borehole no: BH2

Client: DJ Building Contractors
Project: Landslide Risk Assessment
Location: 29 Talbot Road, South Launceston

Drill model: Hanjin D&B 8D
Hole diameter:
Slope: **Bearing:**

TASMAN geotechnics

Sheet no. 2 of 3
Job no. TG18231/1
Date: 16/04/2049
Logged By: TS

Easting: 512897 **Northing:** 5411218

Method: HSA

Depth (m)	Notes Samples Tests	Classification	Material Description	Moisture Condition	Consistency density, index	Structure, additional observations
8.0	SS					
9.0	U63	SC	Clayey SAND, fine to medium grained, grey/pale brown/yellow, medium plasticity fines.	D/M	MD/D	
9.5	SS	CI	Sandy CLAY, medium plasticity, brown, fine to medium grained.	<Wp	VSt	
		SC	Clayey SAND, fine to medium grained, brown orange becoming grey and play orange.	M/D	D	Lens of iron stone, highly weathered.
10.5	SS	CH	Sandy CLAY, medium to high plasticity, brown, fine to medium grained.	>Wp	VSt/St	
		SC	Clayey SAND, fine to medium grained, brown/pale yellow, medium plasticity fines.	M	MD	
11.5	SS	CI	Sandy CLAY, medium plasticity, brown, fine to medium grained.	<Wp	VSt/St	
12.0			Becoming red.			
			Becoming red/brown.			
12.5	SS	SC	50mm lens of clayey SAND, fine to medium grained, orange.	D	D	
		CH	Sandy CLAY, medium to high plasticity, grey, fine to medium grained.	>Wp	St/VSt	
13.5	SS		Grey and brown/orange bands.	>Wp	St/VSt	
14.5	SS		Becoming red/brown.	>Wp	St/VSt	
15.5	SS	SC	SAND, fine to medium grained, orange/grey/pink bands, with some medium	D/M	MD	

method

DT	Diatube
AS	Auger screwing
AH	Auger drilling
RR	Roller/tricone
CB	Claw/blade bit
NMLC	NMLC core
NQ, HQ	Wireline core
HA	Hand auger

water

- 17/03/18 water level on date shown
- water inflow
- partial drill fluid loss
- complete drill fluid loss

Moisture Condition
Dry (D)
Moist (M)
Wet (W)
Cohesive soils can also be described relative to their plastic limit, ie:
<Wp
=Wp
>Wp

Consistency

VS	Very soft
S	Soft
F	Firm
St	Stiff
VSt	Very stiff
H	Hard
Fb	Friable

ENGINEERING BOREHOLE LOG

Client: DJ Building Contractors
Project: Landslide Risk Assessment
Location: 29 Talbot Road, South Launceston
Drill model: Hanjin D&B 8D
Hole diameter:
Slope: **Bearing:**

TASMAN geotechnics

Borehole no: BH2
Sheet no. 3 of 3
Job no. TG18231/1
Date: 16/04/2049
Logged By: TS
Easting: 512897 **Northing:** 5411218

Method	Penetration 1 2 3 4	Notes Samples Tests	Water	Depth	Graphic Log	Classification	Material Description	Moisture Condition	Consistency density, index	Structure, additional observations
				16			plasticity fines.			
		SS		16.5		CH	Sandy CLAY, medium to high plasticity, brown/orange, fine to medium grained.	>Wp	VSt/St	
				17		SC	Clayey SAND, fine to medium grained, orange with pink banding.	D/M	MD/D	
				17.5			Terminated at 17.5m, still going.			
				18 – 24						

method
DT Diatube
AS Auger screwing
AH Auger drilling
RR Roller/tricone
CB Claw/blade bit
NMLC NMLC core
NQ, HQ Wireline core
HA Hand auger

water
17/03/18 water level on date shown
water inflow
partial drill fluid loss
complete drill fluid loss

Moisture Condition
Dry (D)
Moist (M)
Wet (W)
Cohesive soils can also be described relative to their plastic limit, ie:
<Wp
=Wp
>Wp

Consistency
VS Very soft
S Soft
F Firm
St Stiff
VSt Very stiff
H Hard
Fb Friable

ENGINEERING BOREHOLE LOG

Borehole no: BH3

Client: DJ Building Contractors
Project: Landslide Risk Assessment
Location: 29 Talbot Road, South Launceston
Drill model: Hanjin D&B 8D
Hole diameter:
Slope: **Bearing:**

TASMAN geotechnics

Job no. TG18231/1
Date: 21/03/2019
Logged By: TS
Easting: 512927 **Northing:** 5411221
Elevation: 79.6

Method: HSA

Penetration: 1 2 3 4

Depth (m)	Notes Samples Tests	Classification	Material Description	Moisture Condition	Consistency density, index	Structure, additional observations
0		SM	Silty SAND, fine to coarse grained, brown, with some gravel, fine grained sub-angular to sub-rounded	D	Fb	
~0.2		CH	becoming brown-red CLAY, medium to high plasticity with a trace of sand, fine to medium grained	≥Wp	St	
~0.6	SS (0.5–1.0)		red/brown mottled brown with little to no sand	>Wp	St	Cobbles
~1.3	SS (1.5–2.0)		with a trace of gravel, fine to coarse grained, with some sand, fine to medium grained, red-brown	>Wp	St	
~2.2	SS (2.5–3.0)		Sandy CLAY, medium to high plasticity, brown/red mottled brown/orange, fine grained	>Wp	St	Disturbed sample taken
~2.8			orange, fine to medium grained	>Wp	St	Disturbed sample taken
~3.2			pale orange/pale brown			
~3.7	SS (3.5–4.0)	SP	SAND, fine to medium grained, orange/brown, little to no fines	D	L/MD	
~4.3	SS (4.5–5.0)	CI	Sandy CLAY, medium plasticity, dark brown, fine to medium grained	>Wp	St	50% recovery
~4.8	SS (5.0–5.5)	SC	Clayey SAND, fine to medium grained, pale brown with quartz granules and white flecks, medium plasticity fines, becoming pink at 5.0m	D	L/MD	Disturbed sample taken
~5.2			becoming brown/orange with pink/grey mottles	D/M		
~6.2	SS (6.0–6.5)		orange mottled grey/red			50% recovery
~6.7	SS (7.0–7.5)	CH	becoming Sandy CLAY, medium to high plasticity, red/brown-orange	>Wp	St/VSt	Disturbed sample taken
~7.3			becoming brown/orange with some minor black and white lenses/mottles at 7.5m			
8						Varied proportions

method
DT Diatube
AS Auger screwing
AH Auger drilling
RR Roller/tricone
CB Claw/blade bit
NMLC NMLC core
NQ, HQ Wireline core
HA Hand auger

water
17/03/18 water level on date shown
water inflow
partial drill fluid loss
complete drill fluid loss

PLANNING EXHIBITED DOCUMENTS
Ref. No: DA 0485/2020
Date advertised: 29/08/2020
Planning Administration
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Moisture Condition
Dry (D)
Moist (M)
Wet (W)
Cohesive soils can also be described relative to their plastic limit, ie:
<Wp
=Wp
>Wp

Consistency
VS Very soft
S Soft
F Firm
St Stiff
VSt Very stiff
H Hard
Fb Friable

ENGINEERING BOREHOLE LOG

Borehole no: BH3

Client: DJ Building Contractors
Project: Landslide Risk Assessment
Location: 29 Talbot Road, South Launceston
Drill model: Hanjin D&B 8D
Hole diameter:
Slope: **Bearing:**

TASMAN geotechnics

Job no. TG18231/1
Date: 21/03/2019
Logged By: TS
Easting: 512927 **Northing:** 5411221
Elevation: 79.6

Method	Penetration 1 2 3 4	Notes Samples Tests	Water	Depth	Graphic Log	Classification	Material Description	Moisture Condition	Consistency density, index	Structure, additional observations
		SS		8 – 8.5		SP	SAND, fine to medium grained, orange with grey and purple bands, with a trace of medium plasticity fines	D/M	MD	of clay from trace to some, lenses of clayey sand
						CI	Sandy CLAY, medium plasticity, pink/grey, fine to medium grained with some gravel, fine to medium grained pink/purple			
		SS		9 – 9.5		SC	Clayey SAND, fine to medium grained pale orange/grey, medium plasticity fines			Disturbed sample taken
							orange/brown with some gravel, coarse grained and cobbles, sub-angular ironstone			
				10		CI	Sandy CLAY, medium plasticity, brown, fine to medium grained with orange mottles	>Wp	St	
		SS				SC	Clayey SAND, fine to medium grained, medium plasticity fines, pale grey/brown becoming orange with white flecks at 10.2m	M/D		Disturbed sample taken
				10.5		CH	CLAY, high plasticity, grey			
		SS		11			grey/brown with a trace of sand, fine grained	>Wp	VSt	
							with some sand, fine grained			
				11.5		SC	Clayey SAND, fine to coarse grained, orange/red with gravel, fine to medium grained, sub-angular, ironstone	D/M	MD	
		SS		12			with a trace of fines, pale brown/orange and grey, 10mm lens of grey clay at 12.25m			60% recovery
				12.5			Clayey SAND, fine to medium grained, pale brown/white and orange/grey	M	MD	
						CH	Sandy CLAY, medium to high plasticity, brown, fine to medium grained	>Wp	St/VSt	
		SS		13 – 13.5			orange/pale brown with white grains			Disturbed sample taken
						CI	Sandy CLAY, medium plasticity, pale brown, fine to medium grained	≥Wp	VSt	
		SS		14		SC	Clayey SAND, fine to medium grained, pale orange/pale brown, becoming brown and red from 14.2m	M	MD	
							red with some gravel, fine to medium grained, ironstone			
				14.5		CH	CLAY, medium to high plasticity, red mottled brown	>Wp	VSt	
				15 – 16			Hole switched to HQTT at 14.5m			

method

DT	Diatube
AS	Auger screwing
AH	Auger drilling
RR	Roller/tricone
CB	Claw/blade bit
NMLC	NMLC core
NQ, HQ	Wireline core
HA	Hand auger

water

17/03/18 water level on date shown
water inflow
partial drill fluid loss
complete drill fluid loss

PLANNING EXHIBITED DOCUMENTS
Ref. No: DA 0485/2020
Date advertised: 29/08/2020
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Moisture Condition
Dry (D)
Moist (M)
Wet (W)
Cohesive soils can also be described relative to their plastic limit, ie:
<Wp
=Wp
>Wp

Consistency

VS	Very soft
S	Soft
F	Firm
St	Stiff
VSt	Very stiff
H	Hard
Fb	Friable

ENGINEERING CORED BOREHOLE LOG

Borehole no: BH3

Client: DJ Building Contractors
Project: Landslide Risk Assessment
Location: 29 Talbot Road, South Launceston
Drill model: Hanjin D&B 8D
Barrel type: HQTT
Fluid:
Inclination: **Bearing:**

TASMAN geotechnics

Job no. TG18231/1
Date: 21/03/2019
Logged By: TS
Easting: 512927
Northing: 5411221
Elevation: 79.6

