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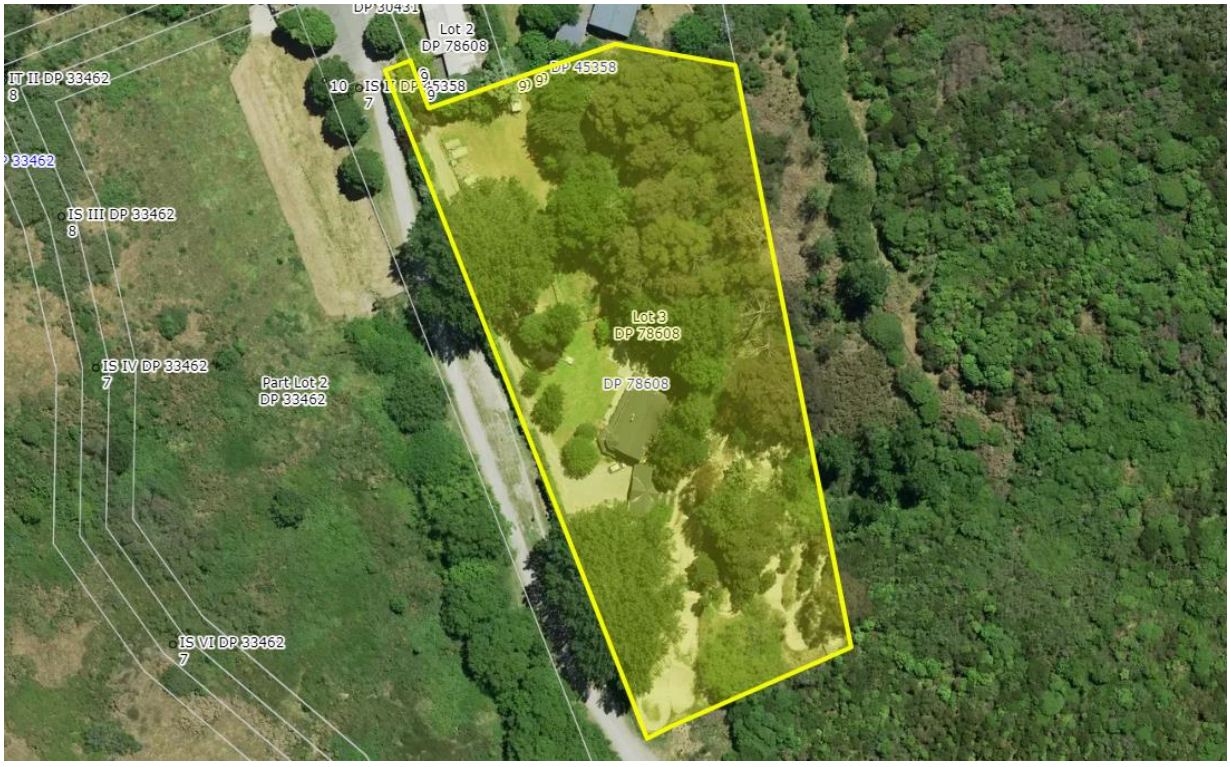
Subdivision & Land Use (Earthworks) Consent Application

169 Bowenvale Ave, Cashmere, Christchurch



Prepared For: Bowenvale Park Estates Limited

Prepared by: Graham Surveying Limited

Project: GSL23152

Date: December 2023

Document History

Version	Effective Date	Description of Revision	Prepared by:	Reviewed by:
1	22/12/2023	Subdivision Application	Megan Austin	Jitske Den Heever

FORM 9: APPLICATION FOR RESOURCE CONSENT

To: Christchurch City Council

1. Bowenvale Park Estates Limited applies for subdivision consent, to subdivide Lot 3 DP 78608 held in Record of Title CB45A/976 into twelve (12) residential allotments, one (1) access Lot, and three (3) right of ways.

   Land use consent is also required to undertake earthworks for pavement construction, drainage and minimal re-contouring of the lots towards the right of way.

2. The proposal is fully described in the attached AEE and plans which forms part of this application.

3. The site at which the proposed activity is to occur is:

   Address: 169 Bowenvale Ave, Cashmere

   Legal Description: Lot 3 DP 78608

   Area: 9686m^2 (more or less)

4. The name of the owners to which the Application relates is Elisa-Jane Currie, Paul Brian Currie, Michael Craig Laing.

5. There are no other activities that are part of the proposal to which this application relates.

6. No additional resource consents are needed for the proposal to which this application relates.

7. We attach an assessment of the proposed activity's effects on the environment that –

   (a) includes information required by clause 6 of Schedule 4 of the Resource Management Act 1991; and

   (b) addresses the matters specified in clause 7 of Schedule 4 of the Resource Management Act 1991; and

   (c) includes such detail as corresponds with the scale and significance of the effects that the activity may have on the environment.

8. We attach an assessment of the proposed activity against the matters set out in Part 2 of the Resource Management Act 1991.

9. We attach an assessment of the proposed activity against relevant provisions of a document referred to in section 104(1)(b) of the Resource Management Act 1991, including the information required by clause 2(2) of Schedule 4 of that Act.

10. We attach information that adequately defines the following:

    (a) the position of all new boundaries; and

    (b) the areas of all new allotments; and

(c) the locations and areas of new reserves to be created, including any esplanade reserves and esplanade strips; and

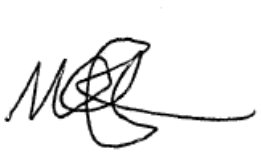
(d) the locations and areas of any existing esplanade reserves, esplanade strips, and access strips; and

(e) the locations and area of any parts of the bed of a river or lake to be vested in the territorial authority under section 237A of the Resource Management Act 1991; and

(f) the locations and areas of any land within the coastal marine area (which is to become part of the common marine and coastal area under section 237A of the Resource Management Act 1991); and

(g) the locations and areas of land to be set aside as new roads.

11. We attach the following further information required to be included in this application by the district plan, the regional plan, the Resource Management Act 1991, or any regulations made under that Act.



Megan Austin

Resource Management Planner

22 December 2023

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Appendices

1 Description of Site and Existing Environment

The application site is located at 169 Bowenvale Avenue, Cashmere and is legally described as Lot 3 DP 78608 and has a site area of 9668m^2 (more or less). A copy of the Record of Title is contained in Appendix A.

The application site is located to the east of Bowenvale Avenue. The site contains an existing residential unit and an accessory building. The majority of the site comprises vegetation – namely large trees and bushland. An existing network waterway is located to the west of the site and runs along the length of Bowenvale Avenue. The waterway is set back more than 15m from the western boundary. Figure 1 below identifies the location of the site.

Land adjoining the site directly to the north at 163 & 165 Bowenvale contains two allotments each comprising a residential unit. There is a large vacant allotment (46.8 ha) to the east and south of the site at 281 Huntsbury known as 'Bowenvale Park', comprising of bushland/mature trees and grassland further towards the south of the site. There is a vacant allotment (1.18ha) to the west of the site at 130 Bowenvale Avenue, and Bowenvale Reserve Track is also located to the west of the site.

Within the wider surrounding environment, the east, south, and west of the site largely comprise vacant green allotments containing vegetation. The site directly to the east and south is zoned 'open space natural zone' and is utilised for recreational purposes. There are popular recreational parks and tracks comprising of Victoria Park to the south, and Mt Vernon Park and Montgomery Spur Reserve to the east. The wider surrounding environment to the north of the site is primarily residential.

Bowenvale Avenue is classified as a local road.

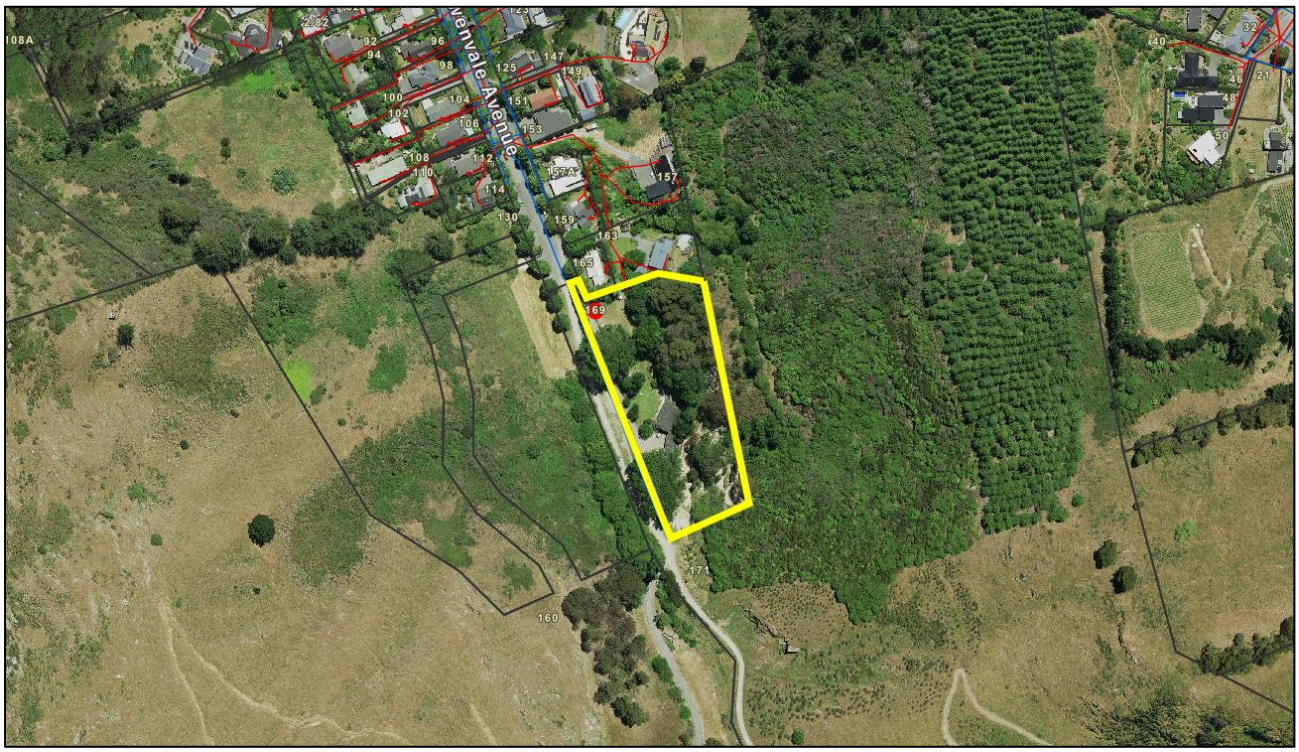


Figure 1 The site at 169 Bowenvale Avenue identified in yellow and the surrounding environment (Source: Canterbury Maps).

2 Description of Proposal

2.1 Subdivision

It is proposed to remove the existing dwelling and related structures in order to subdivide the subject site as described below.

Subdivision consent is sought to subdivide Lot 3 DP 78608 into twelve (12) residential lots, a joint owned access lot (Lot 13), and three private right of ways to service the allotments. A copy of the Scheme Plan is attached in **Appendix B**. Proposed Lots 1 -12 have Lot sizes ranging from 700m^2 – 790m^2. A summary of the proposed new lots to be created by the subdivision is provided in Table 1 below:

Table 1: Nature of the proposed allotments

Proposed Allotments	Lot Area (gross)
Lot 1	*710m^2*
Lot 2	*780m^2 (700m^2 net)*
Lot 3	*775m^2 (700m^2 net)*
Lot 4	*700m^2*
Lot 5	*700m^2*
Lot 6	*770m^2 (700m^2 net)*
Lot 7	*765m^2 (700m^2 net)*
Lot 8	*700m^2*
Lot 9	*700m^2*
Lot 10	*760m^2 (700m^2 net)*
Lot 11	*755m^2 (700m^2 net)*
Lot 12	*710m^2*
JOAL Lot 13	*850m^2*

2.2 Easements

Table 2: Schedule of Proposed Easements

Schedule of Proposed Easements			
PURPOSE	***SHOWN***	***BURDENED LAND***	***BENEFITED LAND***
RIGHT OF WAY	*A*	*LOT 13*	*LOT 1 – 12*
	B	*LOT 2*	*LOTS 1, 3 & 4*
	C	*LOT 3*	*LOTS 1, 2 & 4*
	D	*LOT 6*	*LOTS 5, 7 & 8*
	E	*LOT 7*	*LOTS 5, 6 & 8*
	F	*LOT 10*	*LOTS 9, 11 & 12*
	G	*LOT 11*	*LOTS 9, 10 & 12*
RIGHT TO DRAIN SEWAGE *RIGHT TO CONVEY WATER* *RIGHT TO CONVEY ELECTRICITY* *RIGHT TO CONVEY TELECOMMUNICATIONS*	*A*	*LOT 13*	*LOTS 1 – 12*
	B	*LOT 2*	*LOT 3*
	C	*LOT 3*	*LOT 2*
	D	*LOT 6*	*LOT 7*
	E	*LOT 7*	*LOT 6*
	F	*LOT 20*	*LOT 11*
	G	*LOT 11*	*LOT 10*
RIGHT TO DRAIN WATER	*A*	*LOT 13*	*LOTS 1 – 12 & PART LOT 3 DP*
	B	*LOT 2*	*LOTS 1, 3 & 4*
	C	*LOT 3*	*LOTS 1, 2 & 4*
	D	*LOT 6*	*LOTS 5, 7, 8 & PART LOT 3 DP 28705*
	E	*LOT 7*	*LOTS 5, 6, 8 & PART LOT 3 DP 28705*
	F	*LOT 10*	*LOTS 9, 11, 12 & PART LOT 3 DP 28705*
	G	*LOT 11*	*LOTS 9, 10, 12 & PART LOT 3 DP 28705*
	H	*LOT 6*	*PART LOT 3 DP 28705*
	I	*LOT 7*	
	J	*LOT 10*	

Table 3: Schedule of Existing Easements

Schedule of Existing Easements			
PURPOSE	***SHOWN***	***BURDENED LAND***	***BENEFITED LAND***
RIGHT OF WAY *RIGHT TO DRAIN WATER* *RIGHT TO DRAIN SEWAGE* *RIGHT TO CONVEY WATER* *RIGHT TO CONVEY ELECTRIC POWER* *RIGHT TO CONVEY TELEPHONIC COMMUNICATIONS*	*K, L, M, N , O , R & S* *DP 78608*	*LOT 3 DP 78608*	*EC 400757.2*
RIGHT OF WAY	*K, L, M, N, O , R & S* *DP 78608*	*LOT 3 DP 78608*	*T 920309*
RIGHT TO CONVEY WATER	*K, L & S* *DP 78608*	*LOT 3 DP 78608*	*A364090.4*

2.3 Roading and Access

Lot 13 is a jointly owned access lot which will serve to provide direct access from Bowenvale Avenue along the western boundary of the site. The access lot will have a formed width of 5.5m and a legal width of 6.2m and will connect to the three proposed Right of Ways to service the allotments as shown on the plans in the Servicing Report contained in **Appendix D**.

The right of ways have an initial access width between 4.9 – 5m which transitions to a width of 4m along the main length of each access. The right of way shown by easements ‘B & C’ is located towards the north-west boundary of the site and will serve proposed Lots 1 – 4. Right of Way ‘D & E’ is positioned within the centre west of the site and will service Lots 5 – 8. The third right of way ‘F & G’ is located towards the south-west boundary of the site and will serve lots 9 – 11.

2.4 Existing and Proposed Services

The existing wastewater, stormwater and supply pipes around the existing site area are shown in Figure 2 below.

***Figure 2**: Existing services at 169 Bowenvale Ave. (Source: Christchurch City Council three waters advanced asset network map).*

2.5 Infrastructure

Wastewater

As detailed in the Servicing Report (**Appendix D**) the existing gravity sewer reticulation network main will be extended up to Bowenvale Avenue. It is proposed that the new 150mm diameter main will be extended for 135 metres along the accessway. All lots will be serviced via individual 100mm diameter connections.

The proposed waterway layouts are shown on the Infrastructure Servicing Plan in the servicing report, attached in **Appendix D**.

Stormwater

There is an existing open drain and stormwater reserve located at the top of Bowenvale Avenue. It is proposed to discharge all runoff associated with the site to the stormwater reserves, as depicted in the servicing layout plan. All stormwater within the ROW will be discharged to the public stormwater network within Bowenvale Avenue.

The Engineering Report outlines the proposal to also treat the stormwater via a StormFilter proprietary treatment device in a trafficable manhole, or equivalent treatment device if approved by CCC. Stormwater detention will also be achieved with 30m^3 roof tanks to be utilised on each site to achieve hydraulic neutrality.

All lots will be designed to ensure that a secondary overflow path out to the road network is available for events that exceed a 2% annual exceedance probability and the capacity of the new stormwater system.

The proposed stormwater layout is shown on the Infrastructure Servicing Plan contained within the Servicing Report in **Appendix D**.