Drilling information				Rock substance						Rock mass defects		
Method	Case-lift	Water	Depth	Graphic Log	Substance Description rock type, grain characteristics, colour, structure, minor components	Weathering	Strength (see notes) 1 2 3 4	Recovery % 25 50 75	RQD % 25 50 75	Spacing (mm) 10 100 1000	Defect Description thickness, type, inclination, planarity, roughness, coating — particular	general
			8.5 – 14.5		Continued from augers at 14.5m							
			14.5		CLAY, medium to high plasticity, brown with occasional red mottles, with some sand, fine to medium grained							
	●–●		15		Ironstone gravel and cobbles in CLAY matrix, medium plasticity, red/brown (grey clay), with some sand							
	●–●		15.5		Partially lithified Sandy CLAY, medium to high plasticity, red and brown with occasional grey clay lenses							
			16		becoming brown mottled red							

method
DT Diatube
AS Auger screwing
AD Auger drilling
RR Roller/tricone
CB Claw or blade bit
NMLC NMLC core
NQ, HQ, PQ Wireline core
HQ Conv. Conventional core

core-lift
casing used
barrel withdrawn

graphic log/core recovery
core recovered graphic symbols indicate material
no core recovered

water
17/03/18 water level on date shown
water inflow
partial drill fluid loss
complete drill fluid loss
25 water pressure test result (lugeons) for depth interval shown

weathering
FR fresh
SW slightly weathered
MW moderately weathered
HW highly weathered
XW extremely weathered
DW distinctly weathered (covered MW and HW)

strength
1 = VL very low
2 = L low
3 = M medium
4 = VH high
5 = EH extremely high

defect type
JT joint
PT parting
SM seam
SZ sheared zone
SS sheared surface
CS crushed seam

planarity
PL planar
CU curved
UN undulating
ST stepped
IR irregular

roughness
VR very rough
RO rough
SO smooth
SL slickensided

coating
CN clean
SN stained
VN veneer
CO coating

ENGINEERING CORED BOREHOLE LOG

Borehole no: BH3

Client: DJ Building Contractors
Project: Landslide Risk Assessment
Location: 29 Talbot Road, South Launceston
Drill model: Hanjin D&B 8D
Barrel type: HQTT
Fluid:
Inclination: **Bearing:**

TASMAN geotechnics

Job no. TG18231/1
Date: 21/03/2019
Logged By: TS
Easting: 512927
Northing: 5411221
Elevation: 79.6

Method	Case-lift	Water	Depth	Substance Description (rock type, grain characteristics, colour, structure, minor components)	Weathering	Strength	Recovery %	RQD %	Spacing (mm)	Defect Description
HQTT				Ironstone lens, red/brown, fine to medium grained						
			16.5	Clayey SAND, fine to medium grained, grey mottled orange						
	●–●			Ironstone lens, red/brown, fine to medium grained						
			17	Sandy CLAY, medium to high plasticity, grey with some orange mottles, fine to medium grained						
			17.5	Sandy CLAY, medium plasticity, red/brown (decomposed ironstone) with ironstone lens (20mm thick)						
			18	Sandy CLAY, medium plasticity, brown mottled orange and red, fine to medium grained						
	●–●		18.5	Ironstone, deeply weathered to extremely weathered, presenting as Clayey SAND, fine to medium grained, medium plasticity fines, orange and red						
			19	becoming orange with red and brown mottles						
				Sandy CLAY, medium plasticity, grey with orange-brown mottles, fine to medium grained						
			19.5	orange/brown						
	●–●			grey						
			20	Clayey SAND, orange/brown fine to medium grained						
			20.5	Grey with some black grains						
			21	becoming grey mottled brown/orange with some black grains						
	●–●			orange and grey						
			21.5	Hole terminated at 21.3m, still going						
			22							
			22.5							
			23							
			23.5							
			24							

PLANNING EXHIBITED DOCUMENTS
Ref. No: DA 0485/2020
Date advertised: 29/08/2020
Planning Administration

method
DT Diatube
AS Auger screwing
AD Auger drilling
RR Roller/tricone
CB Claw or blade bit
NMLC NMLC core
NQ, HQ, PQ Wireline core
HQ Conv. Conventional core

core-lift
casing used
barrel withdrawn

graphic log/core recovery
core recovered graphic symbols indicate material
no core recovered

water
17/03/18 water level on date shown
water inflow
partial drill fluid loss
complete drill fluid loss
water pressure test result (lugeons) for depth interval shown

weathering
FR fresh
SW slightly weathered
MW moderately weathered
HW highly weathered
XW extremely weathered
DW distinctly weathered (covered MW and HW)

strength
1 = VL very low
2 = L low
3 = M medium
4 = VH high
5 = EH extremely high

defect type
JT joint
PT parting
SM seam
SZ sheared zone
SS sheared surface
CS crushed seam

planarity
PL planar
CU curved
UN undulating
ST stepped
IR irregular

roughness
VR very rough
RO rough
SO smooth
SL slickensided

coating
CN clean
SN stained
VN veneer
CO coating

ENGINEERING BOREHOLE LOG

Borehole no: BH4

Client: DJ Building Contractors
Project: Landslide Risk Assessment
Location: 29 Talbot Road, South Launceston

Drill model: Hanjin D&B 8D
Hole diameter:
Slope: **Bearing:**

Job no. TG18231/1
Date: 17/04/2019
Logged By: DG

Easting: 512919 **Northing:** 5411280

Method	Penetration 1 2 3 4	Notes Samples Tests	Water	Depth	Classification	Material Description	Moisture Condition	Consistency density, index	Structure, additional observations
				0	SM	Sandy SILT, mid brown. Debris (e.g. bricks) in upper 200mm.	D	Fb	Debris, bricks, roots at top 200mm.
				0.5					
				1	CH	CLAY, high plasticity, mid brown.	<Wp	Fb	Crumbly.
				1.5	CI	Sandy CLAY, pale brown/off-white, medium plasticity	>Wp	Fb	
				2		CLAY, medium plasticity, pale grey, with some sand, medium to fine grained, becomes brown from 2.5m	>Wp	Fb	
				2.5					
				3	SC	Clayey SAND, pale grey with brown and pink lenses, thinly bedded, minor iron oxide cementation along sparse thin seams	M	Fb	
				3.5	CH	CLAY, high plasticity, pale brown/grey	M	Fb	
					CI	Sandy CLAY, medium to high plasticity, pale brown, sand is fine to medium grained	M	Fb	
				4	CH	CLAY, high plasticity, tan, with trace to nil sand	M	VSt/Fb	
				4.5	CI-SC	Sandy CLAY to Clayey SAND, tan/brown/pink/white	M	Fb	
				5					
				5.5					
				6					
				6.5	CH	CLAY, high plasticity, tan/brown	M	H	
				7	SC	Clayey SAND, medium grained, tan/white/grey	M	H	
					CH	CLAY, high plasticity, tan, slightly red tinged	M	H	
				7.5					
HSA				8	CI	CLAY or MUDSTONE, mid-brown/tan, weakly lithified, with a trace of sand, and	M	H	

method

DT	Diatube
AS	Auger screwing
AH	Auger drilling
RR	Roller/tricone
CB	Claw/blade bit
NMLC	NMLC core
NQ, HQ	Wireline core
HA	Hand auger

water

▼ 17/03/18 water level on date shown

► water inflow

◁ partial drill fluid loss

◀ complete drill fluid loss

Moisture Condition
Dry (D)
Moist (M)
Wet (W)
Cohesive soils can also be described relative to their plastic limit, ie:
<Wp
=Wp
>Wp

Consistency

VS	Very soft
S	Soft
F	Firm
St	Stiff
VSt	Very stiff
H	Hard
Fb	Friable

ENGINEERING BOREHOLE LOG

Borehole no: BH4

Client: DJ Building Contractors
Project: Landslide Risk Assessment
Location: 29 Talbot Road, South Launceston

Sheet no. 2 of 2
Job no. TG18231/1
Date: 17/04/2019
Logged By: DG

Drill model: Hanjin D&B 8D
Hole diameter:
Slope: **Bearing:**

TASMAN geotechnics

Easting: 512919 **Northing:** 5411280

Method	Penetration 1 2 3 4	Notes Samples Tests	Water	Depth	Graphic Log	Classification	Material Description	Moisture Condition	Consistency density, index	Structure, additional observations
				8		CH	trace sand as sandy lenses	M	VSt	
							CLAY, high plasticity, tan/brown with a trace of fine grained gravel and/or coarse grained sand, not lithified			
				8.5 – 9			becomes paler brown with a trace of sand	M	St	
				9.5			CLAY, high plasticity, slightly reddish brown, weakly lithified, with some to trace sand, fine to medium grained, sandy lenses	M	St	Sample splits.
				10 – 10.5			becomes pale grey, weakly lithified with sandy lenses	M	H	
				11		CH	Band of IRONSTONE	M	H	
							becomes brown with a trace of sand	M	H	
				11.5		SP	Lens of SAND	M	H	
						CH	brown, with some/trace sand	M	H	
				12 – 12.5		CH/SC	Mix of high plasticity CLAY and Clayey SAND, brown and grey, with traces of ironstone gravels.	M	H	
						SC	Clayey SAND, pale grey, thinly bedded, medium grained	M	MD/D	
				13 – 13.5		CH	CLAY, high plasticity, brown with a trace of sand	M	VSt	
						SC	Clayey SAND, thinly bedded pale grey and brown, rip-up mudstone clasts and rare shell fragments	M	MD	
				14 – 14.5		CH	CLAY, high plasticity, brown, with a trace of sand and a trace of gravel	M	VSt	
				15		SC	Clayey SAND	M	D	
							Terminated at 15m, still going.			
				15.5 – 16						

method
DT Diatube
AS Auger screwing
AH Auger drilling
RR Roller/tricone
CB Claw/blade bit
NMLC NMLC core
NQ, HQ Wireline core
HA Hand auger

water
17/03/18 water level on date shown
water inflow
partial drill fluid loss
complete drill fluid loss

Moisture Condition
Dry (D)
Moist (M)
Wet (W)
Cohesive soils can also be described relative to their plastic limit, ie:
<Wp
=Wp
>Wp

Consistency
VS Very soft
S Soft
F Firm
St Stiff
VSt Very stiff
H Hard
Fb Friable

Appendix B

Laboratory Test Results

Summary of soil classification tests

Borehole	**Depth**	**Liquid Limit (%)**	**Plastic Limit (%)**	**Plasticity Index (%)**	**Linear Shrinkage (%)**	**% Gravel**	**% Sand**	**% Fines**
BH1	2.0-2.2m	96	26	70	19	0	0	100
	5.0-5.5m	59	24	35	13	0	32	68
	10.0-10.3m	77	20	57	22	7	23	70
	13.5-13.8m	45	22	23	6	0	52	48
	15.1-15.3m	29	24	5	1	0	83	17
	18.6-18.7m	-	-	-	-	0	49	51
	24.2-24.3m	-	-	-	-	0	34	66
	24.8-25.0m	48	21	27	12	0	9	91
	28.6-28.8m	49	25	24	9	0	66	34
BH2	0.5-1.0m	81	27	54	18	0	8	92
	5.0-5.5m	-	-	-	-	0	35	65
	9.0-9.5m	-	-	-	-	0	34	66
	11.5-11.8m	43	15	28	10	0	47	53
	13.5-13.7m	54	21	33	14	0	37	63
BH3	1.5-2.0m	76	22	54	17	12	20	68
	10.7-10.8m	87	25	62	21	0	5	95
	12.0-12.3m	46	23	23	11	0	43	57

Soil moisture content, BH1

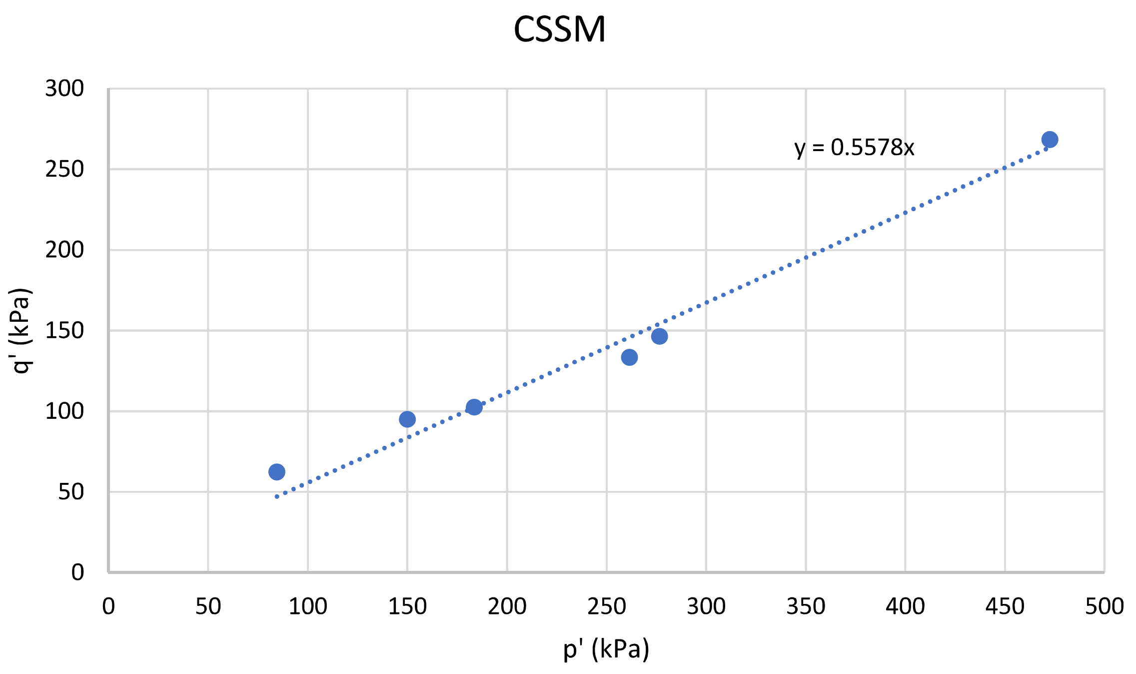
Depth	Liquid Limit (%)
1.45-1.5	33
2.4-2.5	30
4.5-5.0	29
5.45-5.5	23
6.45-6.5	24
7.4-7.5	20
9.3-9.4	23
10.4-10.5	24
12.2-12.3	16

Critical State Soil Mechanics

Use p' – q' space to obtain line of best fit for triaxial test stages.