Water Supply

A new 150mm water main is proposed to be constructed at 130 Bowenvale Avenue. This main will be extended for a length of 180m along the site and up the new accessway. Each lot will be provided with individual toby boxes and water laterals. The proposed water supply layout is attached in the appended copy of the Servicing Report in **Appendix D**.

A new fire hydrant will be installed on the 150mm line, and an existing fire hydrant is located within 270m of the furthest proposed unit located within the site. The water supply design will comply with Part 7 of the CCC Engineering Code of Practice.

Electrical & Telecommunications

There are existing power and telecommunication services located in Bowenvale Avenue that will be available to service the developments. Orion and Enable will be engaged to provide design plans for construction once the resource consent has been granted.

2.6 Land use Consent

Earthworks

Land use consent is required to undertake earthworks. The earthworks will be limited to cut/fill for the pavement construction and drainage, and minimal re-contouring of the lots.

Earthworks will have a cut volume of 600m^{3}and a fill volume of 200m^3 over an area of roughly 5,500m^2.

The proposed earthworks will be setback from the network waterway by at least 17m.

An Erosion and Sediment control plan (ESCP) will be completed, and controls will be installed as per Christchurch City Council approved Engineering Approval plans and in general accordance with Environment Canterbury best practice guidelines.

The proposed earthworks plan is attached in **Appendix D**.

2.7 Natural hazards (rockfall and slope instability)

A geotechnical investigation has been carried out by Subterra Limited with regard to the proposed subdivision. The findings of the Geotechnical Investigation are summarised below:

- According to the GNS Geological Unit QMap, the site is underlain by Neogene igneous rocks, comprising of basaltic (hawaiite_ to trachytic lava flows interbedded with tuff and breccia (including lahars), many dies and minor lava domes (Mvl).
- According to available information, the closest mapped area (on Bowenvale Avenue approximately 950m north of the site) indicates a predicted 85th percentile groundwater depth of at least 5.0m. During site investigation groundwater was not encountered during intrusive investigation to a maximum investigation depth of 4.2m below ground level.
- According to available information, the site is likely not subject to liquefaction and the risk is nil to minor. The investigation considered that the future land performance of the site is likely to be within the limits of MBIE land classification Technical Category 1 (TC1), were the site to be categorised using the MBIE Technical Category definition.
- The report outlines that the potential geotechnical constraints at the site relate to rockfall risk and slope instability. The report outlines that Lots 1-4 & 8 do *not* have a risk of rockfall, and are thus suitable for residential development; however, Lots 5-7 & 12 have limits risk of rockfall.
- According to available information the site is not located within a flood management area.

In terms the rock fall hazard the following recommendations have been made with regard to the rockfall risk and slope instability:

- The geotechnical investigation recommended that Lots 5 – 7 and 12 and need to have a 5m setback (no build buffer zone) from the predicted rockfall paths.

The investigation noted that Lots 9, 10, or 11 have a risk of rockfall and should not be developed without further comprehensive rockfall modelling and Annual Fatality Risk (AIFR) calculations to determine the appropriate remediation to mitigate the rockfall risk.

We propose a condition of consent that comprehensive rockfall modelling be undertaken prior to the construction of dwellings on proposed lots 5 – 7 and 9 - 12 and that the future development of these lots must comply with all necessary mitigation measures recommended in the Detailed Rockfall Assessment.

Please refer to **Appendix C** for a copy of the full Geotechnical Report which includes the Statement on Professional Opinion.

2.8 Contaminated Land

The application site has not been identified on Environment Canterbury's Listed Land Use Register as a HAIL (Hazardous Activities and Industries List) site. There is no evidence to suggest any activity listed on the HAIL register has occurred or is more than likely that to have occurred on the site.

The National Environmental Standard for assessing and managing contaminants in soil to protect human Health (NESCS) is therefore not considered relevant to this application.

3 Christchurch District Plan Assessment

3.1 Plan Change 14 Housing and Business Choice

Plan change 14 (PC14) for Christchurch District Plan was notified on 17th March 2023 which proposes amendments to objectives, policies and rules associated with residential development within residential zones in accordance with the Medium Density Residential Standards (MDRS) in Schedule 3A of the RMA 1991 as amended on 20 December 2021.

In terms of PC14, the site is identified as being within the Residential Hills Zone. This zone is not proposed to change. The site has the Qualifying Matters of 'low public transport accessibility' and 'slope hazard'.

Note: The Christchurch City Council has asked for a pause of Plan Change 14 as of the 6th of December 2023.

3.2 Zoning and Overlays (Operative Plan)

The Application site is zoned Residential Hills. The site is subject to the following overlays:

- Christchurch International Airport Protection Surface
- Network waterway
- Water body setback
- Liquefaction Management Area – north-west half of site
- Remainder of Port Hills and Banks Peninsula Slope Instability Management Area – ½ way through site to the northeast to the south west
- Rockfall Management Area – southeast ½ of site

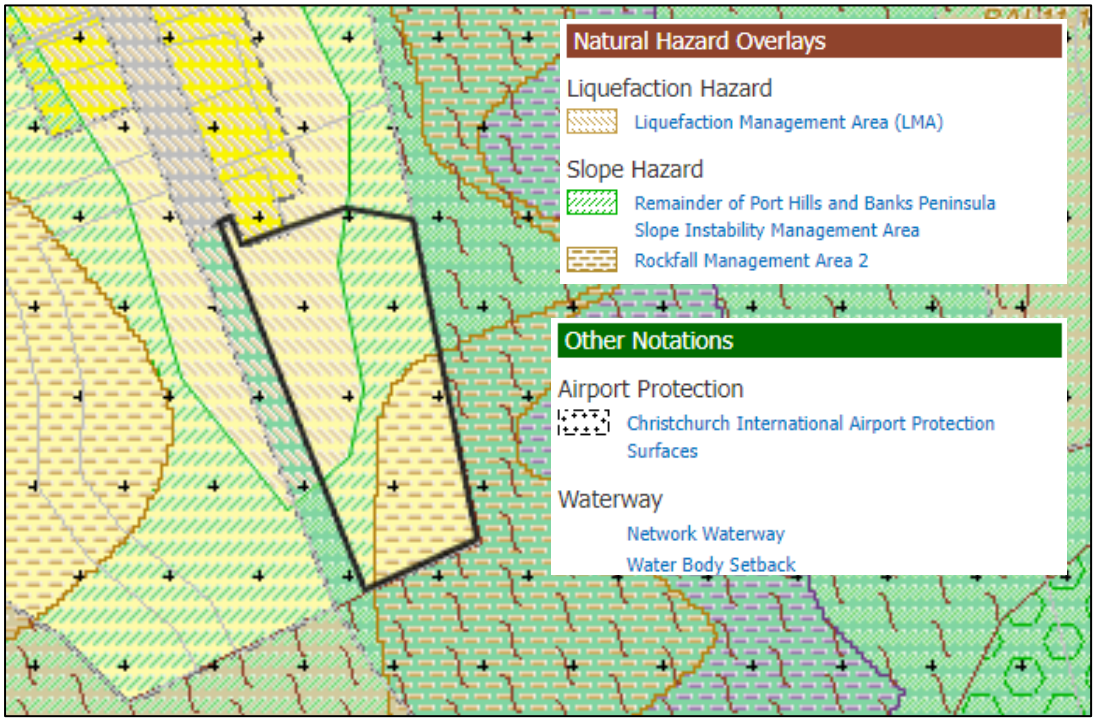


Figure 3 Applicable Christchurch District Plan overlays (Source: Christchurch District Plan).

3.3 Operative Plan Activity Status Assessment

Chapter 5 – Natural Hazards

Chapter 5.5 Liquefaction Hazard			
Rule Number	***Standard***	***Assessment***	***Activity Status***
5.5.2 C1- Liquefaction Hazard	Any subdivision which creates an additional vacant allotment or allotments in the LMA.	The site is partially located within the LMA and creates additional vacant allotments.	**C1**
5.5.3 RD1 – Liquefication Hazard	a. Any activity located on a site with an area of 1500m^2 or more, qualifying as a controlled or restricted discretionary activity under any of the following residential rules: …	The site is greater than 1500m^2. However, the site does not qualify under any of the specified rules.	**N/A**
Chapter 5.6 Slope Instability			
Rule Number	***Standard***	***Assessment***	***Activity Status***
Table 5.6.1.1a: **a. Subdivision:** **RD1 (Rockfall Mgmt Area 2) &RD3 (Remainder of Port Hills and Banks Peninsula slope Instability Mgmt Area**	The activities listed below have the activity status listed within each slope Instability Management Area. In relation to restricted discretionary activities, discretion to grant or decline consent and impose conditions is restricted to the matters of discretion set out in Rule 5.6.1.6 Table 5.6.1.1a - Subdivision	The proposal is for a subdivision in the Rockfall Management Area (RD1) and in the Remainder of Port Hills & Banks Peninsular Slope Instability Management Area (RD3).	**Restricted Discretionary**
Table 5.6.1.1a **b. Earthworks, except where specifically provided below in Rule 5.6.1:** **RD4 (Rockfall mgmt. Area).**	The activities listed below have the activity status listed within each slope Instability Management Area. In relation to restricted discretionary activities, discretion to grant or decline consent and impose conditions is restricted to the matters of discretion set out in Rule 5.6.1.6 Table 5.6.1.1a – Earthworks except where specifically provided below in Rule 5.6.1.1	The proposal includes earthworks within the Rockfall Management Area.	**Restricted Discretionary**

Chapter 6 – General Rules and Procedures

Chapter 6.6 Waterbody Setbacks			
Rule Number	***Standard***	***Assessment***	***Activity Status***
6.6.4.1 (P4) Removal or demolition of any building or part of a building including	a) No lawfully established flood protection or erosion or bank stability control structures shall be removed. b) No parts of the structure shall remain in the water body setback that could catch debris or otherwise affect land drainage. Advice note:	The existing dwelling is setback approximately 40m from the network waterway and removal and demolition of the existing building and related works will comply with the standards	**Permitted**

associated earthworks	1. The Council's Water Supply, Wastewater and Stormwater Bylaw 2014 applies. 2. The Canterbury regional plans include provisions for earthworks in riparian margins and provisions in relation to dust control. 3. Erosion and sediment control guidance is available from the Canterbury Regional Council and may be of assistance.		
6.6.4.1 (P5) – Impervious surfaces	The total area of impervious surfaces shall not exceed 10% of the waterbody setback area within any site in any zone, expect an open space zone or the Transport Zone….	The proposed jointly owned access lot is located at least 14m from the network waterway setback and as such no impervious surfaces are proposed within the waterway setback for the drainage channel located to the west of the site. .	**N/A**
6.6.4.1 (P6) – Fencing	a. Shall not be built over any part of a water body. b. Shall allow access to the water body for maintenance purposes. c. Shall not be located closer to the water body bank than 3 metres or 1/3 of the normal water body setback distance, whichever is the greater. d. Shall consist of no greater than 20% solid structure. Exceptions: 1. Temporary fencing or construction hoarding remaining on a site for less than three months are exempt from the activity specific standards. 2. Where a legal road, esplanade reserve or esplanade strip exists between the water body and the fence, the activity specific standards shall not apply.	No fencing is proposed within the 5m waterway setback. Fencing for proposed Lots 1 and 12 shall be considered at the time of any future build.	**N/A**
6.6.4.1 (P7) Culvert crossings for network waterways	Culvert crossings for network waterways – shall be designed in accordance with Council's Waterways, Wetlands and Drainage Guide.	Not Applicable.	**N/A**
6.6.4.3 (RD1) - Earthworks	Earthworks: a. not exempt by Rule 6.6.3 h. and not provided for by Rule 6.6.4.1 P1; and/or b. listed in Rule 6.6.4.1 P1 that do not meet one or more of the activity specific standards; other than earthworks provided for by Rule 6.6.4.4 D1 or D2	The Christchurch District Plan maps identify that there is a network waterway setback applicable to the site. The existing drain runs down the western boundary of the site. All earthworks will be setback more than 5m from the waterway (proposed setback of 27m).	**N/A**

Chapter 6.7 Aircraft Protection			
Rule Number	***Standard***	***Assessment***	***Activity Status***
6.7.4.1 (P1)	Any activity not specifically provided for as a restricted discretionary or prohibited activity in Rules 6.7.4.1.3 or 6.7.4.1.6	Complies.	**PERMITTED**

Chapter 7 – Transport

Chapter 7 Transport			
Rule Number	***Standard***	***Assessment***	***Activity Status***
7.4.3.7 Access design	a. Any activity with vehicle access shall be designed in accordance with Appendix 7.5.7 (where relevant): - Any vehicle access longer than 50m and with a formed width less than 5.5m wide shall provide passing opportunities (with a min width of 5.5m) at least every 50m, with the fist being at the site boundary. - Where a vehicle access serves 9 or more parking spaces or residential units and there is no other pedestrian and/or cycle access available to the site then a minimum 1.5m wide space for pedestrians/cycle shall be provided and the legal width of the access shall be increased by 1.5m. - Accessways serving between 9-15 residential units shall have a minimum legal width of 5.0 and a minimum formed width of 4m.	- The vehicle access is longer than 50m and has a formed width of 5.5m - The vehicle access serves 12 allotments, and has a legal width of 6.2m. The access does not comply with the 1.5m width requirement for pedestrian and cycle access and falls short by 0.3m.. - The vehicle access meets the minimum legal width requirement of 5m and formed width of 4m (5.5m & 6.2m proposed). - The proposed right of ways each have a minimum formed width of 3m and legal width of 4m.	**Restricted Discretionary 7.4.2.3 RD1**
	b. Any activity providing 4 or more car parking spaces or residential units – Queuing space	At this stage the number of car parks are unknown, however for 11-20 parks – provide 6m queuing space. The plan proposes legal width of 6.2m that meets the required 6m queuing space.	**Permitted**
	c. Outside the Central City, any vehicle access: - to an urban road serving more than 15 car parking spaces or more than 10 heavy vehicle movements per day; and/or - on a key pedestrian frontage: Either an audio and visual method of warning pedestrians of the presence of vehicles or a visibility splay in accordance with Appendix 7.5.9 shall be provided. If any part of the access lies within 20m of a Residential Zone any audio method should not operate between 20:00 and 08:00 hours.	N/A	**N/A**
	d. N/A	N/A	**N/A**

	e. N/A	N/A	**N/A**
7.4.3.8 Vehicle crossings	a. Any activity with a vehicle access to any road or service land – a vehicle crossing shall be provided constructed from the property boundary to the edge of the carriageway/service lane.	The vehicle crossing of the JOAL complies with this standard.	**Permitted**

Chapter 8 – Subdivision

Chapter 8.5 Subdivision Activity Status			
Rule Number	***Standard***	***Assessment***	***Activity Status***
Rule 8.5.1.2 C4	Subdivision to create allotments for access, utilities, emergency service facilities, utilities, roads and reserves.	The minimum net site area requirements do not apply for Access Lot 13.	**Permitted**
Rule 8.5.1.2 C6	Subdivision providing for residential activity in the Residential Hills Zone. a. Activity standards in Rules 8.6.1 – 8.9.9 and 8.6.12 b. An identified building area must be shown on the scheme plan of subdivision on every allotment on which a residential unit is anticipated. c. Where the site contains an existing residential unit at the time the subdivision is made, the identified building area must include the existing residential unit, or it must indicate that the residential unit will be removed from the site altogether or that it will be relocated to an identified building area for that site. d. The identified building area must: i. Include a single area of land of not less than 100m^2 and no greater than 2000m^2 which is capable of containing a residential unit; Include curtilage area continuous to the area identified	The Geotechnical Report has identified that Lots 1-8 and 12 are considered suitable for development, provided future dwellings within lots 5-7 & 12 observe a 5m setback. Despite this, no identified building area has been shown on the scheme plan. Therefore, the proposal does not comply with this standard. A detailed rock assessment is currently being undertaken to provide mitigation measures for lots 9-11 before the lots can be deemed suitable for development.	**Does Not Comply**
Rule 8.5.1.3 RD2	subdivision in any zone that does not meet any one or more of the relevant standards in: i) Rule 8.5.1.2 C5, c8; OR ii) Rule 8.5.1.3 RD7 Except as otherwise specified in: i) Rule 8.5.1.4 D1 to D5; and ii) Rule 8.5.1.5 NC1 to NC8	This rule applies to the subdivision. No identified building areas are proposed on the plan.	**Applies – Restricted Discretionary**
Rule 8.5.1.3 RD2	subdivision in any zone that does not meet any one or more of the relevant standards in: iii) Rule 8.5.1.2 C5, c8; OR iv) Rule 8.5.1.3 RD7	The proposal does not comply with the activity standard 'Service lanes, cycle ways and pedestrian access ways' (8.6.5) as the pedestrian access way	**Applies – Restricted Discretionary**