If slope of line = M, then ϕ = arcsin(M)

Line of best fit has slope M = 0.5578, thus ϕ = 34°



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Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

Undrained Triaxial Test with measurement of pore water pressure

Customer:	Tasman Geotechnics Pty Ltd	Report Number:	W19DS01467-1
Customer Address:	PO Box 4026, Invermay TAS 7248	Report Date:	21/08/2019
Project:	LRA	CG Job No:	1100088
Location:	-	Test Method:	AS1289.6.4.2
Customer Order No:	TG18231/1 COC1	Page:	1 of 5

Testing performed and reported at our Dandenong South Laboratory

Sample No.:	S19DS-05022	Test method:	AS1289.6.4.2
Borehole:	BH02	Normal Stress:	40, 85, 170
Depth:	5.0m to 5.5m	Pore pressure:	450
Sample Date:	16/04/2019	Sample dimensions (mm):	63(d) x 126(h)
Sample Type:	U63 Tube	Date tested:	22/07/2019

Results Summary

Dry density (t/m^3): 1.724
Initial Moisture content (%) 15.1
Final Moisture content (%) 19.9

	Stage 1	Stage 2	Stage 3
Axial strain rate:	0.042	0.042	0.042
Strain at failure:	1.76	3.26	5.92
Minor stress Ó$_{3f}$	22	55	130
Major Stress Ó1	147	245	423
Corr Dev Stress	125	190	293

Photos After Test

Effective Cohesion *c*': 30
Shear resistance Φ': 26

Mode of failure: Plastic Deformation
Failure criteria: Principal Stress Ratio

Sample Description: sandy CLAY, Dark Brown, Medium Plasticity.

Remarks:

ilac-MRA NATA Accreditation No. 12719

Accredited for compliance with ISO/IEC 17025-Testing. The results of tests, calibrations and/or measurements included in this document are

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J. Lamont
NATA Accreditation No. 12719

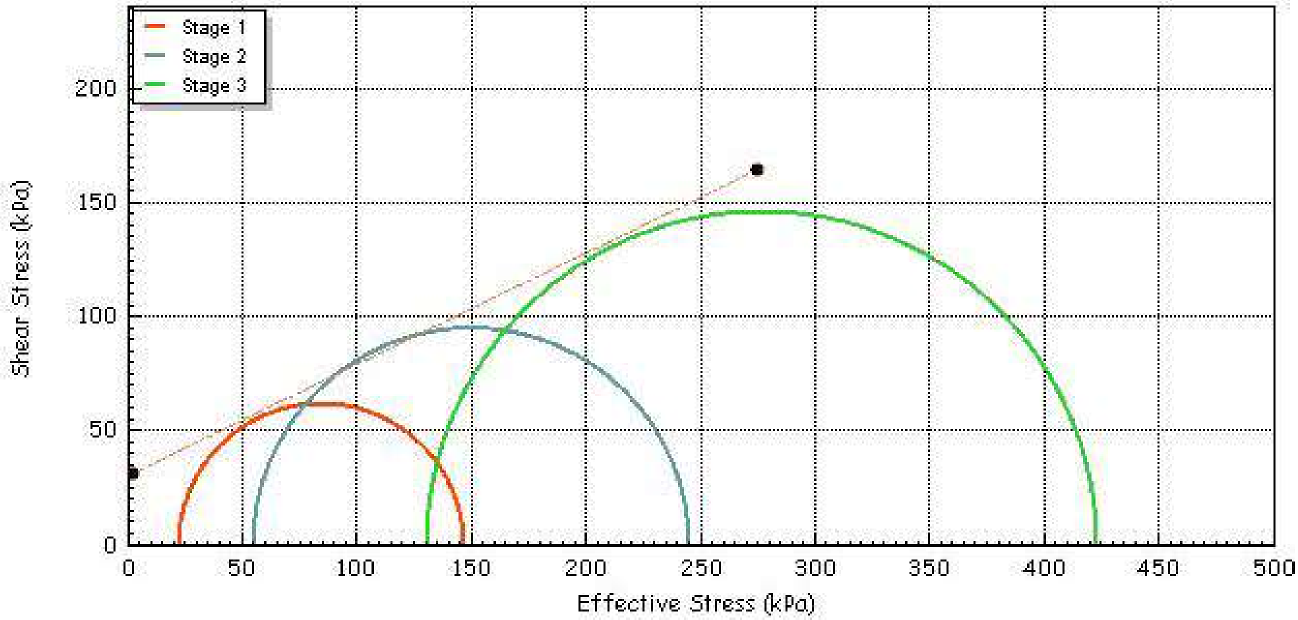
Form No.: CG336.002
Issue Date: 13/06/19

Effective Stress Triaxial Compression

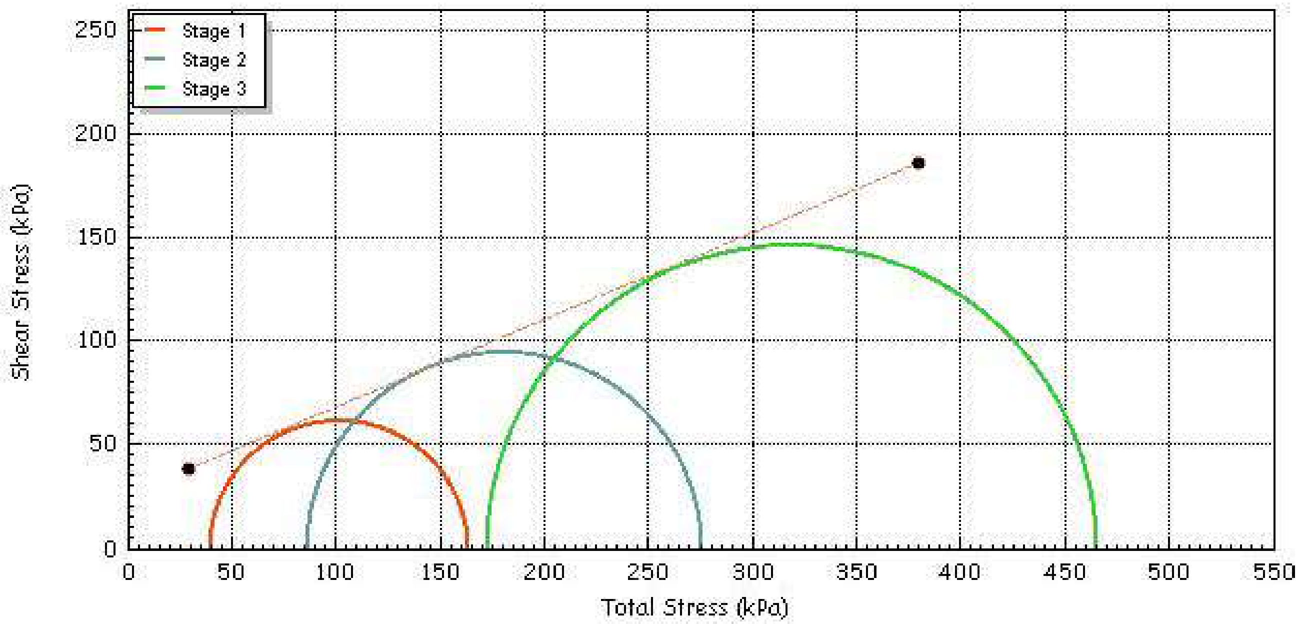
Consolidated Undrained

Shear Stage Plots

Effective Cohesion	c'	(kPa)	30.26
Effective Friction	ϕ'	(deg)	26.1



Total Cohesion	c	(kPa)	26.35
Total Friction	ϕ	(deg)	22.8



CHADWICK GEOTECHNICS

Test Method	AS1289.6.4.2 - 1998	Test Name	CUPP_05022
Database:	.\SQLEXPRESS \ chadgeotest2	Test Date	22/07/2019
Site Reference		Borehole	BH2 5.0 - 5.5m
Jobfile	TG18231 1100088	Sample	S19DS-05022
Client	Tasman Geotechnics	Depth	
Operator KPA	Checked JLL	Approved JLL	

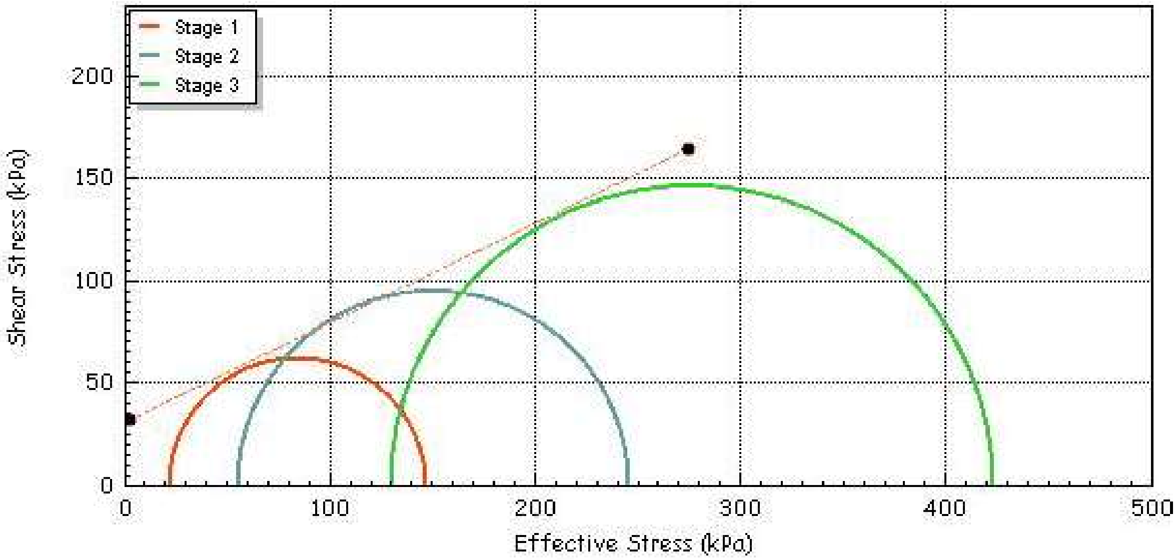
Dandenong South - Accreditation No. 12719