	Except as otherwise specified in: iii) Rule 8.5.1.4 D1 to D5; and iv) Rule 8.5.1.5 NC1 to NC8	does not meet the required 1.5m width (1.2m proposed).	
Rule 8.9.2.1 - Earthworks	a. Earthworks shall not exceed the volumes in Table 9 over any 12 month time period – **20m3/site.** b. Earthworks in zones listed in Table 9 shall not exceed a maximum depth of 0.6m, other than in relation to farming activities, quarrying activities or permitted education activities.	Approximately 800 m^3 of earthworks are proposed with a maximum volume of cut of approximately 600 m^3 and maximum volume of fill of 200 m^3. The maximum depth of cut shall not exceed 0.6m	**Restricted Discretionary 8.9.2.3 (RD1)**
Chapter 8 >> Subdivision Activity Standards			
Activity Standards			
8.6.1 Minimum net site area and dimensions	8.6.1(a) Allotments in the Residential Hills Zone shall have a minimum dimension of 16m x 18m. 8.6.1(d) Allotments shall comply with Table 1; Minimum net site areas for Residential Hills Zone is 650m^2 8.6.1a, c, e-g	All proposed allotments meet the minimum required dimension and net site area.	**Complies**
8.6.2 Allotments with existing or proposed buildings	Where an allotment is to be created around an existing building (that has been constructed to the extent that its exterior is fully closed in), or a proposed building (where the subdivision consent is to be issued at the same time as, or after, the building consent for that has been issued …	The existing dwelling and structures are proposed to be demolished. The allotments do not include existing buildings.	**N/A**
8.6.3 Access	a. All sites shall have access which is able to allow vehicles to pass to and from a formed road, and such access shall be in accordance with Appendix 8.10.2 to this chapter and the standards set out in Chapter 7 b. Access shall not be to a state highway, limited access road or across a rail line.	a. Complies – refer to Chapter 7 above b. N/A	**Complies**
8.6.5 Service lanes, cycle ways and pedestrian accessways	a. Service lanes, cycle ways and pedestrian access ways shall be laid out and vested in accordance with the standards set out in Table 7 below.	A 1.5m pedestrian access must be provided. The proposal only provides 1.2m, therefore, is not compliant with this standard.	**Restricted Discretionary 8.5.1.3 RD2**
8.6.6 Esplanade reserve strip or additional land	Esplanade reserves and strips shall be provided in accordance with Appendix 8.10.1.	N/A	**N/A**
8.6.7 Water supply	a. All allotments shall be provided with the ability to connect to a safe potable water supply. b. Provision shall be made for sufficient water supply and access to water	All allotments will be serviced by Councils reticulated water supply. Provision shall be made for sufficient water supply and	**Complies**

	supplies for firefighting consistent with the New Zealand Fire Service Firefighting Water Supplies Code of Practice (SNZ PAS:4509:2008), except where the allotment is for a utility, road, reserve or access purposes.	access to water supplies for firefighting.	
8.6.8 Wastewater disposal	a. All allotments shall be provided with the ability to connect to a wastewater system. A valid certificate, issued in accordance with Rule 8.4.1.3, is held which certifies that the wastewater system has adequate capacity for the respective potential land uses on all proposed allotments, except where a relevant outline development plan shows that adequate wastewater capacity is available. b. Where a reticulated sewer is available, and discharge is accepted in the Council's network, each new allotment shall be provided with a piped outfall connection laid at least 600mm into the net site area of the allotment. c. Where a reticulated sewer is not available, all allotments shall be provided with a means of disposing of sanitary sewage within the net site area of the allotment. d. /	All lots will be serviced by Council's reticulated wastewater system via connecting to the existing gravity sewer reticulation network and extending this a further 135m up the accessway.	**Complies**
8.6.9 Stormwater disposal	a. All allotments shall be provided with a means for the management of collected surface water from all impervious surfaces. Where discharge is accepted in the Council's network, each new allotment shall be provided with a piped outfall laid at least 600mm into the net area of the allotment.	All runoff associated with the site will be discharged to the stormwater reserve, in line with the global consent. Stormwater within the ROW will be reticulated via kerb & channel, sumps and pipework prior to discharge to the public stormwater network within Bowenvale Avenue. Refer to the Infrastructure report attached as Appendix D.	**Complies**

For completeness, please note that the Chapter 14 standards are not relevant as this proposal entails the vacant subdivision of the site and no new dwellings are proposed as part of this application.

4.1 Conclusion with Respect to Assessment of District Plan

Overall, the proposal has a restricted discretionary status as summarised below:

- Rule 8.5.1.3 (RD2): There is no identified building area specified on the plans
- Rule 8.5.1.3 (RD2): The pedestrian access is 0.3m short of the required 1.5m width.
- Rule 5.5.2 (C1): The site creates additional vacant allotments within the Liquefaction Management Area.
- Rule 5.6.1.1 (RD1), (RD3) & RD4): Subdivision in the Rockfall Management Area & the Slope Instability Area, and earthworks in the Rockfall Management Area.
- Rule 8.9.2.3 (RD1): Earthworks that exceed the maximum earthwork volumes.
- Rule 7.4.2.3 (RD1): The pedestrian access does not meet the required 1.5m width.

5 Assessment of Effects on the Environment

5.1 Introduction

Section 88 of the Resource Management Act 1991 (the RMA) sets out the requirements for persons making an application to a local authority for a resource consent and requires that any application for a Resource Consent include an assessment of any actual or potential effects that the activity may have on the environment, and the ways in which any adverse effects may be mitigated. This section also requires that any assessment shall be in such detail as corresponds with the scale and significant of the actual and potential effects that the activity may have on the environment and shall be prepared in accordance with the Fourth Schedule of the RMA. This assessment has been made in accordance with both these requirements.

As a restricted discretionary activity, the assessment of effects of the subdivision and associated land use are limited to the matters over which the Council has limited its discretion in Chapters 5 and 8 of the Operative District Plan.

In this case the effects of the proposal are considered to relate to subdivision design, pedestrian access, servicing, natural hazards, general hazards, and earthworks. The following is an assessment of the relevant matters:

5.2 Subdivision Design

Subdivision Design and Layout

The proposed subdivision creates allotments that are a sufficient size and dimension to fit into the existing surrounding environment. The proposed boundaries are based on ensuring that the proposed allotments are of adequate size (700m – 780m) for the Residential Hills Zone.

Despite not providing 'identified building areas' on the plan, the proposed vacant lots will be able to accommodate a building area (built platform) of at least a 100m² that is located outside of the required setbacks. As such any future dwellings on the proposed lots can easily comply with the required development standards of the CCC-DP in the event that it does not, a resource consent will be required, and any adverse effects will be assessed at that stage.

The proposed subdivision will maintain a suitable relationship to nearby properties and provide for the planned character anticipated for the zone. The subdivision will complement the existing residential character of the immediate area and provides for a layout that is efficient, safe, and accessible.

Subdivision effects on the wider environment and persons within the immediate surrounding environment will be less than minor and acceptable.

Access

Right of way easements are proposed to ensure each allotment will have rights to utilise the legal access to Bowenvale Avenue (Lot 13). The JOAL will be properly constructed to the carriageway and meets the minimum required formed width.

Pedestrian access way

The vehicle access (Lot 13) will serve 12 allotments, as such, the District Plan requires the access to increase by 1.5m in width to service pedestrians and cyclists. The access does not comply with this increase and will have a shortfall of 0.3m (1.2m proposed). Notwithstanding, the shortfall of 0.3m will be less than minor and acceptable as the 1.2m pedestrian access will allow sufficient space for pedestrian and/or cyclist use.

The JOAL (Lot 13) will not be highly trafficked or at a high-speed environment. Users of the JOAL will be regular users and will be aware of constraints and pedestrian movement. As such, safety effects on users of the pedestrian access will be less than minor and acceptable.

Servicing and Infrastructure

Each allotment will have access to public water, wastewater, stormwater, electricity, and telecommunication connections. Appropriate easements are in place as per the schedule of easements listed in section 2.2.

The design and construction of infrastructure which will serve the development will comply with the requirements of the Christchurch City Council's Infrastructure Design Standard and Construction Specification. Once the resource consent has been granted, all electricity and telecommunications will be designed to utility and industry standards.

As such, all lots will have legal access and all necessary servicing provided for this stage of development. The subdivision will not have any significant adverse effects on the wider environment or persons within the immediate surrounding environment.

5.3 Transport

Pedestrian access

As stated in the above section, the vehicle access (Lot 13) does not comply with the required pedestrian access width requirement of 1.5m. Notwithstanding, the accessway will have a less than minor effect on the safety and security of people driving in and out of the site as there is sufficient room for two-way vehicle traffic to safely pass pedestrians (4m), and adequate room for both pedestrians and cyclists to access the Lots (1.2m). The shortfall is minimal and will not adversely affect the safety and amenity values of neighbouring properties and/or the function of the transport network as the shortfall will have a negligible effect and the access will only be utilised by residents and visitors of the 12 Lots.

5.4 Natural Hazards

Liquefaction

The site is identified within the Christchurch District Planning Maps as being within a Liquefaction Management Area.

The proposal will result in the creation of 12 allotments, 11 of which will be vacant. A Geotechnical Report was prepared by Subterra Limited at 169 Bowenvale and includes a Statement of Professional Opinion on the suitability of the site for subdivision under Section 106 of the RMA.

The report classifies the site as containing 'Technical Category 1 (TC1) land, and outlines that the risk of static subsidence is considered low. Despite this, Subterra Limited have provided recommendations to ensure that any potential effects from subsidence will be appropriately mitigated. These recommendations include providing for foundations which are on a suitable bearing stratum and are subject to specific engineering design, as well as including that any backfill above existing ground level should be undertaken from a professional geotechnical engineer.

The proposed allotments are of an appropriate size, design, and location, and the earthworks have been kept to a minimal. All future built form will be constructed in accordance with the recommendations stipulated in the Geotechnical Report.

The proposed subdivision will not exacerbate the extant risk of liquefaction to either future occupiers of the site or neighbouring properties. To this effect, any adverse effects relating to liquefaction will be less than minor. Please refer to **Appendix C** for the full Geotechnical Report.

5.5 General Hazards

Subdivision in the Rockfall Management Area & Slope Instability Management Area and Earthworks in the Rockfall Management Area

The proposal is for a subdivision in the Rockfall Management Area (RD1) and in the Remainer of the Port Hills & Slope Instability Management Area (RD3), and for earthworks in the Rockfall Management Area (RD4). As stated in Section 2.8, the Subterra Geotechnical Report outlined that the potential geotechnical constraints at the site are rockfall risk and slope instability.

The report provides a detailed assessment in regards to rockfall and slope instability, and outlines the different methods used to assess risk. It was considered that '*there are no reasons from a geotechnical perspective that proposed Lots 1-8 and 12 are considered unsuitable for development, provided any development is undertaken with appropriate engineering design measures.'*

It was noted however, that a detailed rockfall report will be required for the applicant to develop on Lots 9, 10, or 11, or if the applicant wishes to build within the 'no buffer' (5m setback zone) of Lots 5, 6, 7, and 12. The applicant has currently engaged Subterra Geotechnical to prepare this rockfall report, and has agreed to propose a condition of consent that specifies that all affected Lots will be required to show they meet the mitigatory measures stipulated in the report.

Accordingly, all future developments proposed for the site will be designed in accordance with the appropriate mitigation measures outlined in the rockfall report, because of this, it is considered that any actual or potential adverse effects emerging from the subdivision in regard to natural hazards to be less than minor and acceptable.

Please refer to **Appendix C** for the full Geotechnical Report.

5.6 Earthworks

Earthworks are required to enable the development of residential allotments and the construction of the access way (Lot 13). Approximately 800m^3 of earthworks are proposed, including 600m^3 of cut, and 200m^3 of fill. The proposed subdivision therefore has the potential to create adverse effects in terms of nuisance, land stability, amenity and natural values.

Earthworks during construction activities are proposed to manage effects such as runoff, noise, dust and vibration, resulting from the earthworks during the earthworks stage.

Effects will be managed through:

- An Erosion and Sediment Control Plan will be completed as part of the Engineering Approval, and Erosion and Sediment Controls will be installed as Per Christchurch City Councils approved Engineering Approval plans in general accordance with Ecan's best practice.
- All earthworks will be carried out in accordance with Councils requirements through Environment Canterbury's Toolbox, with silt fencing and a stabilised construction accessway. Effectively managing the effects from the proposed construction on site, minimising noise, dust and vibrations resulting from earthworks.
- It is noted that the effects from earthworks are temporary in nature and once construction is completed, no additional adverse effects are anticipated in relation to earthworks.
- No unusual construction techniques are required, and significant excavation or fill is not required. As such, it is expected that earthworks will comply with the permitted construction noise and vibration standards, and standard noise control practices will suitably mitigate these effects.

In terms of surface water drainage, as detailed in the earthworks plan attached in **Appendix D**, earthworks are kept to a minimum. The contours of the site mostly blend into the design and all surface water drainage will drain into the proposed network and away from neighbouring properties ensuring the proposal will not adversely impact on adjoining lands surface drainage. Further, in terms of land stability and amenity values the level of fill will not affect the stability of adjoining land in respect of subsidence and the level of alteration remains consistent with the surrounding land maintaining amenity in terms of views and outlook.

The earthworks proposed as part for the proposal are limited in duration, consistent with the scale of development on the site and will be undertaken in accordance with best practice site management techniques so as to not cause any significant adverse amenity effects on the

wider environment and persons. Overall, potential effects of earthworks are considered to be less than minor.

Summary

Overall, it is considered that the actual and potential effect of the subdivision are less than minor and acceptable.

6 Objectives and Policies

6.1 Operative Christchurch District Plan

Chapter 5 – Natural Hazards

5.2.1.1 Objective - Natural hazards

a. The Objective for this chapter is Objective 3.3.6 in Chapter 3 Strategic Directions.

3.3.6 Objective – Natural Hazards

a. New subdivision, use and development (other than new critical infrastructure or strategic infrastructure to which paragraph b. applies):

i. is to be avoided in area where the risks from natural hazards to people, property and infrastructure are assessed as being unacceptable; and

ii. in all other areas, is undertaken in a manner that ensures the risks of natural hazards to people, property and infrastructure are appropriately mitigated.

5.2.2.1.1 Policy - Avoid new development where there is unacceptable risk

a. Avoid new subdivision, use and development, including new urban zonings, where the risk from a natural hazard is assessed as being unacceptable.

5.2.1.1.4 Policy - No transferring of natural hazard risk

a. Ensure that subdivision, use and development (including proposals for hazard mitigation works or hazard removal) do not transfer or create unacceptable natural hazard risk to other people, property, infrastructure or the natural environment.

5.2.2.3.1 Policy - Management of liquefaction risk

a. Map the Liquefaction Management Area based on a district-wide assessment of where damaging liquefaction is more likely to occur.

b. Provide for rezoning, subdivision, use and development on flat land where liquefaction risk has been appropriately identified and assessed, and can be adequately remedied or mitigated.

5.2.2.4.1 Policy – Slope Instability

In slope instability hazard management areas in the Port Hills and across Banks Peninsula:

i. Avoid subdivision, use and development where the activity will result in an unacceptable risk to life safety (AIFR>10-4 using the GNS Science method and parameters for establishing life safety risk), taking into account all relevant site-specific information and any hazard mitigation works proposed; and

ii. Otherwise, manage subdivision, use and development so that risk of damage to property and infrastructure is mitigated to an acceptable extent.

5.2.2.4.3 Policy – Slope instability for all of the Port Hills and Banks Peninusula

iii. In areas not already identified in Policy 5.2.2.4.1a as being subject to cliff collapse, rockfall or mass movement, but where the land may be subject to slope instability:

iv. To the extent appropriate, require proposals for subdivision, use and development to be assessed by a geotechnical specialist to evaluate the presence of hazards and level of risk to people and property (including infrastructure) from slope instability hazards; and

v. Only allow subdivision, use and development where risk can be reduced to an acceptable level.

As detailed in Section 5 of this document, the site is located within a Liquefaction Management Area, and within a Rockfall Management Area and Slope Instability Management Area. On behalf of the applicant, Subterra Limited have prepared a geotechnical assessment in respect of the proposed subdivision. In summary Subterra Ltd identify that based on their assessment, the risks from liquefaction subsidence are considered low, and the risk from rockfall is considered appropriate for Lots 1-4 & 8. Despite this, Lots 9-11 have a clear risk of rockfall and should not be developed without further rockfall modelling, and a setback buffer has been recommended for Lots 5-7 & 12.

A detailed rockfall report is currently being prepared by Subterra Geotechnical which will seek to provide appropriate recommendations to mitigate the risk from rockfall, especially for Lots 9-11. Any proposed mitigatory measures specified in the report will be implemented before the sites are further developed. As a result, the proposal is considered to be consistent with the relevant objectives and policies.

Chapter 7 – Transport

7.2.1 Objective - Integrated transport system for Christchurch District

a. An integrated transport system for Christchurch District

i) That is safe and efficient for all transport modes;

ii) That is responsive to the current recovery needs, and enables economic development, in particular an accessible Central City able to accommodate projected population growth;

iii) That supports safe, healthy and liveable communities by maximising integration with land use;

iv) That reduces dependency on private motor vehicles and promotes the use of public and active transport;

v) That is managed using the one network approach

7.2.1.3 Policy – Vehicle access and manoeuvring

a. Provide vehicle access and manoeuvring, including for emergency service vehicles, compatible with the road classification, which ensures safety, and the efficiency of the transport system.

7.2.1.6 Policy – Promote public transport and active transport

a. Promote public and active transport by:

i. *Ensuring new, and upgrades to existing, road corridors provide sufficient space and facilities to promote safe walking, cycling and public transport, in accordance with the road classification where they contribute to the delivery of an integrated transport system;*
ii. *Ensuring activities provide an adequate amount of safe, secure, and convenient cycle parking and, outside of the Central City, associated end of trip facilities*
iii. *Encouraging the use of travel demand management options that help facilitate the use of public transport, cycling, walking and options to minimise the need for travel; and*
iv. *Requiring new District Centres to provide opportunities for a public, transport interchange.*
v. *Encouraging the formation of new Central City lanes and upgrading of existing lanes in the Central City, where appropriate, to provide for walking and cycling linkages and public spaces.*
vi. *Developing a core pedestrian area within the Central City which is compact, convenient and safe, with a wider comprehensive network of pedestrians and cycle linkages that are appropriately sized, direct, legible, prioritized, safe, have high amenity, ensure access for the mobility impaired and are free from encroachment.*

The proposal is consistent with the objectives and policies of the transport chapter as the JOAL provides sufficient space for both vehicles and pedestrians/cyclists to effectively utilise without causing averse effects on safety and amenity values.

Chapter 8 – Subdivision and earthworks

8.2.2 Objective - Design and amenity and the Meadowlands Exemplar Overlay

a. *An integrated pattern of development and urban form through subdivision and comprehensive development that:*
   i. *provides allotments for the anticipated or existing land uses for the zone;*
   ii. *consolidates development for urban activities;*
   iii. *improves people's connectivity and accessibility to employment, transport, services and community facilities;*
   iv. *improves energy efficiency and provides for renewable energy and use; and*
   v. *enables the recovery of the district.*
b. *A comprehensively planned development in the Meadowlands Exemplar Overlay in the Residential New Neighbourhood (North Halswell) Zone that is environmentally and socially sustainable over the long term.*

8.2.2.2 Policy - Design and amenity / Tohungatanga

a. *Ensure that subdivision;*
   i. *incorporates the distinctive characteristics of the place's context and setting;*
   ii. *promotes the health and wellbeing of residents and communities; and*
   iii. *provides an opportunity to recognise Ngāi Tahu culture, history and identity associated with specific places, and affirms connections between mana whenua*

and place, particularly with sites of Ngāi Tahu cultural significance identified in Appendix 9.5.6.

8.2.2.3 Policy - Allotments

a. *Ensure that the layouts, sizes and dimensions of allotments created by subdivision are appropriate for the anticipated or existing land uses.*
b. *In residential subdivisions (outside the Central City), provide for a variety of allotment sizes to cater for different housing types and affordability.*

8.2.2.4 Policy - Identity

a. *Create or extend neighbourhoods which respond to their context and have a distinct identity and sense of place, by ensuring that subdivision, where relevant:*
    i. *incorporates and responds to existing site features (including trees, natural drainage systems, buildings), cultural elements and values and amenity values (including by taking advantage of views and outlooks);*
    ii. *incorporates public spaces that provide opportunities for formal and informal social interaction;*
    iii. *has a pattern of development that responds to the existing urban context;*
    iv. *is designed with a focus on the use of open space, commercial centres, community facilities, and the use of views;*
    v. *outside the Central City, in addition to iv., is designed with a focus on density, roads, land form, stormwater facilities and, in the Residential New Neighbourhood Zone, development requirements in an outline development plan, as key structuring elements; and*
    vi. *incorporates and responds to Rangatiratanga – the expression of te reo kawa, tikanga, history, identity and the cultural symbols of Ngāi Tahu.*

8.2.2.5 Policy - Sustainable design

a. *Enable resource efficiency, use of renewable energy, and community safety and development, by:*
    i. *ensuring that the blocks and allotments maximise solar gain, including through orientation and dimension;*
    ii. *providing a development pattern that supports walking, cycling and public transport; and*
    iii. *ensuring visibility and interaction between private and public spaces, and providing well-lit public spaces.*

8.2.2.6 Policy - Integration and connectivity

a. *Ensure effective integration within and between developments and existing areas, including in relation to public open space networks, infrastructure, and movement networks.*
b. *Ensure that the boundaries between new and existing developments are, where appropriate, managed to avoid or mitigate adverse effects.*

c. *Outside the Central City, avoid significant adverse effects and remedy or mitigate other adverse effects on existing businesses, rural activities or infrastructure.*

8.2.3 Objective - Infrastructure and transport

a. *Subdivision design and development promotes efficient provision and use of infrastructure and transport networks.*
b. *A legible, well connected, highly walkable, and comprehensive movement network for all transport modes is provided.*
c. *Outside the Central City, land is set aside for services which can also be used for other activities, such as pedestrian or cycle ways.*

8.2.3.2 8.2.3.2 Policy - Availability, provision and design of, and connections to, infrastructure

a. *Manage the subdivision of land to ensure development resulting from the creation of additional allotments:*
    i. *does not occur in areas where infrastructure is not performing, serviceable or functional; and*
    ii. *will be appropriately connected to and adequately serviced by infrastructure, including through any required upgrade to existing infrastructure.*
b. *Ensure that new network infrastructure provided in relation to, or as part of, subdivision development is constructed, designed and located so that it is resilient to disruption from significant seismic or other natural events including by ensuring that, as far as practicable, damage from such events is minimised.*
c. *Ensure that, as part of subdivision, there is adequate provision, with sufficient capacity, to service the scale and nature of anticipated land uses resulting from the subdivision, for:*
    i. *wastewater disposal, including lawful trade waste disposal for anticipated industrial development, consistent with maintaining public health and minimising adverse effects on the environment;*
    ii. *water supply, including water of a potable standard for human consumption, and water for fire fighting purposes;*
    iii. *telecommunication services including connection to a telecommunication system, with new lines being generally underground in new urban areas; and*
    iv. *electric power supply, with new lines being generally underground in new urban areas - including, if necessary, ensuring the provision of new or additional or the upgrading of existing infrastructure in a manner that is appropriate for the amenities of the area.*
d. *Where wastewater disposal is to a reticulated system, ensure all new allotments are provided with a means of connection to the system.*
e. *Where a reticulated wastewater system is not available, ensure appropriate onsite or standalone communal treatment systems are installed.*
f. *Promote use of appropriate on-site measures to manage the effects of trade wastes and reduce peak flows and loading on wastewater systems.*

8.2.3.3 Policy - Transport and access

a. Ensure the provision and development of comprehensive movement networks for all transport modes that:
- *i. are legible, well connected, highly walkable, safe and efficient; and:*
- *ii. enable access by people of all ages and physical abilities to public open space facilities, public transport, suburban centres, and community facilities and to move between neighbourhoods and the wider urban area.*

b. Ensure movement networks enable:
- *i. vehicle parking, which in the Central City should be in accordance with the road classification;*
- *ii. access to properties, including for fire appliances;*
- *iii. street landscaping, including street trees;*
- *iv. safety and visibility;*
- *v. ease of navigation;*
- *vi. surface water management, in relation to movement networks; and*
- *vii. utility services.*

c. Ensure that, where road or property access to an existing road is created, the existing road is of an appropriate standard.

8.2.3.4 Policy - Stormwater disposal

a. District wide:
- *i. Avoid any increase in sediment and contaminants entering water bodies as a result of stormwater disposal.*
- *ii. Ensure that stormwater is disposed of in a manner which maintains or enhances the quality of surface water and groundwater.*
- *iii. Ensure that any necessary stormwater control and disposal systems and the upgrading of existing infrastructure are sufficient for the amount and rate of anticipated runoff.*
- *iv. Ensure that stormwater is disposed of in a manner which is consistent with maintaining public health.*

b. Outside the Central City:
- *i. Encourage stormwater treatment and disposal through low-impact or water-sensitive designs that imitate natural processes to manage and mitigate the adverse effects of stormwater discharges.*
- *ii. Ensure stormwater is disposed of in stormwater management areas so as to avoid inundation within the subdivision or on adjoining land.*
- *iii. Where feasible, utilise stormwater management areas for multiple uses and ensure they have a high quality interface with residential activities or commercial activities.*
- *iv. Incorporate and plant indigenous vegetation that is appropriate to the specific site.*
- *v. Ensure that realignment of any watercourse occurs in a manner that improves stormwater drainage and enhances ecological, mahinga kai and landscape values.*
- *vi. Ensure that stormwater management measures do not increase the potential for birdstrike to aircraft in proximity to the airport.*
- *vii. Encourage on-site rain-water collection for non-potable use.*

viii. Ensure there is sufficient capacity to meet the required level of service in the infrastructure design standard or if sufficient capacity is not available, ensure that the effects of development are mitigated on-site.

The proposed subdivision has been designed such that it is consistent with the objectives and policies of the Residential Hills Zone. The subdivision will allow for allotments that are of sufficient size and dimension and provided with adequate access and servicing for the anticipated purpose. The proposal is considered to be consistent with the relevant objectives and policies of the District Plan.

8.2.4 Objective - Earthworks

a. Earthworks facilitate subdivision, use and development, the provision of utilities, hazard mitigation and the recovery of the district.

8.2.4.1 Policy - Water quality

a. Ensure earthworks do not result in erosion, inundation or siltation, and do not have an adverse effect on surface water or groundwater quality.

8.2.4.3 Policy - Benefits of earthworks

a. Recognise that earthworks are necessary for subdivision, use and development, the provision of utilities, hazard mitigation and the recovery of the district.

8.2.4.4 Policy - Amenity

a. Ensure, once completed, earthworks do not result in any significant shading, visual impact, loss of privacy or other significant detraction from the amenity values enjoyed by those living or working in the locality.

8.2.5 Objective - Earthworks health and safety

a. People and property are protected during, and subsequent to, earthworks.

8.2.5.1 Policy - Land stability

a. Avoid earthworks that will create a significant risk to people and property through subsidence, rockfall, cliff collapse, erosion, inundation, siltation or overland flows.

8.2.5.2 Policy - Nuisance

a. Subject to Policy 8.2.4.3, ensure that earthworks avoid more than minor adverse effects on the health and safety of people and their property, and do not generate continuous or persistent noise, vibration, dust or odour nuisance.

8.2.5.4 Policy - Earthworks design

a. Ensure that earthworks over identified thresholds are designed to enable the anticipated land use.

8.2.5.5 Policy - Management of contaminated land

a. Enable earthworks where necessary to appropriately manage land contamination.

Earthworks on site will facilitate establishment of the residential allotments, access lot and infrastructure. The overall level of earthworks remains compatible with adjoining land and will not generate significant risks to people and property in respect of overland flows, land instability etc. The proposal is considered to be compatible with the relevant objectives and policies.

8 Regional Policy Statement

The Canterbury Regional Policy Statement (CRPS) became operative on 15th January 2013. The CRPS provides an overview of the resource management issues in the Canterbury region, and the objectives, policies and methods to achieve integrated management of natural and physical resources. The methods include direction for provisions in district and regional plans.

The proposal is not considered to be of a nature or scale that challenges the provisions of the Regional Policy Statement.

9 Resource Management Act (RMA)

Part 2 – Purpose and Principles

The matters set out in Part 2 are reflected in the objectives and policies of the District Plan which give effect to Part 2 and have been considered as part of this application. Further consideration of these sections is not considered necessary for this application.

Sections 95 to 95G - Notification

Sections 95A of the Resource Management Act set out the process for determining whether an application should be processed on a notified, limited notified or non-notified basis. There is no presumption in favour of notification. Public notification is only required if the Council decides that the activity "will have or is likely to have adverse effects on the environment that are more than minor". The following assessment considers whether public or limited notification is required or precluded.

Public Notification

A consent authority must follow the steps set out in this section to determine whether to publicly notify an application for a resource consent.

Public Notification of consent application (under 95A of RMA 1991)	
Step 1 under 95A(3)	
Is Public notification required under section 95C?	**NO**
Has applicant requested for the application to be publicly notified?	**NO**
Is the application made jointly with an application to exchange recreation reserve land under section 15AA of the Reserves Act 1977?	**NO**
Step 2 under 95A(5)	
Is the application for more than one or more activities and these activities are subject to rule or national NES that precludes public notification?	**NO**
Is the application for a boundary activity controlled, restricted discretionary, or a non-complying activity but only if the activity is a boundary activity?	**NO**
Step 3 under 95A(8)	
Is this application subject to rule or national environmental standard that requires public notification?	**NO**
Step 4 under 95A(9)	
Are there special circumstances that warrant the application being publicly notified?	**NO**

We consider that the proposal is not subject to mandatory notification because we do not request public notification and the application has not been made jointly with an application to exchange recreational reserve land. We also consider that there are no special circumstances that would warrant public notification under section 95A (9).

For the reasons outlined in the AEE of this report, it has been determined that the adverse effects on the wider environment will not have adverse effects that are more than minor.

In summary therefore, we consider that public notification is not required for this application.

Limited Notification:

A consent authority must follow the steps set out in this section to determine whether to give limited notification if the application is not publicly notified under section 95A.

Limited Notification of consent application (under 95B of RMA 1991)	
Step 1	
Are there any affected protected customary rights group or affected customary marine title groups (in the case of an application for a resource consent for an accommodated activity)?	**NO**
Is the proposed activity is on or adjacent to or may affect land that is the subject of a statutory acknowledgement made in accordance with an Act specified Schedule 11?	**NO**
Are there affected person in accordance with section 95E?	**NO**
Step 2	
Are the activity that are subject to a rule or national environmental standard that precludes limited notification?	**NO**
If the application is for a controlled activity (but no other activities) that requires a resource consent under a district plan (other than a subdivision of land).	**NO**
Step 3	
In the case of a boundary activity, determine in accordance with section 95E whether an owner	**NO**
Are there affected person in accordance with section 95E?	**NO**
Step 4	
Are there special circumstances that warrant limited notification of the application?	**NO**

We note that there are no affected protected customary rights groups of affected customary marine title groups in relation to this proposal. Furthermore, the proposal is not on or adjacent to that is subject to a statutory acknowledgment made in accordance with the Ngai Tahu Claims Settlement Act 1998.

Further there are no special circumstances that warrant limited notification or any persons.
In summary, we consider that limited notification is not required for this application.

Section 104 – Consideration of Applications

For any resource consent application, section 104 of the Act requires the consent authority, in making a decision on a resource consent application, to have regard to:

- The actual potential effects on the environment of allowing the activity (Section 104(1)(a)).
- The relevant provisions of any national environmental standard, other regulation, national policy statement, coastal policy statement, regional policy statement or proposed regional policy statement, plan or proposed plan (section 104(1)(b)).
- Any other matters considered relevant or necessary to consider (section 104(1)(c)).

The actual and potential effects associated with the proposal have been assessed in Section 5 of this document. An assessment of the proposal against the relevant provisions of the District Plan.

Section 104C– Determination of applications for restricted discretionary activities

When considering an application for a resource consent for a restricted discretionary activity, a consent authority must consider only those matters over which—

(a) a discretion is restricted in national environmental standards or other regulations:
(b) it has restricted the exercise of its discretion in its plan or proposed plan.

The consent authority may grant or refuse the application. However, if it grants the application, the consent authority may impose conditions under section 108 only for those matters over which—

(a) a discretion is restricted in national environmental standards or other regulations:
(b) it has restricted the exercise of its discretion in its plan or proposed plan.

Section 106 – Subdivision

A consent authority may refuse to grant a subdivision consent or may grant a subdivision consent subject to conditions if it considers that there is a risk from natural hazards or if sufficient provision has not been made for legal and physical access to each allotment created by the subdivision.

As detailed in the geotechnical report prepared by Tetra Tech Coffey Ltd, Lots 1-8 & 12 are considered suitable for development, whilst Lots 9-11 will require comprehensive rockfall modelling and Annual Individual Fatality Risk (AIFR) calculations to determine the appropriate remediation strategy to mitigate the rockfall risk. Any development on Lots 5-7 & 12 are to observe a 5m setback. A report is currently being undertaken to propose mitigation strategies for the affected allotments in order to ensure that risk is appropriately mitigated under s105.