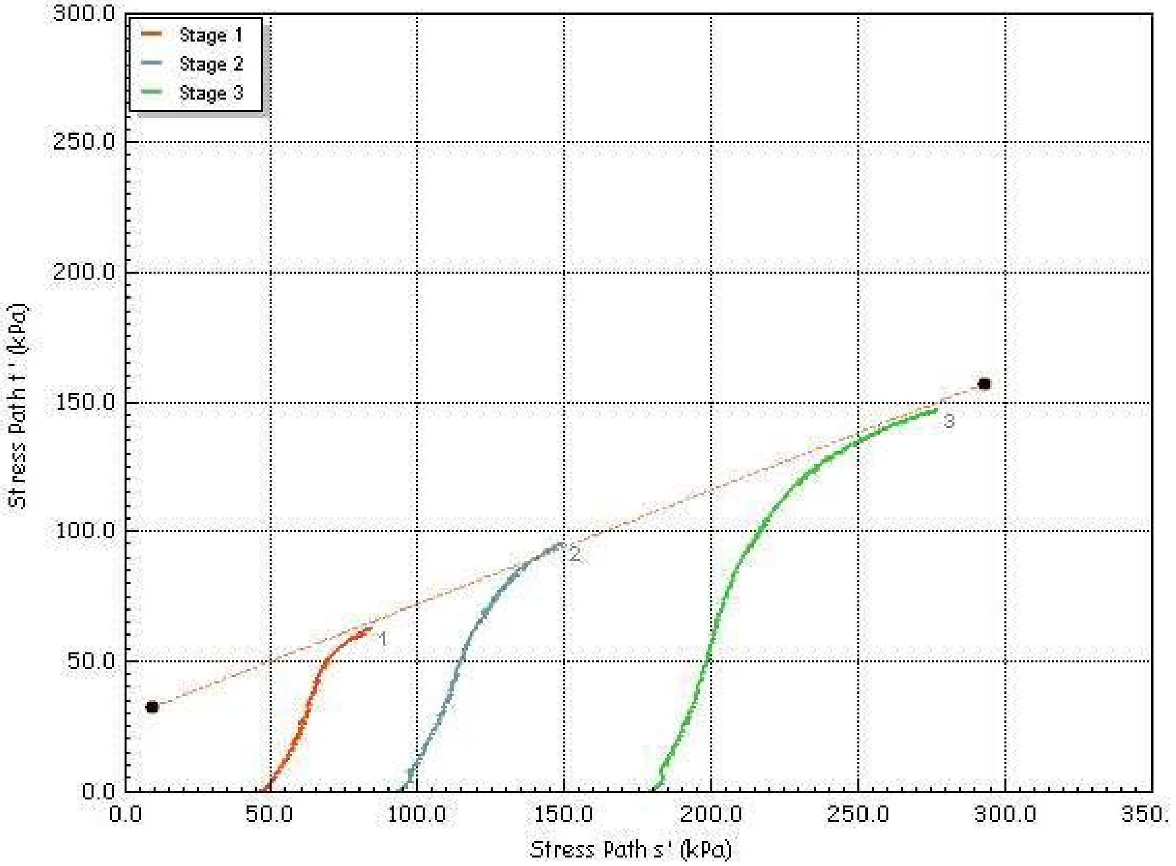
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots

Effective Cohesion	c'	(kPa)	30.26	Effective Cohesion	c'	(kPa)	30.99
Effective Friction	ϕ '	(deg)	26.1	Effective Friction	ϕ '	(deg)	26.1





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	Database: .\SQLEXPRESS \ chadgeotest2		Test Date	22/07/2019
	Site Reference		Borehole	BH2 5.0 - 5.5m
	Jobfile	TG18231 1100088	Sample	S19DS-05022
	Client	Tasman Geotechnics	Depth	
	Operator KPA	Checked JLL	Approved JLL	

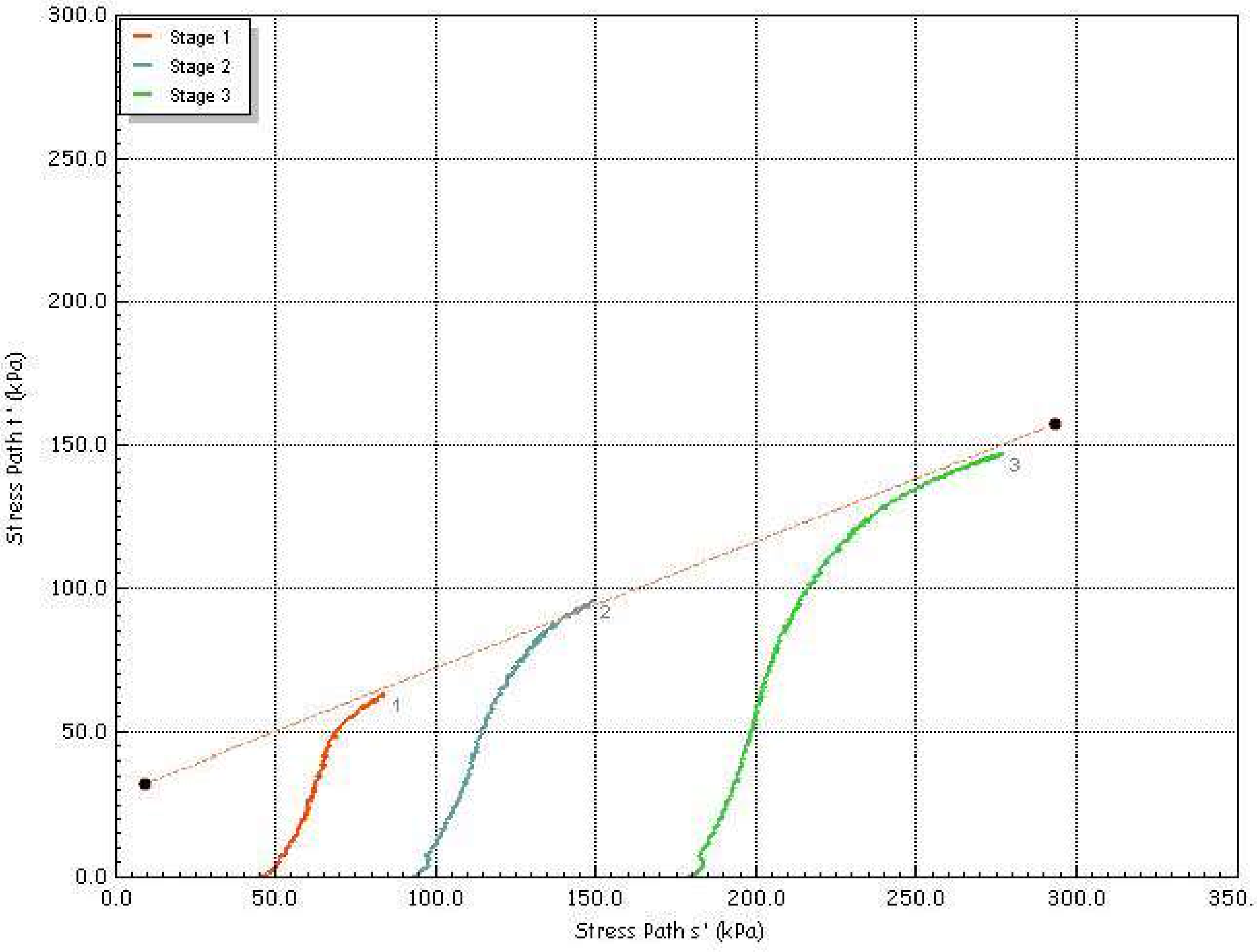
Dandenong South - Accreditation No. 12719

Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots

Effective Cohesion	c'	(kPa)	30.99
Effective Friction Angle	ϕ'	(deg)	26.1
Stress Path Intercept	t_0'	(kPa)	27.82
Stress Path Inclination	θ	(deg)	23.8



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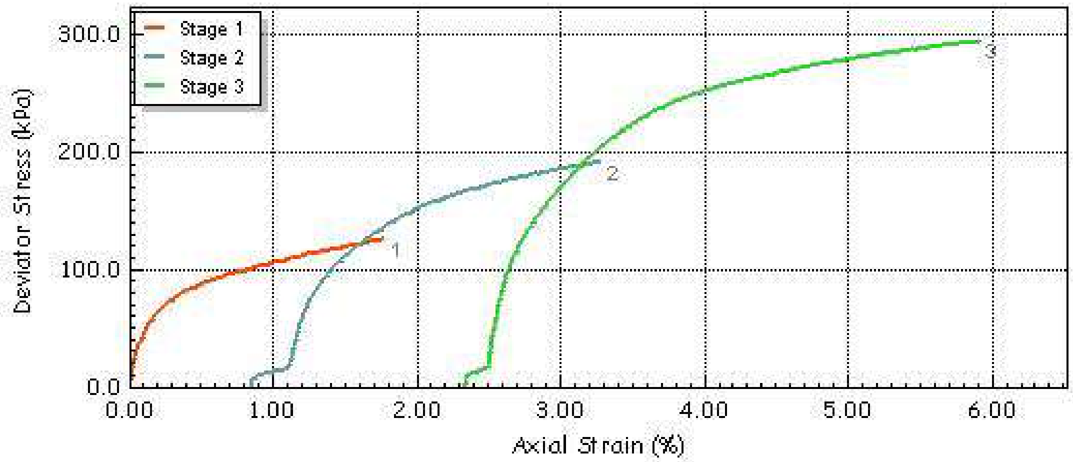
	Database: .\SQLEXPRESS \ chadgeotest2		Test Date	22/07/2019
	Site Reference		Borehole	BH2 5.0 - 5.5m
	Jobfile	TG18231 1100088	Sample	S19DS-05022
	Client	Tasman Geotechnics	Depth	
	Operator KPA	Checked JLL	Approved JLL	

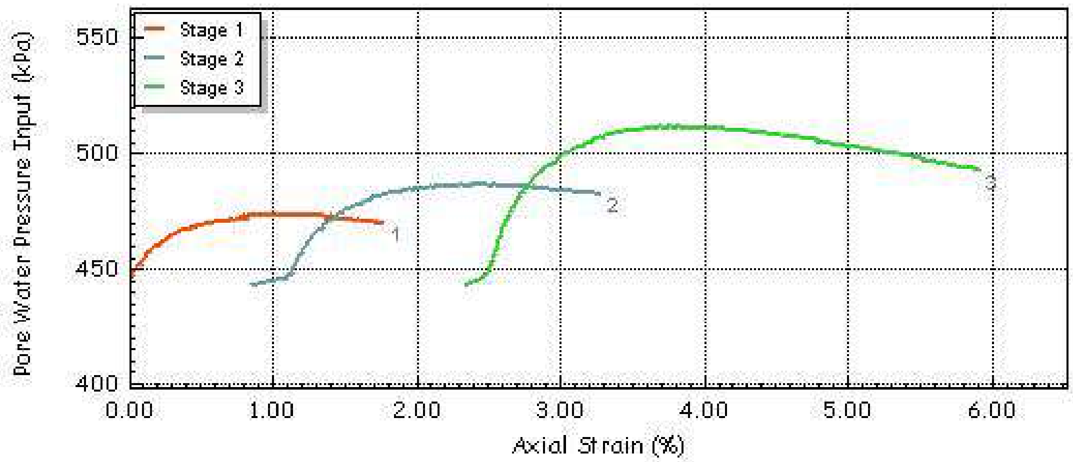
Dandenong South - Accreditation No. 12719