10 Conclusion

Consent is sought for the proposed subdivision at 169 Bowenvale Avenue, Cashmere. This application has been prepared by Graham Surveying Limited on behalf of Bowenvale Park Estates Limited

Consent is sought as a Restricted Discretionary activity for both subdivision and land use. Pursuant to Rules 8.5.1.3 RD2, 7.4.2.3 RD1, 5.5.2 C1, 5.6.1.1 RD1, RD3 & RD4, the proposal requires a subdivision consent for a restricted discretionary activity, and pursuant to Rule 8.9.2.3 RD1, requires land use consent for a restricted discretionary activity.

It is considered that the actual and potential adverse effects of the above non-compliances are less than minor and will not have an adverse effect on the environment and/or any person(s). The proposal is in accordance with the relevant objectives and policies of the CDP. We anticipate that the standard conditions imposed by Council upon an activity of this nature will be sufficient to ensure that the activity is carried out in accordance with application and that its effects are appropriately managed.

Accordingly, it is requested that Council grant subdivision consent on a non-notified basis. We request that a draft set of conditions is circulated for review and comment prior to any final notice of decision being issued.

Appendix A
Record of Title

Appendix B
Scheme Plan

Appendix C
Geotechnical Report

Appendix D
Servicing Report

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **CB45A/976**
Land Registration District **Canterbury**
Date Issued 12 August 1998

Prior References
CB26K/898

Estate Fee Simple
Area 9686 square metres more or less
Legal Description Lot 3 Deposited Plan 78608
Registered Owners
Paul Brian Currie, Elisa-Jane Currie and Michael Craig Laing

Interests

Appurtenant hereto is a drainage easement described in and created by Transfer 173750 - 11.11.1926 at 2.40 pm

Appurtenant hereto is a drainage easement described in and created by Transfer 174939 - 9.12.1926 at 2.55 pm

Appurtenant hereto is a drainage easement described in and created by Transfer 174943 - 9.12.1926 at 3.00 pm

Appurtenant hereto is a drainage easement described in and created by Transfer 174942 - 9.12.1926 at 3.00 pm

920310 Transfer creating the following easements - 24.7.1973 at 11.30 am

Type	Servient Tenement	Easement Area	Dominant Tenement	Statutory Restriction
Right of way	Lot 3 Deposited Plan 30431 - CT CB12K/993	Yellow DP 30431	Lot 3 Deposited Plan 78608 - herein	

Subject to a right of way over part marked K,L,M,N,O,R,S on DP 78608 appurtenant to Lot 1 DP 47734 CT CB27K/445, Lot 1 DP 57585 CT CB34A/554, part Lot 2 DP 33462 CT CB34A/555 and Lots 1,2 & 3 DP 37778 CsT CB17B/115-117 created by Transfer 920309 - 24.7.1973 at 11.30 am

400757.2 Easement Certificate specifying the following easements - 14.9.1982 at 10.13 am

Type	Servient Tenement	Easement Area	Dominant Tenement	Statutory Restriction
Right of way, right to drain water and sewage and right to convey water, electric power and telephonic communications	Lot 3 Deposited Plan 78608 - herein	O DP 78608	Part Lot 3 Deposited Plan 28705 - CT CB25F/638	
Right of way, right to drain water and sewage and right to convey water, electric power and telephonic communications	Lot 3 Deposited Plan 78608 - herein	R DP 78608	Part Lot 3 Deposited Plan 28705 - CT CB25F/638	

Right of way, right to drain water and sewage and right to convey water, electric power and telephonic communications	Lot 3 Deposited Plan 78608 - herein	S DP 78608	Part Lot 3 Deposited Plan 28705 - CT CB25F/638
Right of way, right to drain water and sewage and right to convey water, electric power and telephonic communications	Lot 3 Deposited Plan 78608 - herein	K DP 78608	Part Lot 3 Deposited Plan 28705 - CT CB25F/638
Right of way, right to drain water and sewage and right to convey water, electric power and telephonic communications	Lot 3 Deposited Plan 78608 - herein	L DP 78608	Part Lot 3 Deposited Plan 28705 - CT CB25F/638
Right of way, right to drain water and sewage and right to convey water, electric power and telephonic communications	Lot 3 Deposited Plan 78608 - herein	M DP 78608	Part Lot 3 Deposited Plan 28705 - CT CB25F/638
Right of way, right to drain water and sewage and right to convey water, electric power and telephonic communications	Lot 3 Deposited Plan 78608 - herein	N DP 78608	Part Lot 3 Deposited Plan 28705 - CT CB25F/638

523903.4 Easement Certificate specifying the following easements - 21.12.1984 at 9.37 am

Type	Servient Tenement	Easement Area	Dominant Tenement	Statutory Restriction
Drain sewage	Lot 3 Deposited Plan 65981	F DP 65981	Lot 3 Deposited Plan 78608 - herein	
Drain sewage	Lot 2 Deposited Plan 47459	C DP 47459	Lot 3 Deposited Plan 78608 - herein	
Drain sewage	Lot 2 Deposited Plan 47459	D DP 47459	Lot 3 Deposited Plan 78608 - herein	

The easements specified in Easement Certificate 523903.4 are subject to Section 309(1)(a) Local Government Act 1974

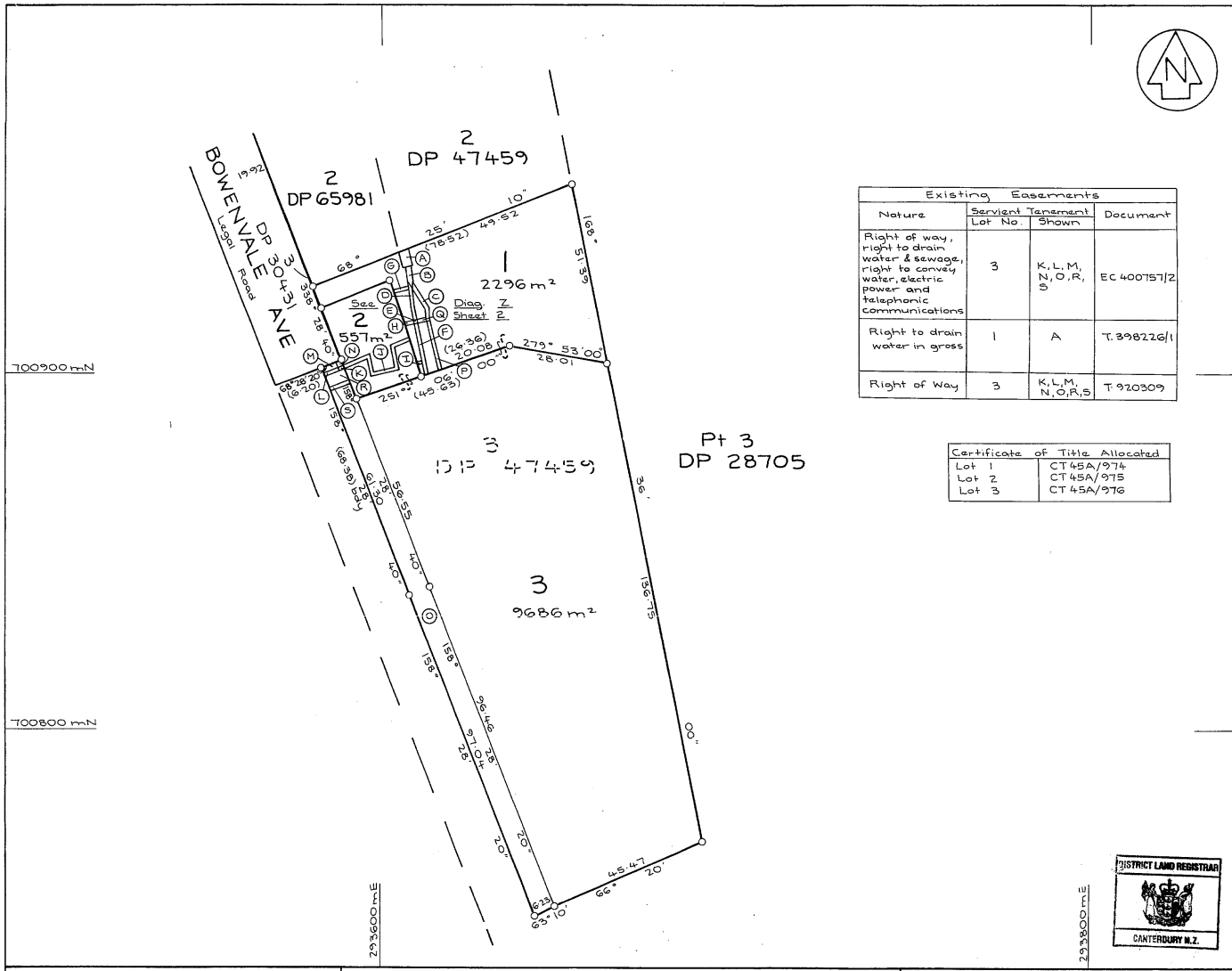
A364090.4 Easement Certificate specifying the following easements - 12.8.1998 at 12.33 pm

Type	Servient Tenement	Easement Area	Dominant Tenement	Statutory Restriction
Right to convey electric power and telephonic communications	Lot 3 Deposited Plan 78608 - herein	K DP 78608	Lot 1 Deposited Plan 78608	

Right to convey electric power and telephonic communications	Lot 3 Deposited Plan 78608 - herein	K DP 78608	Lot 2 Deposited Plan 78608
Right to convey electric power and telephonic communications	Lot 3 Deposited Plan 78608 - herein	N DP 78608	Lot 1 Deposited Plan 78608
Right to convey electric power and telephonic communications	Lot 3 Deposited Plan 78608 - herein	N DP 78608	Lot 2 Deposited Plan 78608
Drain water	Lot 1 Deposited Plan 78608	A DP 78608	Lot 3 Deposited Plan 78608 - herein
Drain water	Lot 1 Deposited Plan 78608	B DP 78608	Lot 3 Deposited Plan 78608 - herein
Drain water	Lot 1 Deposited Plan 78608	D DP 78608	Lot 3 Deposited Plan 78608 - herein
Drain water	Lot 1 Deposited Plan 78608	E DP 78608	Lot 3 Deposited Plan 78608 - herein
Drain water	Lot 1 Deposited Plan 78608	F DP 78608	Lot 3 Deposited Plan 78608 - herein
Drain sewage	Lot 1 Deposited Plan 78608	A DP 78608	Lot 3 Deposited Plan 78608 - herein
Drain sewage	Lot 1 Deposited Plan 78608	B DP 78608	Lot 3 Deposited Plan 78608 - herein
Drain sewage	Lot 1 Deposited Plan 78608	C DP 78608	Lot 3 Deposited Plan 78608 - herein
Drain sewage	Lot 1 Deposited Plan 78608	P DP 78608	Lot 3 Deposited Plan 78608 - herein
Convey water	Lot 3 Deposited Plan 78608 - herein	K DP 78608	Lot 1 Deposited Plan 78608
Convey water	Lot 3 Deposited Plan 78608 - herein	L DP 78608	Lot 1 Deposited Plan 78608
Convey water	Lot 3 Deposited Plan 78608 - herein	S DP 78608	Lot 2 Deposited Plan 78608

The easements specified in Easement Certificate A364090.4 will be subject to Section 243(a) Resource Management Act 1991 when created

12504804.2 Mortgage to ASB Bank Limited - 9.12.2022 at 11:26 am



Existing Easements			
Nature	Servient Tenement Lot No.	Shown	Document
Right of way, right to drain water & sewage, right to convey water, electric power and telephonic communications	3	K, L, M, N, O, R, S	EC 400757/2
Right to drain water in gross	1	A	T. 398226/1
Right of Way	3	K, L, M, N, O, R, S	T. 920309

Certificate of Title Allocated	
Lot 1	CT 45A/974
Lot 2	CT 45A/975
Lot 3	CT 45A/976

Approvals

Registered Proprietors

Pursuant to Section 223 Resource Management Act 1991
dated ... day of ... 19...
The Christchurch City Council has approved this plan of subdivision subject to the granting or reserving of the easements shown in the memorandum endorsed hereon
and certifies that the plan is in accordance with the requirements and provisions of the Operative District Scheme.
IN WITNESS WHEREOF THE COMMON SEAL of the CHRISTCHURCH CITY COUNCIL was affixed hereto in the presence of:
Mayor / Councillor
Administration Officer

Memorandum of Easements

Nature	Servient Tenement Lot No.	Shown	Dominant Tenement
Right to drain sewage	1	A,B,C,P	Lot 3
	1	A,B,C,Q,E,H	Lot 2
Right to drain water	1	A,B,D, E,F	Lots 2 & 3
	1	G,I	Lot 2
Right to convey water	2	J	Lot 1
	3	K,L	Lot 1
Right to convey electric power and telephonic communications	2	J	Lot 1
	3	K,N	Lots 1 & 2
Right to convey water	3	S	Lot 2

Lots 1 & 2 do not have frontage to a public road

Total Area 1.2539 ha

Comprised in CT 26K/898 (All)

I, Robin Eric Fear
Registered Surveyor and holder of an annual practising certificate (or who may act as a registered surveyor pursuant to section 25 of the Survey Act 1986) hereby certify that this plan has been made from surveys executed by me or under my directions, that both plan and survey are correct and have been made in accordance with the Survey Regulations 1972 or any regulations made in substitution thereof.
Dated at Christchurch this 6th day of May 1998 Signature

Field Book ... p. ... Traverse Book ... p.
Reference Plans SO 10223 DP's 27012, 28705, 30431, 47459, 45358, 65981
Examined ... Correct

Approved as to Survey
25/6/1998 Deputy Chief Surveyor

Deposited this 12th day of August 1998
for District Land Registrar

File ... Received 8.6.98 Instructions

DP78608

DOSLI FORM D15

DISTRICT LAND REGISTRAR
CANTERBURY N.Z.

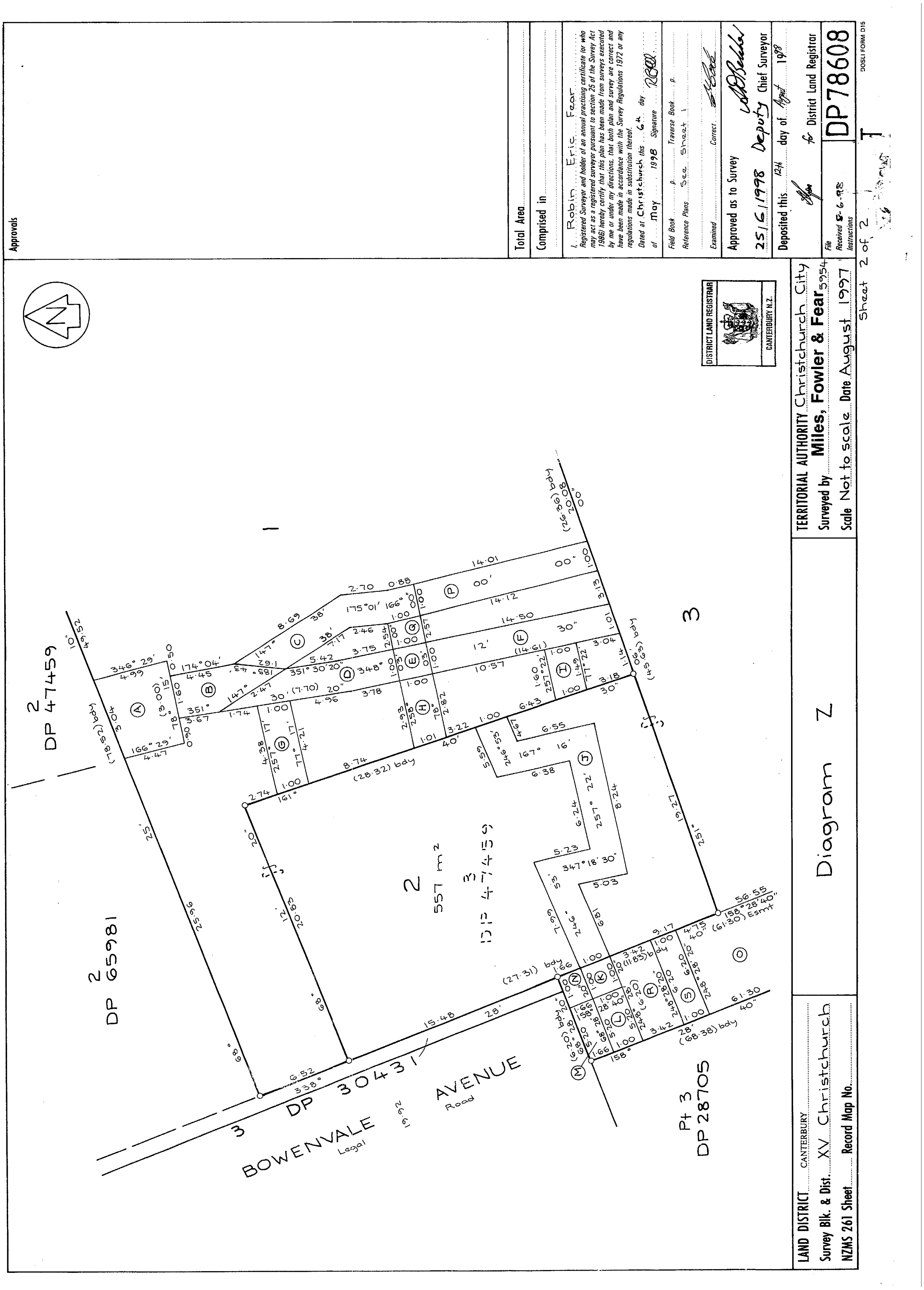
LAND DISTRICT CANTERBURY
Survey Blk. & Dist. XV Christchurch
NZMS 261 Sheet ... Record Map No. ...

Lots 1-3 being Subdivision of Lot 3 DP 47459

TERRITORIAL AUTHORITY Christchurch City
Surveyed by Miles, Fowler & Fear 5954
Scale 1: 750 Date August 1997

Sheet 1 of 2

T


Approvals
Total Area
Comprised in
I, Robin Eric Fear
Registered Surveyor and holder of an annual practising certificate (or who may act as a registered surveyor pursuant to section 25 of the Survey Act 1986) hereby certify that this plan has been made from surveys executed by me or under my directions, that both plan and survey are correct and have been made in accordance with the Survey Regulations 1972 or any regulations made in substitution thereof.
Dated at Christchurch this 6th day of May 1998 Signature
Field Book p. Traverse Book p.
Reference Plans See Sheet 1
Examined Correct
Approved as to Survey
25/6/1998 Deputy Chief Surveyor
Deposited this 12th day of August 1998
District Land Registrar
File
Received 5-6-98
Instructions
DP78608
DOSLI FORM D15
DISTRICT LAND REGISTRAR
CANTERBURY N.Z.
TERRITORIAL AUTHORITY Christchurch City
Surveyed by Miles, Fowler & Fear 5954
Scale Not to scale Date August 1997
Sheet 2 of 2
Diagram Z
LAND DISTRICT CANTERBURY
Survey Blk. & Dist. XV Christchurch
NZMS 261 Sheet
Record Map No.
2
DP 47459
2
DP 65981
1
3
2
557 m²
3
DP 47459
3 DP 30431
BOWENVALE AVENUE
Legal Road
Pt 3
DP 28705

SUBTERRA
Geotechnical Investigation

Geotechnical Report for Proposed Subdivision

169 Bowenvale Avenue, Cashmere

Prepared for Bowenvale Park Estates Ltd

Report version A released 10/11/2023

Report prepared by:

Harry Greenfield
Engineering Geologist
MSc, MEngNZ

Report reviewed and approved by:

Firas Salman
Technical Director – Geotechnical
PhD, CMEngNZ, CPEng

Limitations of Report

This report is for the use of the client listed above and is not intended to be used by other parties without the express written permission of Subterra in advance.

To the extent permitted by law, Subterra accepts no liability for any cost, expense, loss, or damage incurred by any party relating to the information contained within the following report.

The investigation and research in this report has been carried out by experienced and conscientious professionals in the field to a standard of care expected in engineering practice. No other guarantee is given as to how accurate and comprehensive the information contained herein is.

Subterra's recommendations are based on our understanding of the current regulations and standards in New Zealand and are not legal opinions.

The recommendations of this report are based on our visual and physical investigation of the site. Some inference is made as to the lateral continuity of soils between the investigation points which cannot be guaranteed.

Contents

1 INTRODUCTION

1.1 ENGAGEMENT

Subterra Ltd was engaged by Bowenvale Park Estates Ltd on 22/08/2022 to undertake a geotechnical investigation and report for the property at 169 Bowenvale Avenue, Cashmere (Lot 3 DP 78608), henceforth referred to as 'the site'.

1.2 PROPOSED DEVELOPMENT

It is proposed to subdivide the site into twelve residential lots, for eventual development.

It is our understanding that the existing dwelling and outbuildings will be removed from the site to allow for the proposed subdivision to be completed.

A proposed subdivision scheme plan and topographical survey provided by the client forms Appendix A.

1.3 EXISTING ENGINEERS REPORTS

A geotechnical investigation and report were prepared by Cook Costello Consulting Engineers in 2015. This report is discussed in Section 3.

1.4 OBJECTIVE

The objective of this report is to address the natural hazards as outlined in the S106 of the RMA1991 to support the Resource Consent application to subdivide the site into 12 residential lots.

1.5 SCOPE OF WORKS

Subterra's investigation comprised the following scope of works:

- A desktop study to review geological mapping and geotechnical hazard resources available online.
- A site walkover along with photographic record.
- A review of freely-available historical aerial photographs.
- An intrusive investigation comprising hand auger boreholes and Scala Penetrometer tests.
- A Resource Management Act S106 assessment and provision of a geotechnical statement of professional opinion on the suitability of the land for subdivision.

- Provision of an interpretive report summarising the above along with a description of the geotechnical constraints to development of the proposed lots.

This report assesses the land only, not the condition of any structures at the site.

This report is considered suitable to support a Resource Consent application to subdivide the site. It is not suitable to accompany a Building Consent application, which will require further investigation and reporting once the nature and layout of the future developments are known.

2 Site Description

2.1 Site Location

The site is an irregular shape, accessed from a driveway extending south from the end of Bowenvale Avenue and covering a total area of approximately 1 Ha (Figure 1).

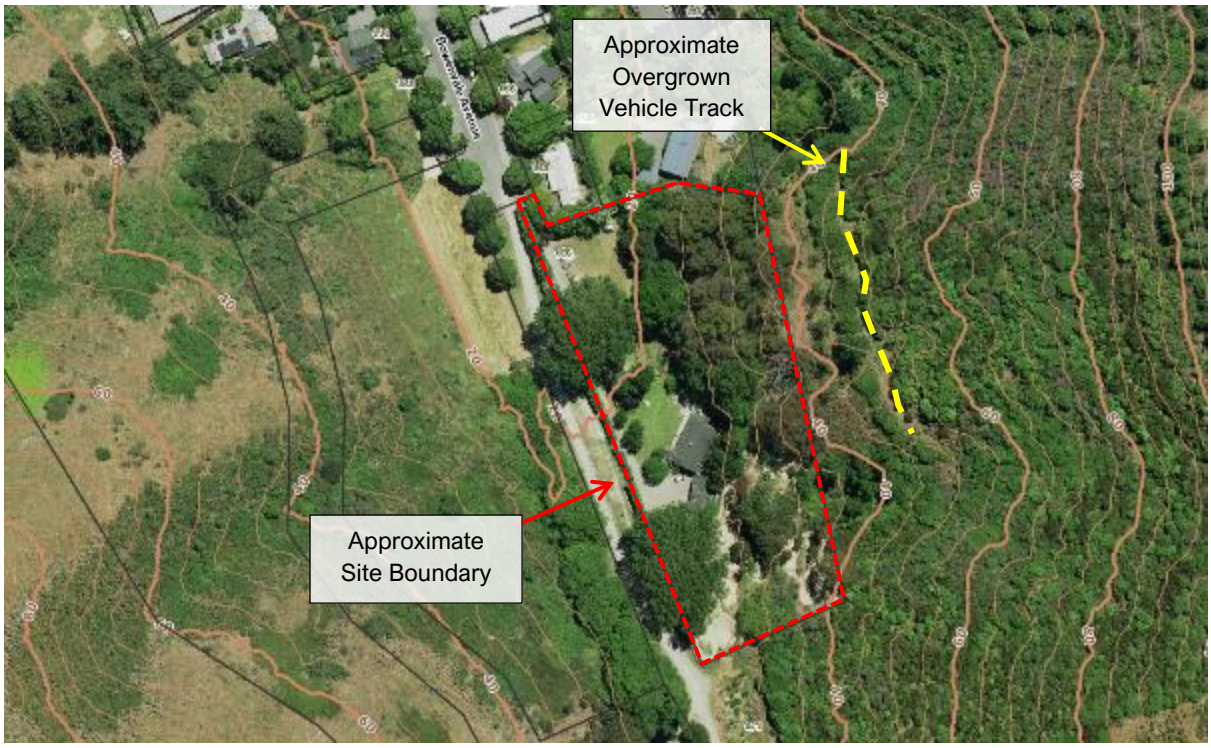


Figure 1: Site Location with 5m contour lines (courtesy Canterbury Maps)

2.2 Site Walkover

The site is in two distinct parts; the west half is largely flat ground and includes the existing dwelling and outbuildings, whereas the east half ascends a moderate to steep slope (refer to contours on Figure 1). The elevation of the site is approximately 19m to 40m RL, west-to-east across the site (based on Canterbury Maps contours).

The upper site had been cleared of vegetation prior to Subterra's site walkover. Numerous large, mature trees had been felled on the upper slope, which appeared to have been churned up by machinery.

Two large gullies (Gully A and Gully B) transect the upper site, north and south of the existing dwelling, respectively (Figure 4). A drain has been dug by the customer which extends part-way towards the base of Gully B (Figure 7).

No ground damage was evident at the time of Subterra's visit (06/09/2023); however, it should be noted that the ground had been turned over and as such, it is possible that there could be signs of instability which have been obscured.

Subterra's walkover included walking across approximately a 20-30m strip of the property directly east of the site, up to an overgrown vehicle track which spans across

most of the slope (Figure 1). During our walkover, no rock outcrop or loose boulders were observed anywhere on the site or directly to the east.

Figure 2 to Figure 12 show the site, taken during Subterra's site walkover and drone flyover:

Figure 2: Aerial view of the site taken on 06/09/2023 using Subterra's drone. Approx. site boundary marked

Figure 3: Aerial view of the site looking south. Approx. boundary marked

Figure 4: Aerial view of the site looking northeast. Major gullies approximately marked in blue

Figure 5: Aerial view of the site looking east

Figure 6: Aerial view of the southeast end of the site looking southeast. Approx boundary marked

Figure 7: View of the drain dug by the customer which connects to the base of Gully B

Figure 8: View of the site from the south corner looking north

Figure 9: View of the north corner of the site looking east up the slope

Figure 10: View along the east boundary of the site from near the north end, looking south

Figure 11: View along the east boundary of the site from near the south end, looking north

Figure 12: View of the site from the southeast corner looking north

3 COOK COSTELLO 2015 GEOTECHNICAL REPORT

Cook Costello Consulting Engineers undertook a geotechnical investigation and prepared a Geotechnical Report for the site in (ref. 12448-116, dated 14/08/2015). The following is a summary of information contained in their report.

3.1 SITE INVESTIGATION

Cook Costello undertook 4 hand auger boreholes with Scala Penetrometer tests around the existing dwelling. Their investigation logs are attached as Appendix B.

Their intrusive investigation encountered topsoil up to 0.2m thick across the tested area of the site, underlain by silt with variable clay and sand (loess) to at least 1.4m begl (maximum extent of investigation).

3.2 SLOPE STABILITY ASSESSMENT

Cook Costello made the following comments about the site's stability:

"*The global slope stability of the site is generally stable. The pre-development slope angle of the site is 7°".*

"There is some low vulnerability of the site to uphill hazards such as debris flow and rockfall due to the presence of source material and topography of the uphill land".

"There is no indication of the presence of non-engineered fill or subsurface erosion features. There are no signs on or nearby the site showing a presence of past instability".

3.3 LIQUEFACTION ASSESSMENT

Cook Costello concluded that "*Properties located on elevated ground in the Port Hills and Banks Peninsula area are generally not at risk of liquefaction... The property at 169 Bowenvale Avenue presents a low risk of liquefaction hazard".*

3.4 RECOMMENDATIONS

Cook Costello made the following general recommendations for the design of future foundations in hill areas with the potential for movement:

- *"Simple plan shapes and lighter weight buildings with short plan dimensions down-hill are recommended. Split levels should be avoided.*
- *Houses consisting of linked but structurally separate modules are recommended with uniform foundation systems.*
- *Houses supported on shallow timber piles are strongly preferred as they introduce a degree of flexibility and improve the repairability of the foundations and services. However, deep piles are not recommended.*
- *Retaining structures should be separated from the house wherever possible."*

4 SITE HISTORY

4.1 AERIAL MAPPING

Subterra reviewed historical aerial photographs for the years 1929 through to 2019, available on Canterbury Maps[1].

- In 1929 the site was undeveloped, bare land at the base of the Huntsbury ridgeline. Several large gullies were visible crossing the upper (east) side of the site. On the hillside above the site, some small evidence of rock outcrop is evident, though this is very sparse.
- Through the 1940's, 1950's, and 1960's no significant changes were visible to the site or its immediate surroundings.
- By 1974 a small structure was visible on the north half of the site. Vegetation had begun to grow on the upper slope.
- By 1984 the properties directly north of the site (163 and 165 Bowenvale Avenue) had been residentially developed. The forest on the upper slope east of the site had been planted, with small trees visible in rows.
- By 1994 much of the site was obscured by mature trees and vegetation.
- By 2004 the site was residential, with the existing dwelling and driveway visible. Most of the east half of the site was completely obscured by vegetation.

The major gullies which bisect the upper site are historical features that might pose a geotechnical constraint to the construction of dwellings in the upper slope of the site.

4.2 HISTORICAL LAND USE

The ECan Listed Land Use Register[2] (LLUR) holds information regarding sites that have been or currently are used for activities which have the potential to cause contamination.

The LLUR does not currently have any information about a Hazardous Activities or Industries List site on the site.

[1] *Historical Aerial Imagery*. (2021). Retrieved in September 2023 from Canterbury Maps: https://apps.canterburymaps.govt.nz/CanterburyHistoricAerialImagery/

[2] *Listed Land Use Register*. (2021). Retrieved in September 2023 from Environment Canterbury: https://llur.ecan.govt.nz/

5 DESK-BASED INFORMATION

5.1 GEOLOGICAL MAPPING

According to the GNS Geological Unit QMap, available on the New Zealand Geotechnical Database[3], the site is underlain by Neogene (9.7 to 11-million-year-old) igneous rocks, comprising *'Basaltic (hawaiite) to trachytic lava flows interbedded with tuff and breccia (uncluding lahars), many dikes & minor lava domes.'* (Mvl).

5.2 GEOLOGICAL INVESTIGATION DATA

Table 1 below is a summary of information from previous investigation holes within the local area, found on the New Zealand Geotechnical Database (NZGD).

Hole Reference	Location from site	Depth begl	Summary
HA-DCP 8652	~110m N 149 Bowenvale Ave	2.7m	TOPSOIL to 1.3m Sandy SILT 1.3m to 1.9m Silty SAND 1.9m to 2.4m SAND, some silt 2.4m to at least 2.7m
HA-DCP 54077 (2 holes)	~155m NW 102 Bowenvale Ave	3.0m	TOPSOIL/FILL to 0.5m-0.7m Sandy SILT (Loess) 0.5m to at least 3.0m

Table 1: Nearby Geological Investigation Summary

5.3 GROUND WATER DATA

The GNS 'Water Table' maps, available on the NZGD do not extend beneath the subject site. However, the closest mapped area (on Bowenvale Avenue approximately 950m north of the site) indicates predicted 85th percentile groundwater depths of at least 5.0m. It should be noted that this area is approximately 10m lower in elevation than the lowest part of the site. As such, it is considered likely that the depth to groundwater at the site will be in excess of 5m begl.

5.4 NEW ZEALAND GEOTECHNICAL DATABASE

The following information has been extracted from the NZGD database (Earthquake Commission, 2020).

5.4.1 MBIE Technical Category (TC) Zone

The Canterbury Maps website indicates the site is located in an area labelled 'N/A – Port Hills & Banks Peninsula'.

[3] Earthquake Commission. (2020). *New Zealand Geotechnical Database*. Retrieved in September 2023 from https://www.nzgd.org.nz/

5.4.2 Observed Ground Cracks

Ground cracks across Christchurch were recorded following the 04 September 2010 and 22 February 2011 earthquake events. No ground cracks were recorded on or within the immediate vicinity of the site.

5.4.3 Peak Ground Acceleration During Canterbury Earthquake Sequence

Peak ground acceleration information available on the NZGD suggests that the site can be considered sufficiently tested to an SLS level earthquake during the 4 September 2010 and 22 February 2011 earthquake events, following which no liquefied ejecta was recorded by EQC as being observed at the site or in its immediate vicinity. Subterra reviewed aerial photography of the site taken on 24 February 2011 and no liquefied ejecta was evident on or near the site.

5.5 LIQUEFACTION ASSESSMENT

The site is not designated by MBIE with a Technical Category and is labelled 'N/A – Port Hills & Banks Peninsula'. It was sufficiently tested to an SLS level during the 4 September 2010 and 22 February 2011 earthquake events, following which no liquefaction ejecta was recorded as being observed on the site or its immediate surroundings.