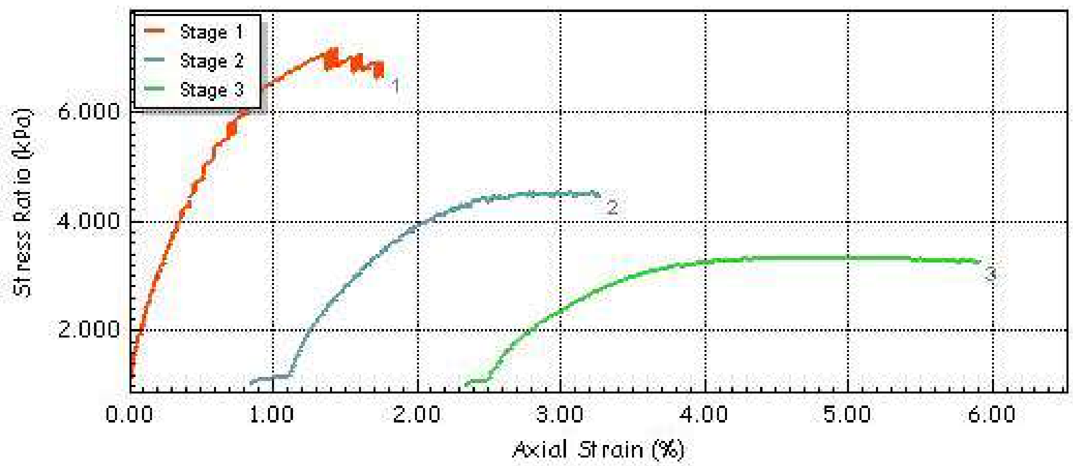
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots







Test Method	AS1289.6.4.2 - 1998	Test Name	CUPP_05022
Database:	.\SQLEXPRESS \ chadgeotest2	Test Date	22/07/2019
Site Reference		Borehole	BH2 5.0 - 5.5m
Jobfile	TG18231 1100088	Sample	S19DS-05022
Client	Tasman Geotechnics	Depth	
Operator KPA	Checked JLL	Approved JLL	

CHADWICK GEOTECHNICS

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CHADWICK GEOTECHNICS

Undrained Triaxial Test with measurement of pore water pressure

Customer: Tasman Geotechnics Pty Ltd
Customer Address: PO Box 4026, Invermay TAS 7248
Project: LRA
Location: -
Customer Order No: TG18231/1 COC1

Report Number: W19DS01467-2
Report Date: 21/08/2019
CG Job No: 1100088
Test Method: AS1289.6.4.2
Page: 1 of 5

Testing performed and reported at our Dandenong South Laboratory

Sample No.: S19DS-05023
Borehole: BH02
Depth: 9.0m to 9.5m
Sample Date: 16/04/2019
Sample Type: U63 Tube

Test method: AS1289.6.4.2
Normal Stress: 75, 155, 310
Pore pressure: 700
Sample dimensions (mm): 63(d) x 127(h)
Date tested: 20/06/2019

Results Summary

Dry density (t/m^3): 1.689
Initial Moisture content (%) 18.2
Final Moisture content (%) 21.9

	Stage 1	Stage 2	Stage 3
Axial strain rate:	0.042	0.042	0.042
Strain at failure:	5.01	6.87	11.84
Minor stress $Ó_{3f}$	81	128	204
Major Stress Ó1	286	395	741
Corr Dev Stress	205	267	537

Photos After Test

Effective Cohesion *c*': 7
Shear resistance Φ': 30

Mode of failure: Plastic Deformation
Failure criteria: Principal Stress Ratio

Sample Description: sandy CLAY, brown, Medium Plasticity.

Remarks:

ilac-MRA NATA Accreditation No. 12719

Accredited for compliance with ISO/IEC 17025-Testing. The results of tests, calibrations and/or measurements included in this document are

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J. Lamont
NATA Accreditation No. 12719

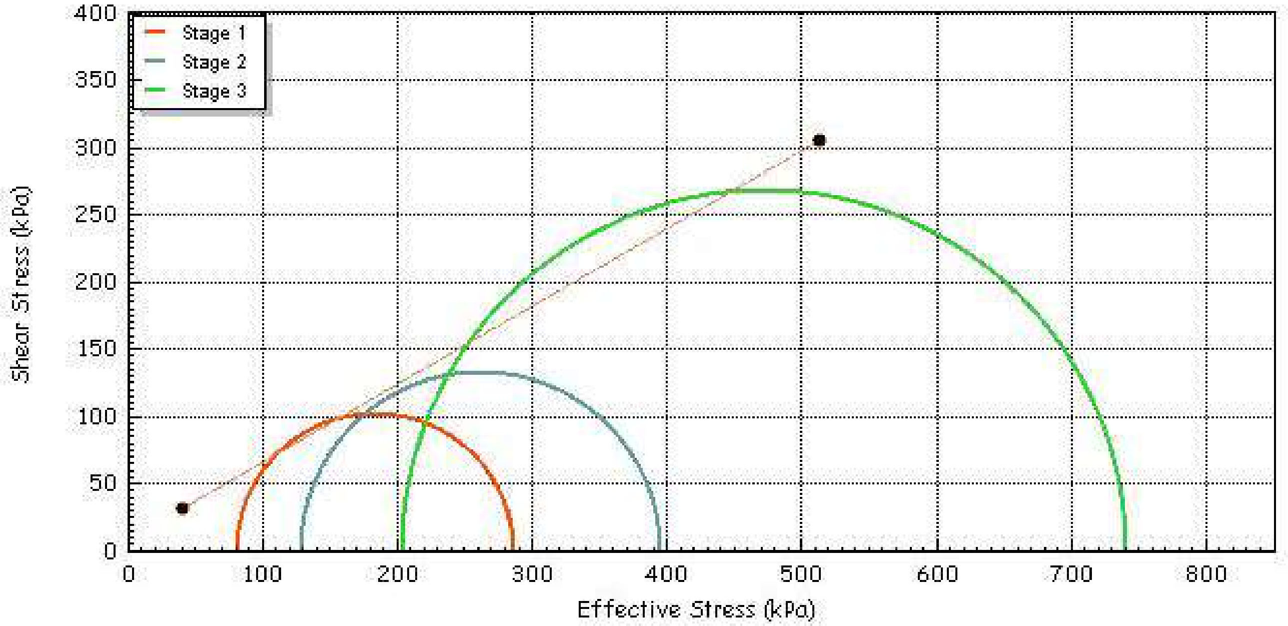
Form No.: CG336.002
Issue Date: 13/06/19

Effective Stress Triaxial Compression

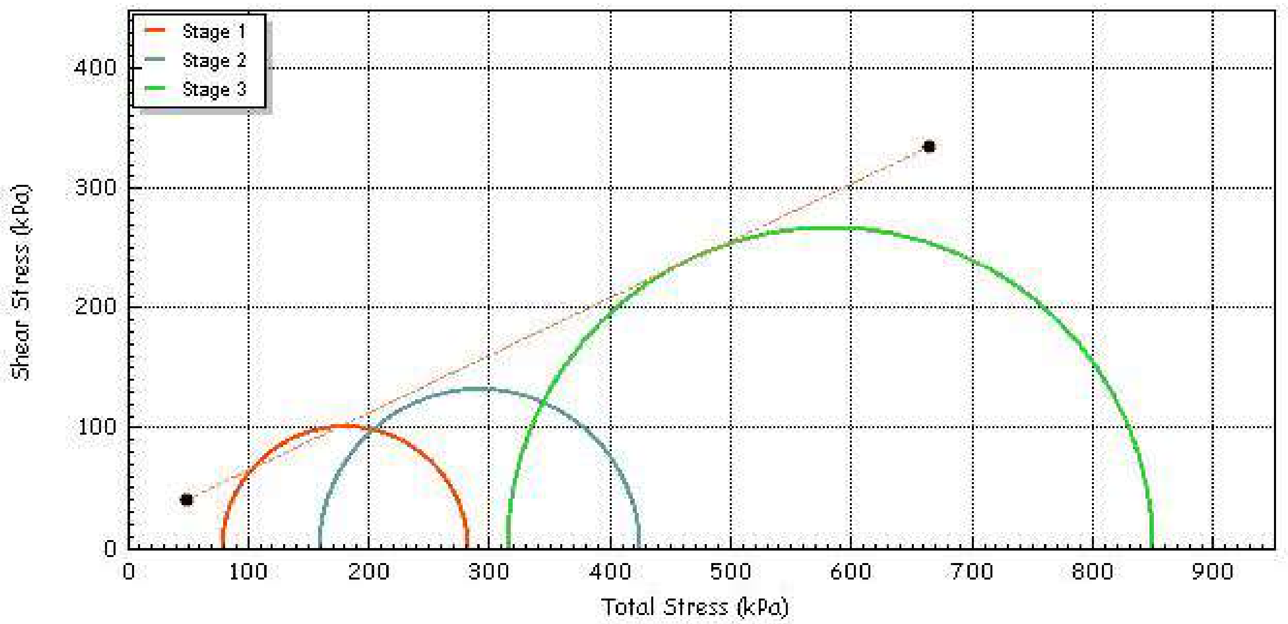
Consolidated Undrained

Shear Stage Plots

Effective Cohesion	c'	(kPa)	6.97
Effective Friction	φ '	(deg)	30.2



Total Cohesion	c	(kPa)	16.43
Total Friction Angle	φ	(deg)	25.6



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	Site Reference	Borehole	BH2 9.0 - 9.5m
	Jobfile TG18231 1100088	Sample	S19DS-05023
	Client Tasman Geotechnics	Depth	
	Operator KPA	Checked JLL	Approved JLL

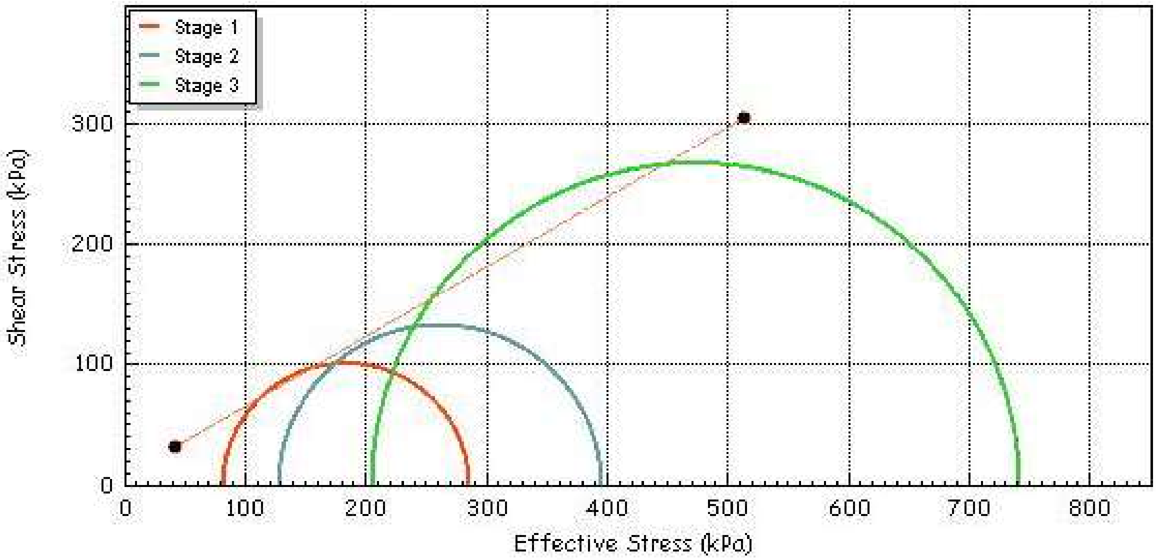
Dandenong South - Accreditation No. 12719