5.5.1 Christchurch Liquefaction Vulnerability Map

The Canterbury Maps Liquefaction Vulnerability Map[4] shows the site as being partially within an area where liquefaction damage is unlikely (the upper, east part of the site) and partially within an area where liquefaction damage is possible (the lower, west part of the site).

5.5.2 Christchurch Liquefaction Lab Study

The Canterbury Maps Liquefaction Lab shows that the site is in an area with no likelihood of severe liquefaction damage. Using the modelling tool on the Liquefaction Lab site, under seismic shaking of 0.2 and 0.6g with magnitude 6 earthquake (M6) (assuming 2019 groundwater levels) the lower, west part of the site is shown to have:

- 100% likelihood of "*None to minor damage*" under M6 0.2g (equivalent to SLS design level), which implies a land performance consistent with TC1 land category under an SLS design event.
- 79% likelihood to have "*none to minor damage*" with 15% to have "*minor to moderate damage*" and 6% to have "*moderate to severe damage*" under M6 0.6g (>ULS design level). This implies a land performance is likely to be consistent with TC1 land category under a ULS design event.

[4] Canterbury Maps. (2021). *Christchurch Liquefaction Viewer*. Retrieved in September 2023 from https://apps.canterburymaps.govt.nz/ChristchurchLiquefactionViewer/

The upper, east part of the site is shown to have 100% likelihood of "*None to minor damage*" under both M6 0.2g (equivalent to SLS design level) and M6 0.6g (>ULS design level).

5.6 Rockfall and Slope Stability

5.6.1 GNS Rockfall Risk

The site is shown on Map D6 of the GNS study for life safety from rockfall risk[5]. The site is indicated to be in an area with an annual individual fatality risk (AIFR) of fatality from rockfall between 10^{-3} and 10^{-5}. The cliff to the east of the site is identified as a potential rockfall source area (Slopes > 35°). Map D6 is attached as Appendix C.

5.6.2 GNS Cliff Collapse

The GNS study for life safety from cliff collapse[6] does not include the subject site.

5.6.3 CCC Earthquake Rockfall Maps

Rock fall maps titled 'Location of fallen and in-situ boulders and bluffs', are provided on the Christchurch City Council (CCC) website[7]. Map 31 includes the subject site and shows several fallen boulders and in-situ boulders on the slope east of the site. Also shown are several Bluff Envelopes, which signify the general location of a bluff which is too dangerous to allow closer inspection to be carried out.

Map 31 is attached as Appendix D.

5.6.4 GNS Mass Movement

The site has not been identified in the GNS study of Mass Movement Areas Report[8] for the Port Hills.

5.6.5 Christchurch District Plan

The Christchurch District Plan[9] (refer to Figure 13) indicates that the site is partly located within the following:

- Liquefaction Management Area;
- Remainder of Port Hills and Banks Peninsula Slope Instability Management Area; and
- Rockfall Management Area 2

[5] Carey, J., Massey, C., Lukovic, B., McSaveney, M., Heron, D., Reis, W., & A, M. (2013). *Port Hills Slope Stability: Life-safety risk from rockfalls (boulder rolls) in the Port Hills.* Christchurch: GNS Science Consultancy Report 2012/123.

[6] McSaveney, M., Massey, C., & Heron, D. (2013). *Port Hills Slope Stability: Life-safety risk from cliff collapse in the Port Hills.* Christchurch: GNS Science Consultancy Report 2012/124

[7] Christchurch City Council. (2013). *Boulder Location Maps*. Retrieved in September 2023 from https://ccc.govt.nz/environment/land/slope-stability/boulder-location-maps

[8] Massey, C., Yetton, M., Carey, J., Lukovic, B., Litchfield, N., Ries, W., & McVerry, G. (2013). *Canterbury Earthquakes 2010/11 Port Hills Slope Stability: Stage 1 Report in the findings from investigations into areas of significant ground damage (mass movements).* Christchurch: GNS Science Consultancy Report 2012/317.

[9] Christchurch City Council, *Christchurch Distruct Plan*. Retrieved in September 2023 from https://districtplan.ccc.govt.nz/PropertySearch/PropertySearchContainer.html

These zones restrict the activities which can be undertaken at the site.

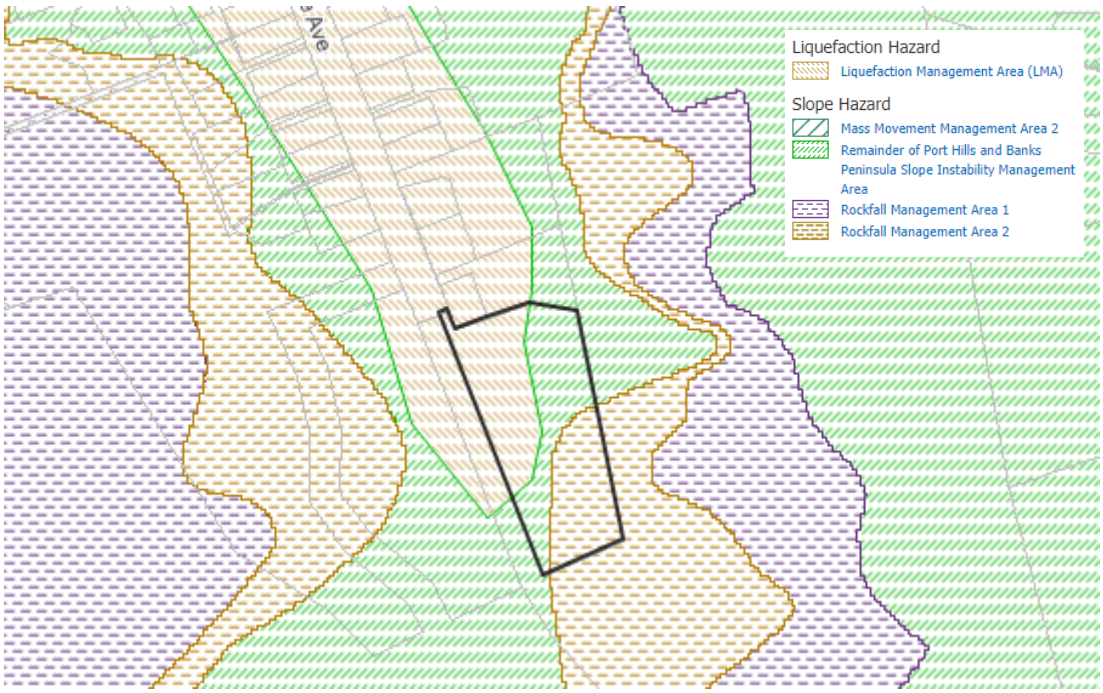


Figure 13: Christchurch District Plan Excerpt

5.7 FLOODING

5.7.1 Flood Management Areas

The Christchurch City Council (CCC) website[10] provides maps of flood-risk areas. This map indicates that the site is not within a Flood Management Area. Once dwellings are proposed in the new Lots, correspondence with the CCC is recommended to establish any FFL requirements at the site.

5.7.2 Nearest Water Body/Water Course

An unnamed creek is shown on Canterbury Maps at the base of the valley, in alignment with Bowenvale Avenue. The nearest major water course is the Heathcote River, located approximately 1.2km north of the site.

[10] Christchurch City Council. (2021). *Floor Level Map*. Retrieved in September 2023 from https://ccc.govt.nz/services/water-and-drainage/stormwater-and-drainage/flooding/floorlevelmap

6 Site Investigation

6.1 Scope of Investigation

In order to determine the ground conditions at the site, a shallow hand investigation comprising hand auger boreholes and Scala Penetrometer tests was considered sufficient for this stage of this project.

6.2 Shallow Hand Testing

Subterra visited the site on 06/09/2023 and carried out nine hand auger boreholes with Scala Penetrometer testing. The results of Subterra's shallow investigation are attached on the Hand Auger Log Sheet which forms Appendix E.

The approximate locations of the test holes are given by Figure 14 below:

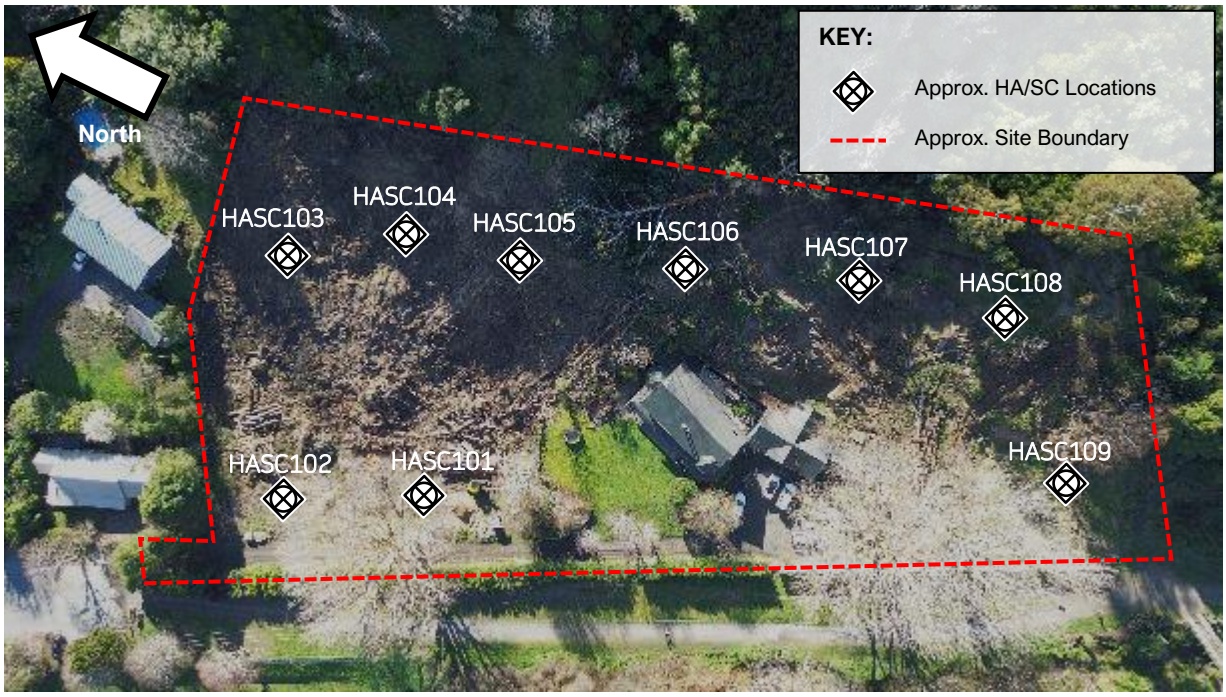


Figure 14: Approximate Test Locations (aerial photo taken 06/09/2023)

6.3 Summary of Subsoil Conditions

Subterra's site investigation indicated the following generalised soil profile beneath the site:

Depth to base of unit (m begl)	Ground Description	Density / Consistency
0.0 to 0.55	TOPSOIL – Organic silt	Soft
>4.2	SILT with variable sand, clay, gravel	Soft to hard

Table 2: Generalised Ground Description

6.4 Groundwater

Groundwater was not encountered during intrusive investigation, to a maximum investigation depth of 4.2m begl.

7 GEOTECHNICAL PROPERTIES

7.1 STATIC GEOTECHNICAL ULTIMATE BEARING CAPACITY (GUBC)

7.1.1 Scala Penetrometer

The Scala Penetrometer results have been analysed using the correlation between blow count and bearing capacity by Stockwell[11].

The blow count of the Scala Penetrometer indicated the following index Geotechnical Ultimate Bearing Capacities (GUBC's) (Table 3):

	SC101	SC102	SC103	SC104	SC105	SC106	SC107	SC108	SC109
Depth to 200kPa	0.1	0.9	0.6	0.4	0.3	0.2	0.3	0.0	0.1
Depth to 300kPa	0.6	1.0	0.6	0.7	0.5	0.3	1.5	0.0	0.2

Table 3: GUBC Depth Summary

7.2 LIQUEFACTION ASSESSMENT

Based on observations following the 2010 and 2011 Canterbury Earthquake Sequence, if a non-liquefiable crust of 3.5m to 4.0m is present, even above significant thickness of liquefiable soils, it is sufficient to prevent liquefaction induced damage[12].

HA102 was undertaken near the lowest point of the site and did not encounter groundwater to the maximum drilled depth of 4.2m begl. In addition, the groundwater depth in nearby mapping is expected to be in excess of 5m.

Furthermore, the old age of the underlain geological formation suggests the risk of liquefaction is nil to minor.

Based on the above and the desktop study information discussed in Section 5.5, we consider that:

- Future land performance of the site is likely to be within the limits of MBIE land classification Technical Category 1 (TC1)), where the site to be categorised using the MBIE Technical Category definition.
- Deep drilling and quantitative liquefaction analysis is not warranted for the scope of this project.

[11] Stockwell, M. (1977). Determination of allowable bearing pressure under small structures. *New Zealand Engineering. V32 I6*.

[12] Bowen, H. J., & Jacka, M. E. (2013). Liquefaction induced ground damage in the Canterbury earthquakes: predictions vs. reality. *19th NZGS Geotechnical Symposium.* Queenstown.

8 ROCKFALL AND SLOPE STABILITY

The major potential geotechnical constraints at the site are rockfall risk and slope instability.

8.1 ROCKFALL ASSESSMENT

A rockfall assessment has been undertaken by Subterra using the ecorisQ software Rockyfor3D, which is a probabilistic, process-based rockfall trajectory model, which simulates rockfall trajectories in three dimensions (3D).

8.1.1 Outcrop Mapping

Subterra conducted walkovers of the upper slope (beyond the site east boundary) on 04/10/2023 and 25/10/2023 to assess the mapped rockfall source areas referenced in the GNS map attached as Appendix D and to investigate the remainder of the slope above the site. A GPS device was used to plot the observed rock outcrop and loose boulders observed across the upper slope.

Rock outcrop was observed in the areas of the upper site indicated by the GNS mapping, though it was not as pervasive as the map would suggest. Much of the observed outcrop was contiguous rock without dilations or fractures.

The largest boulders observed were approximately 1m^3, while most were smaller than 0.25m^3. Figure 15 below shows the rock observed during Subterra's site walkovers. It should be noted that a large area in the lower slope (marked in red below) was not able to be traversed due to heavy vegetation and blackberry.

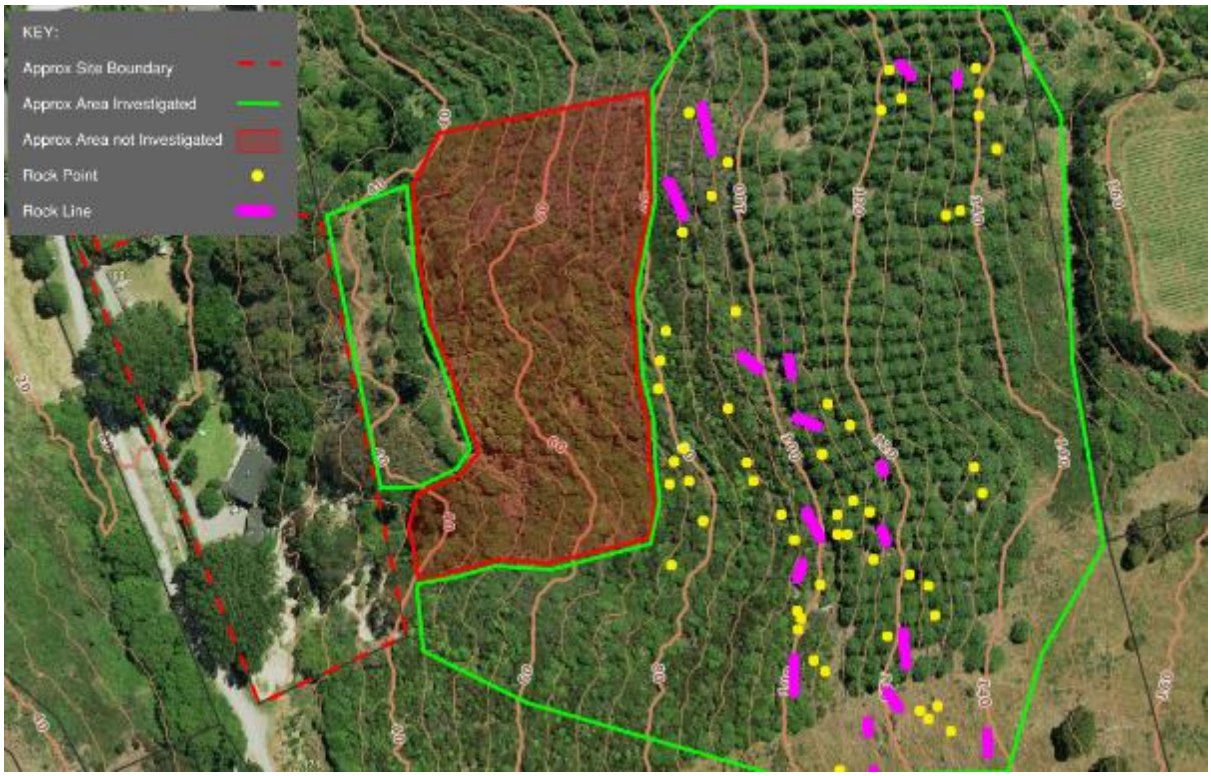


Figure 15: Approximate Observed Outcrop Map with 10m contour lines (modified from Canterbury Maps)

For the purpose of this model, every mapped rock point has been assumed to be a boulder with a volume of 0.25m^3, while every rock line has been assumed to be a boulder with a volume of 1.0m^3. In reality, most of the rock points and rock lines observed were not loose boulders but contiguous rock outcrop with minimal or no dilations. As such, this model is conservative.