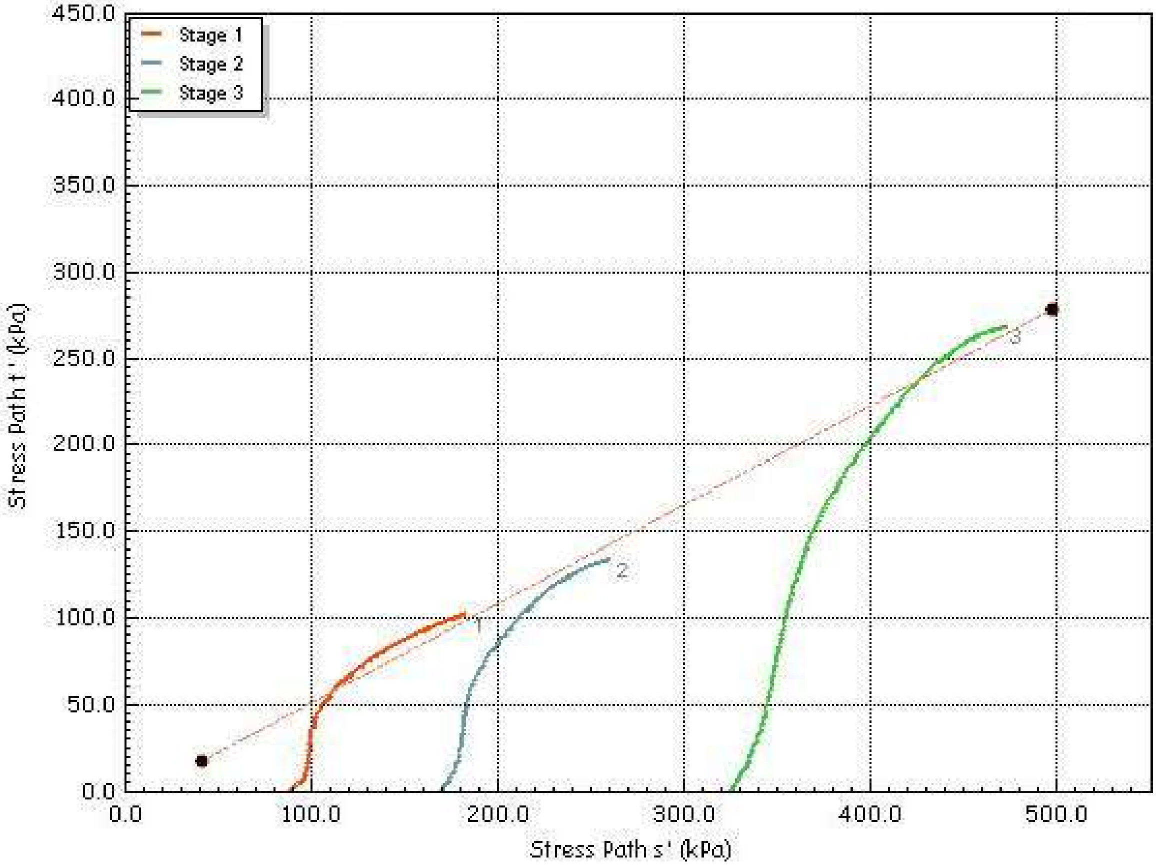
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots

Effective Cohesion c'	(kPa)	6.97		Effective Cohesion c'	(kPa)	-8.08
Effective Friction ϕ'	(deg)	30.2		Effective Friction ϕ'	(deg)	35.0





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	Database:	.\SQLEXPRESS \ chadgeotest2	Test Date	1/07/2019
	Site Reference		Borehole	BH2 9.0 - 9.5m
	Jobfile	TG18231 1100088	Sample	S19DS-05023
	Client	Tasman Geotechnics	Depth	
	Operator KPA	Checked JLL	Approved JLL	

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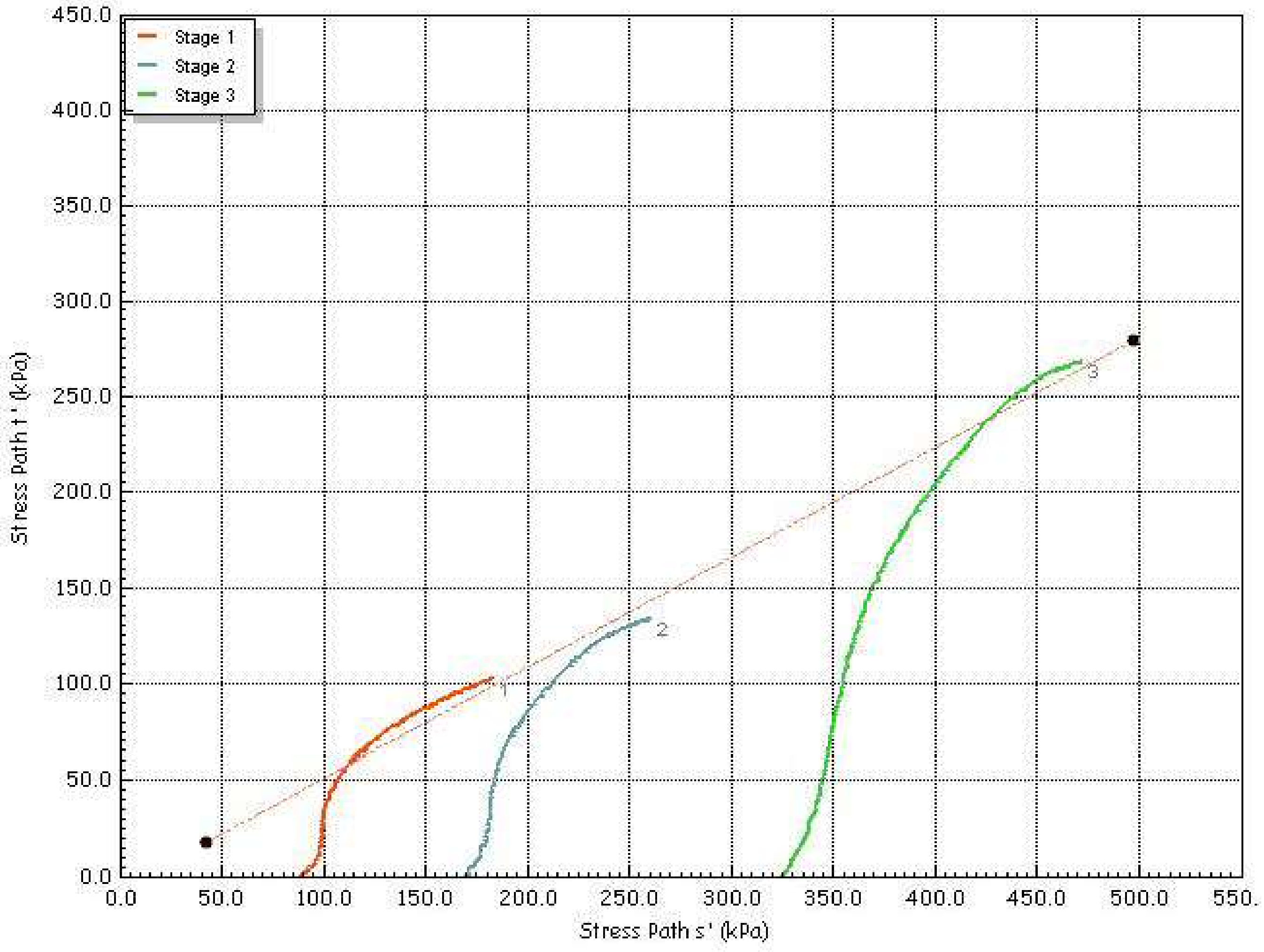
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots

Effective Cohesion	c'	(kPa)	-8.08
Effective Friction Angle	ϕ'	(deg)	35.0
Stress Path Intercept	t_0'	(kPa)	-6.61
Stress Path Inclination	θ	(deg)	29.8



Test Method	AS1289.6.4.2 - 1998	Test Name	CUPP_05023
Database: .\SQLEXPRESS \ chadgeotest2		Test Date	1/07/2019
Site Reference		Borehole	BH2 9.0 - 9.5m
Jobfile	TG18231 1100088	Sample	S19DS-05023
Client	Tasman Geotechnics	Depth	
Operator KPA	Checked JLL	Approved JLL	

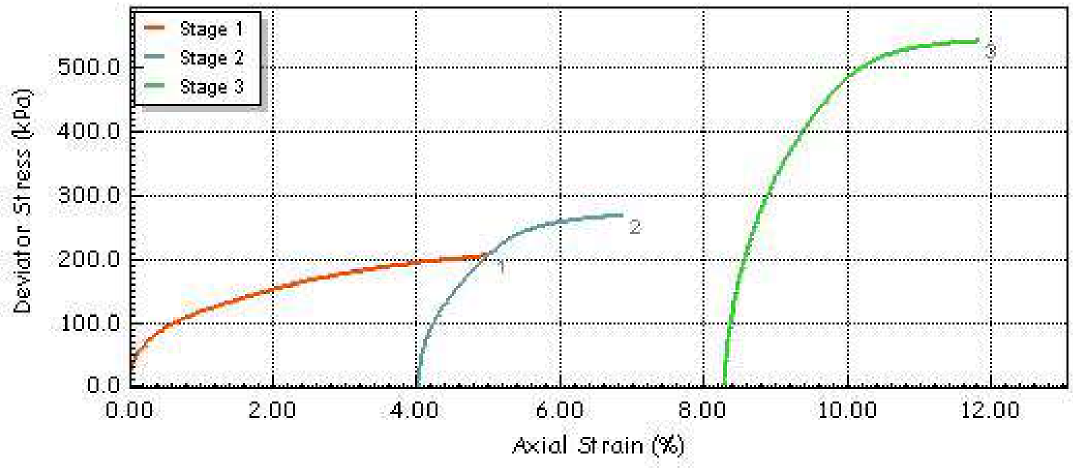
CHADWICK GEOTECHNICS

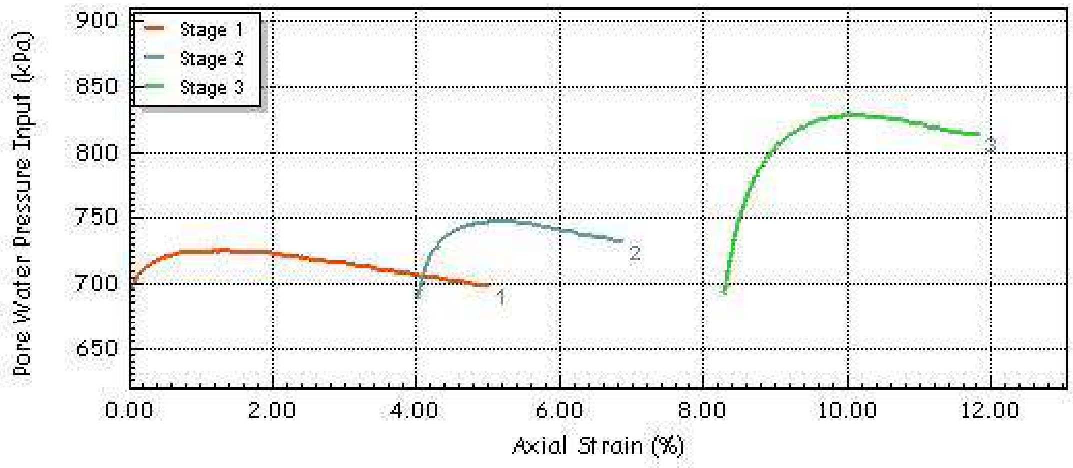
Dandenong South - Accreditation No. 12719

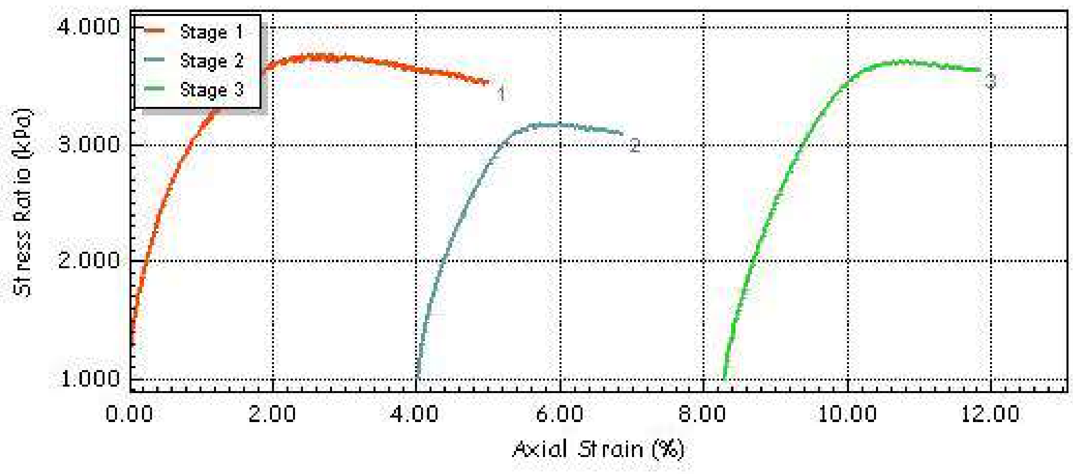
Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots







CHADWICK GEOTECHNICS	Test Method AS1289.6.4.2 - 1998 Database: .\SQLEXPRESS \ chadgeotest2	Test Name	CUPP_05023
		Test Date	1/07/2019
	Site Reference	Borehole	BH2 9.0 - 9.5m
	Jobfile TG18231 1100088	Sample	S19DS-05023
	Client Tasman Geotechnics	Depth	
	Operator KPA	Checked JLL	Approved JLL

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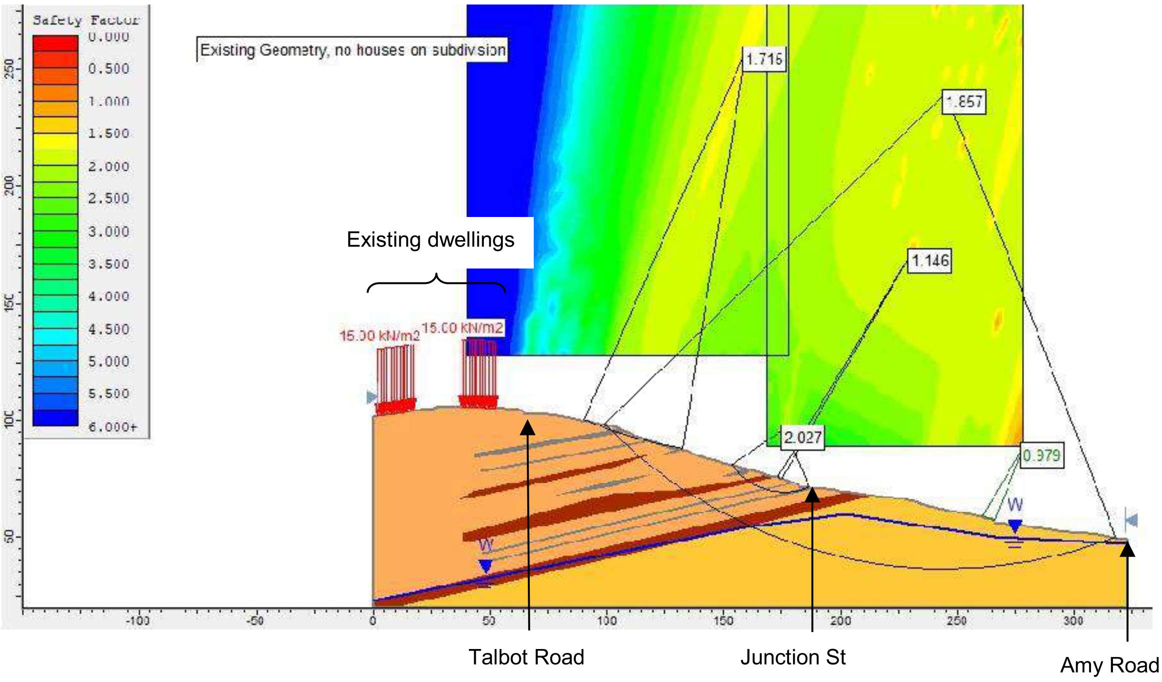
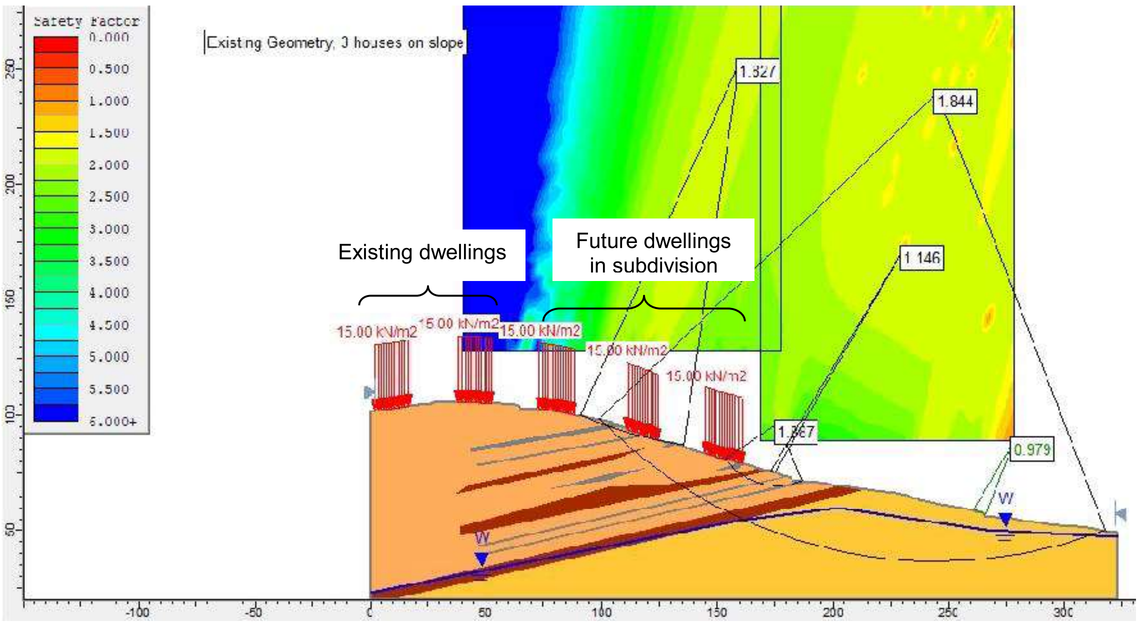
Appendix C

Graphical Slope Stability Results


Safety Factor
Existing Geometry, no houses on subdivision
Existing dwellings
15.00 kN/m2
15.00 kN/m2
1.716
1.857
1.146
2.027
0.979
Talbot Road
Junction St
Amy Road


Safety Factor
Existing Geometry, 3 houses on slope
Existing dwellings
Future dwellings
in subdivision
15.00 kN/m2
1.844
1.146
0.979

Appendix D

Landslide Risk Matrix

TASMAN
geotechnics

Terminology for use in Assessing Risk to Property

These notes are provided to help you understand concepts and terms used in Landslide Risk Assessment and are based on the "Practice Note Guidelines for Landslide Risk Management 2007" published in *Australian Geomechanics* Vol 42, No 1, 2007.

Likelihood Terms

The qualitative likelihood terms have been related to a nominal design life of 50 years. The assessment of likelihood involves judgment based on the knowledge and experience of the assessor. Different assessors may make different judgments.

Approximate Annual Probability	Implied indicative Recurrence Interval	Description	Descriptor	Level
10^{-1}	10 years	The event is expected to occur over the design life	Almost Certain	A
10^{-2}	100 years	The event will probably occur under adverse conditions over the design life	Likely	B
10^{-3}	1000 years	The event could occur under adverse conditions over the design life	Possible	C
10^{-4}	10,000 years	The event might occur under very adverse conditions over the design life	Unlikely	D
10^{-5}	100,000 years	The event is conceivable but only under exceptional circumstances over the design life	Rare	E
10^{-6}	1,000,000 years	The event is inconceivable or fanciful for the design life	Barely Credible	F

Qualitative Measures of Consequence to Property

Indicative Cost of Damage	Description	Descriptor	Level
200%	Structure(s) completely destroyed and/or large scale damage requiring major engineering works for stabilisation. Could cause at least one adjacent property major consequential damage.	Catastrophic	1
60%	Extensive damage to most of structure, and/or extending beyond site boundaries requiring significant stabilisation works. Could cause at least one adjacent property medium consequential damage	Major	2
20%	Moderate damage to some of structure, and/or significant part of site requiring large stabilisation works. Could cause at least one adjacent property minor consequential damage.	Medium	3
5%	Limited damage to part of structure, and/or part of site requiring some reinstatement stabilisation works	Minor	4
0.5%	Little damage.	Insignificant	5

The assessment of consequences involves judgment based on the knowledge and experience of the assessor. The relative consequence terms are value judgments related to how the potential consequences may be perceived by those affected by the risk. Explicit descriptions of potential consequences will help the stakeholders understand the consequences and arrive at their judgment.

Qualitative Risk Analysis Matrix – Risk to Property

Likelihood		Consequences to Property				
	Approximate annual probability	1: Catastrophic	2: Major	3: Medium	4: Minor	5: Insignificant
A: Almost Certain	10^{-1}	VH	VH	VH	H	L
B: Likely	10^{-2}	VH	VH	H	M	L
C: Possible	10^{-3}	VH	H	M	M	VL
D: Unlikely	10^{-4}	H	M	L	L	VL
E: Rare	10^{-5}	M	L	L	VL	VL
F: Barely credible	10^{-6}	L	VL	VL	VL	VL

NOTES:

1. The risk associated with Insignificant consequences, however likely, is defined as Low or Very Low
2. The main purpose of a risk matrix is to help rank risks and set priorities and help the decision making process.

Response to Risk

In general, it is the responsibility of the client and/or regulatory and/or others who may be affected to decide whether to accept or treat the risk. The risk assessor and/or other advisers may assist by making risk comparisons, discussing treatment options, explaining the risk management process, advising how others have reacted to risk in similar situations and making recommendations. Attitudes to risk vary widely and risk evaluation often involves considering more than just property damage (eg environmental effects, public reaction, business confidence etc).

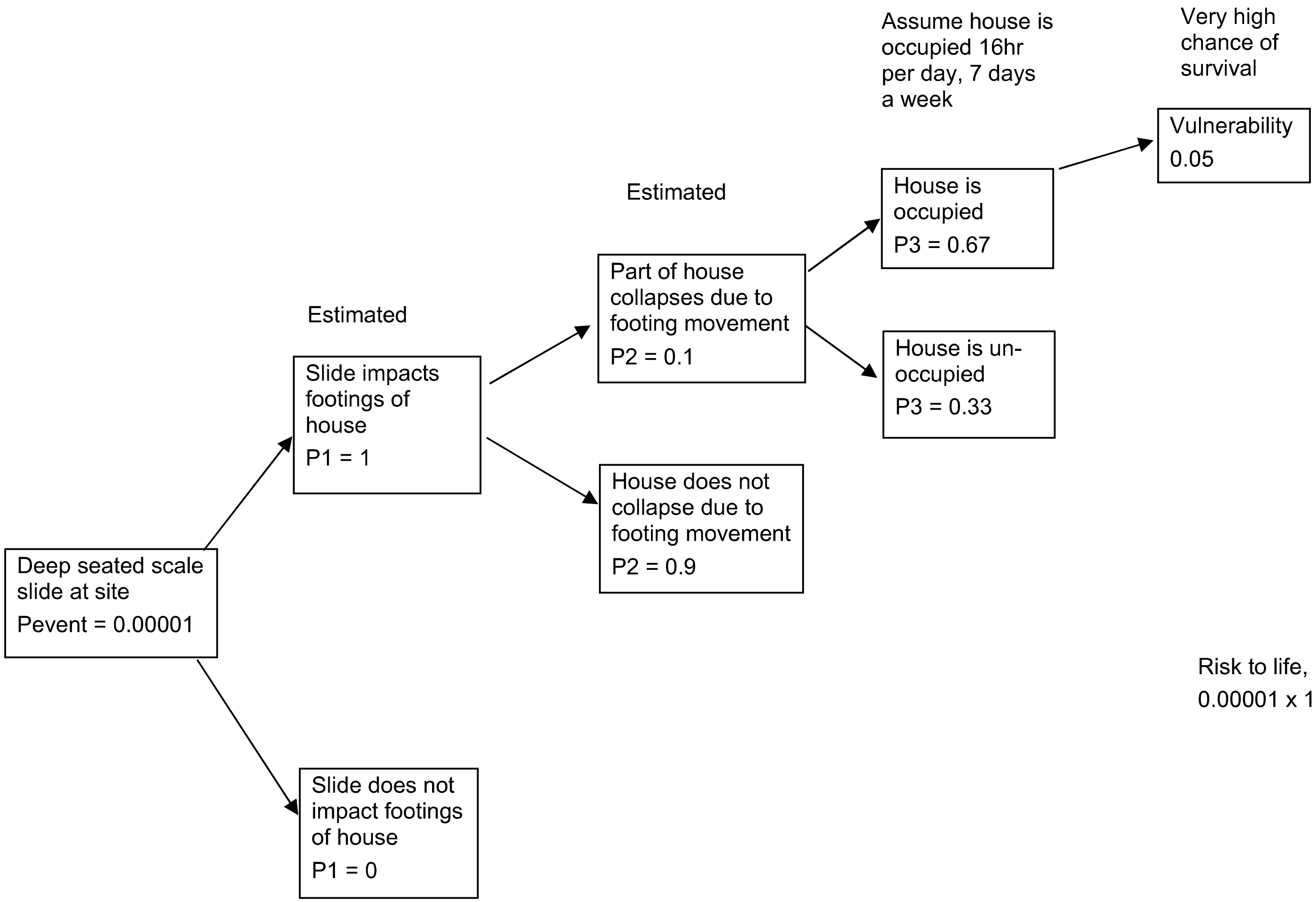
The following is a guide to typical responses to assessed risk.

Risk Level		Example Implications
VH	Very High	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 the value of the property.
H	High	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	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	Usually accepted by regulators. Where treatment has been required to reduce the risk to this level, ongoing maintenance is required.
VL	Very Low	Acceptable. Manage by normal slope maintenance procedures

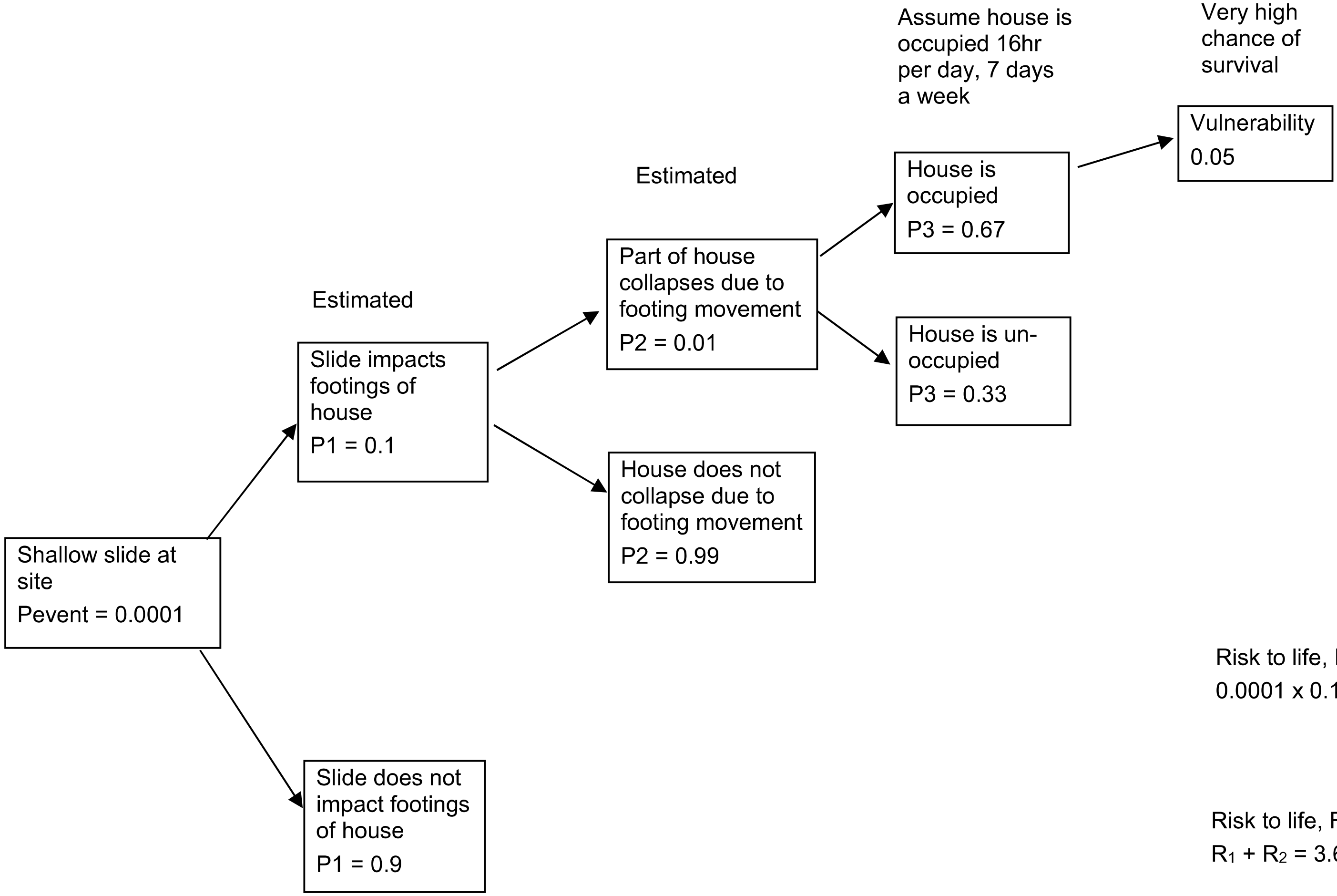
Appendix E

Risk to Life

Event Tree – Risk to Life



Risk to life, R_1 =
$0.00001 \times 1 \times 0.1 \times 0.67 \times 0.05 = 3.3 \times 10^{-8}$



Risk to life, R_2 =
$0.0001 \times 0.1 \times 0.01 \times 0.67 \times 0.05 = 3.3 \times 10^{-9}$

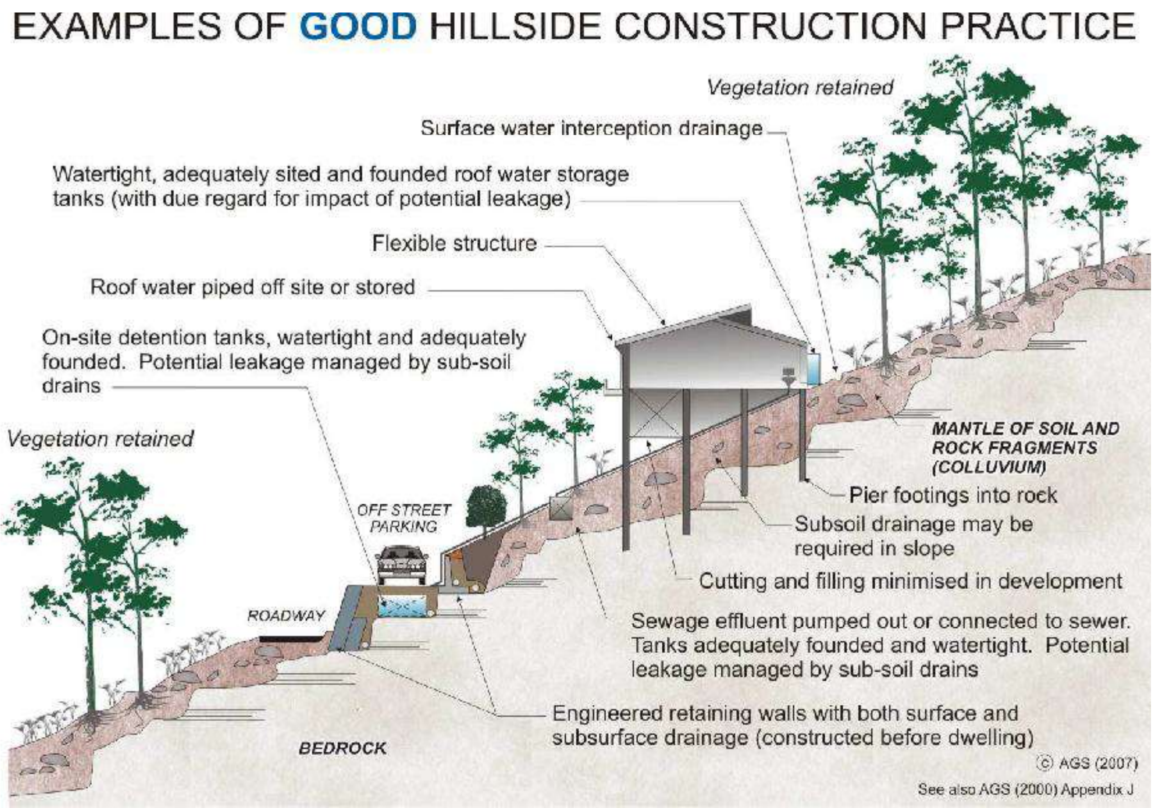
Risk to life, R_{LOL} =
$R_1 + R_2 = 3.6 \times 10^{-8}$

Appendix F

Guidelines to Hillside Construction

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.



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.

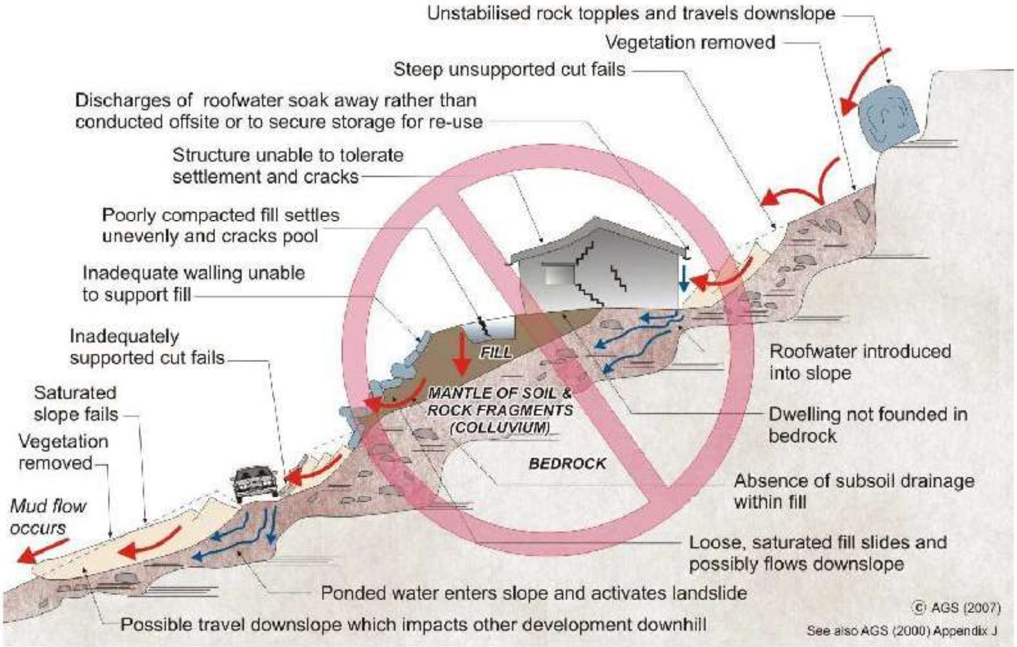
Vegetation clearance - on soil slopes has been kept to a reasonable minimum. Trees, and to a lesser extent smaller vegetation, take large quantities of water out of the ground every day. This lowers the ground water table, which in turn helps to maintain the stability of the slope. Large scale clearing 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.