Note that this model is approximate only. While every effort was made to traverse the entire area shown in Figure 15, the area is heavily vegetated with trees and other growth and the accuracy of the rockfall map cannot be guaranteed.

8.1.2 3D Rockfall Trajectory Modelling

Three models of rock flow paths have been developed with the following input parameters (Table 4). For the full input parameters refer to Appendix F.

Scenario	1	2	3
Soil Type	2 (fine soil)	3 (scree)	3 (scree)
Rg Values	0 / 0.05 / 0.1	0 / 0.05 / 0.1	0 / 0.05 / 0.05

Table 4: Rockyfor3D Input Parameters

Each scenario was modelled under the following two conditions:

1) With the observed rock sources only; and
2) With additional, inferred rockfall sources in the area unable to be accessed by Subterra's site walkover.

The following conditions apply for all of the modelled scenarios:

- Vegetation was not considered
- For each source cell (1 x 1m) 500 rock blocks were simulated
- A digital elevation model derived from LINZ LIDAR data with a resolution of 1m was used as a basis for the rockfall modelling

	Rock Point	Rock Line
Boulder Volume	0.25m^3	1.0m^3

Table 5: Rock Source Parameters

8.1.3 Results

The reach probability output of the modelling runs was used to assess the rockfall paths and their runout lengths.

It should be noted that adding a large block of source area below the observed rock source areas acts as a barrier within the model and causes higher rock flow paths to stop. As such, in some cases, the addition of condition 2) above results in less potential rockfall intersection onto the site.

As such, a composite output has been produced, comprising the aggregate of the maximum flow paths from all modelled scenarios, shown on Figure 16 below and predicting rockfall flow paths onto the site in several locations, namely across proposed Lots 5, 6, 7, 9, 10, 11, and 12.

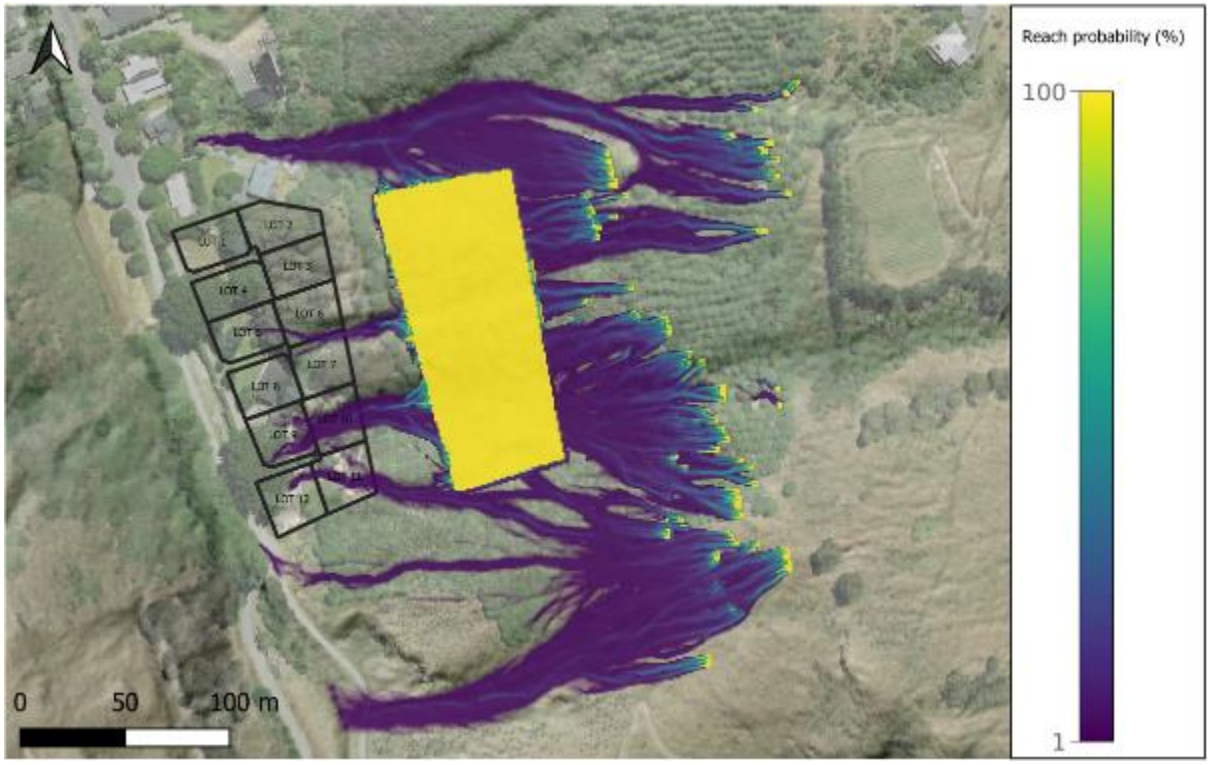


Figure 16: Maximum Modelled Rockfall Paths

In most cases, the modelled rockfall terminated on the flat area which transects the property above the site (which is an overgrown vehicle track, refer to Figure 1 and Figure 17), with the general exceptions of the gullies which cross the site, which act as funnels for rockfall to flow through. The track forms a flat platform approximately 4m wide.

Figure 17: Oblique view of the east boundary of the site looking east, note the overgrown vehicle track approximately marked in yellow

The full results sheets, along with the input parameters, are attached as Appendix F.

8.2 Slope Stability Analysis

A slope stability analysis has been undertaken assuming non-circular failure surfaces within the natural ground surface, for both static and seismic scenarios, using the Rocscience modelling software Slide2 version 9.020.

Two cross-sections (A-A' and B-B') have been used to create the slope models, based on the topographical survey undertaken at the site on 7-8 September 2023 and the contours available on Canterbury Maps. The cross-sections are superimposed on a topographical survey of the site and attached as Appendix G.

8.2.1 Input Parameters

Stability of non-circular slip surfaces was analysed using the Morgenstern-price method of slice limit equilibrium. The stratigraphy of the site was modelled as two soil layers, with the soil/rock interface modelled at 3m below the ground level on the slope, deepening as the base of the slope flattens out.

8.2.2 Back-Analysis of Soil Properties

The slope of the site has been relatively stable through time, based on site observations and historical aerial review. This includes the 2010/2011 Canterbury Earthquake Sequence (CES), in which the site can be considered "sufficiently tested" to an SLS design earthquake level during the 4 September 2010 and 22 February 2011 events.

Subterra's site walkover did not identify any evidence of historic slope instability, also the client advised that to his knowledge the site did not experience slope instability during the CES. Therefore, relative stability of the slope through time implies a Factor of Safety of 1.2 is likely present in the slope soils under 2010/2011 seismic conditions.

Subterra's shallow hand testing encountered shallow refusal on hard silt, so the properties of the soils beneath their penetration depth cannot be confidently inferred. The rock interface at 3m begl has been inferred based on the geological mapping and the rock outcrop observed in the upper slopes.

In the absence of deep testing and supporting laboratory information for the soil parameters, we have back calculated the slope stability to achieve a minimum Factor of Safety (FoS) of 1.0 under the 10th percentile PGA values that the site sustained during the 22 February 2011 event (0.23g using Bradley's method from Section 5.4.3). Note that it is likely that the site underwent significantly higher PGA's than this during this event and as such, the following analysis is conservative.

This gives a cohesion shown in Table 6 below, using a fixed Angle of Internal Friction of 28° and adjusting the cohesion value to achieve the required Factor of Safety.

Peak Ground Acceleration (PGA)	Effective Cohesion c' (kPa)	Effective Angle of Internal Friction ø'	Unit Weight γ (kN/m³)
0.23 g	8	28	18

Table 6: Material Parameters

It should be noted that the above values are a proxy only, in the absence of deep testing and laboratory data, based on the fact that no obvious signs of slope instability were observed at the site, which sustained significant shaking during the 2010/2011 Canterbury Earthquake Sequence.

8.2.3 Seismic Parameters

Pseudo-static seismic analysis was conducted using the following design earthquake parameters for Christchurch, from the MBIE 2021 earthquake geotechnical engineering practice document[13]. Refer to Table 7.

Scenario	PGA (g)	Magnitude (M)	Return Period
SLS1	0.13	7.5	25 years
SLS2	0.19	6.0	25 years
ULS	0.35	7.5	500 years

Table 7: Seismic Parameters

[13] Ministry of Business, Innovation & Employment. (2021). *Earthquake geotechnical engineering practice. Module 1. Overview of the guidelines*

8.2.4 Results

The results of the slope stability analysis are given in Table 8 below and graphical results are attached as Appendix H.

Cross Section	Conditions	Target Factor of Safety (FoS)	Calculated Minimum Factor of Safety (FoS)
A-A'	Static	1.5	1.7
	Seismic (SLS1)	1.2	1.3
	Seismic (SLS2)	1.2	1.2
	Seismic (ULS)	1.0	0.9
B-B'	Static	1.5	1.9
	Seismic (SLS1)	1.2	1.4
	Seismic (SLS2)	1.2	1.3
	Seismic (ULS)	1.0	1.0

Table 8: Slope Stability Analysis Results

Based on the above results, the site can be assumed to be stable under current conditions.

The FoS of less than 1 under ULS conditions do not necessarily imply significant failure is likely[14&15] due to seismic loading being cyclic and ensuing displacements generally being reversed before they reach the point of no return.

[14] Gazetas, G. (2013). "*Can we design in geotechnics with seismic factors of safety less than 1?*", *Proceedings of the 15th European Conference on Soil Mechanics and Geotechnical Engineering - Geotechnics of Hard Soils - Weak Rocks (Part 4)* (pp. 141-154). IOS Press.

[15] Gazetas, G. Anastasopoulos, I. & Garini, E. (2014) "*Geotechnical design with apparent seismic safety factors well-bellow 1*", Soil Dynamics and Earthquake Engineering 57 (2014) 37–45

9 RESOURCE MANAGEMENT ACT ASSESSMENT

Section 106 (1A) of the Resource Management Act (RMA) states:

'A consent authority may refuse to grant a subdivision consent, or may grant a subdivision consent subject to conditions, if it considers that there is a significant risk from natural hazards.

Table 9 below provides our assessment of the above.

Hazard	Potential Susceptibility	
	Current (part a)	Post Development (part b)
Erosion	The site is transected by two large gullies where most of the overland water flow is channelled.	It is not anticipated that the proposed development will accelerate or worsen the erosion rates if appropriate stormwater collection and disposal methods are implemented.
Falling Debris	Part of the site is located in an area with a maximum annual life safety risk from rockfall between 10^{-3} and 10^{-4}. CCC database indicates rock sources were mapped above the site, Subterra's site walkover also observed a number of rocks sources up slope of the site. Christchurch District Plan marked part of the site to be within "Rockfall Management Area 2".	Based on the preliminary rockfall modelling undertaken by Subterra as part of this report, proposed Lots 1, 2, 3, 4, and 8, do not have potential rockfall paths intersecting them. Proposed Lots 5, 6, 7 and 12 have some areas of potential rockfall path intersection which might be avoidable, whereas Lots 9, 10, and 11 are not considered suitable for development unless detailed rockfall modelling and AIFR calculations are undertaken to determine the appropriate mitigation measures.
Slippage	The site's gradient varies from almost level ground (west half) to a maximum of approximately 1V:2H (east half). No observed or recorded historical slope instability. Preliminary slope stability analysis of two cross-sections across the site indicates that the slope is stable under current conditions.	Given the size of the site and the changing topography, further assessment of slope stability will be required prior to development of each lot. Provided slope stability analysis (qualitative and/or quantitative) is undertaken on each proposed lot prior to Building Consent application, it is considered feasible to develop the proposed new lots with new residential dwellings.
Subsidence	Based on the general strength and non-organic nature of the natural soils, the risk of static subsidence is considered low.	Provided that foundations are located on a suitable bearing stratum, and subject to a specific engineered design, the risk of subsidence is unlikely to be worsened. Backfill above exiting ground level should not be undertaken without specific assessment from a professional geotechnical engineer.
Earthquake	The site sustained Peak Ground Accelerations sufficiently testing it to an SLS design earthquake level during the 4 September 2010 and 22 February 2011 earthquake events.	Provided that any development is subject to a specific engineered design, the risk of earthquake damage is not anticipated to be worsened by the future residential development of the site.

Inundation - Flooding	The Christchurch City Council (CCC) indicates that the site is not within a Flood Management Area.	It is considered feasible to develop the new lots with residential dwellings, provided appropriate engineering measures are incorporated.
Tsunami	N/A - The site is not located in a tsunami evacuation zone. Detailed tsunami risk assessment is beyond the scope of this project.	
Volcanic / Geothermal	N/A - No active volcanism or geothermal activity is recorded within the vicinity of the site. Detailed volcanic risk assessment is beyond the scope of this project.	
Wind	Detailed wind risk assessment is beyond the scope of this project.	
Drought	N/A - The site is connected to the Christchurch City Council mains water supply. Detailed drought risk assessment is beyond the scope of this project.	
Fire	The Spreydon Fire Station is located at 77 Simeon Street, approximately 3.9km northwest from the site. Detailed fire risk assessment is beyond the scope of this project.	

Table 9: RMA Section 106 (1) Assessment

It is considered, under Section 106 (1) of the RMA, that there are no reasons from a geotechnical perspective that proposed Lots 1-8 and 12 are considered unsuitable for development, provided any development is undertaken with appropriate engineering design measures and that future dwellings within Lots 5, 6, 7 and 12 observe a 5m setback (no build buffer zone) from the predicted rockfall paths detailed in Subterra's rockfall modelling discussed in Section 8.1.

An amended Subdivision Plan showing the rockfall paths and associated 5m buffer zones forms Appendix I.

If development is proposed on Lots 9, 10, or 11, or within the no build buffer zone on Lots 5, 6, 7 and 12, this will require comprehensive rockfall modelling and Annual Individual Fatality Risk (AIFR) calculations to determine the appropriate remediation strategy to mitigate the rockfall risk. Such analysis is beyond the scope of this report.

10 SUBDIVISION RECOMMENDATIONS

Site-specific investigation and report concluded that the site has nil to low risk of liquefaction-induced ground damage.

10.1 Subdivision Consent Conditions

- Preliminary rockfall modelling indicates that:
    - Lots 1, 2, 3, 4, and 8 do not have a risk of rockfall and are suitable for residential development.
    - Lots 5, 6, 7 and 12 have limits risk of rockfall and need to have a 5 m setback (no build buffer zone) from the predicted rockfall paths. Construction outside the no build buffer zone is permitted. If development is required within the no build buffer zone, then further comprehensive rockfall modelling and Annual Individual Fatality Risk (AIFR) calculations to determine the appropriate remediation strategy to mitigate the rockfall risk.
    - Lots 9, 10, or 11 have a clear risk of rockfall and should not be development without further comprehensive rockfall modelling and Annual Individual Fatality Risk (AIFR) calculations to determine the appropriate remediation strategy to mitigate the rockfall risk.
- Appropriate accessways will need to be formed to provide access to the proposed new lots. This will require specific engineering assessment and design.
- Stormwater concentrations should be appropriately managed and discharged to an approved disposal system and should not be discharged to the ground near the future foundations.

10.2 Consent Notice on Computer Freehold Register

- Specific investigation, assessment and reporting will be required to support the Building Consent application of future development within the site.
- Any development within the identified no build area/lot (as above) will require comprehensive rockfall modelling and Annual Individual Fatality Risk (AIFR) calculations to determine the appropriate remediation strategy to mitigate the rockfall risk.
- Building platforms for any future construction should be designed to achieve the required Finished Floor Level (FFL), taking the risk of inundation into consideration as defined by the Council.
- Stormwater run-off from roofs, driveways and hardstand should be appropriately managed and should be discharged to an approved discharge system away from the foundations of future dwellings.

11 REFERENCES

Bowen, H. J., & Jacka, M. E. (2013). Liquefaction induced ground damage in the Canterbury earthquakes: predictions vs. reality. *19th NZGS Geotechnical Symposium.* Queenstown.

Canterbury Maps. (2021). *Christchurch Liquefaction Viewer*. Retrieved from https://apps.canterburymaps.govt.nz/ChristchurchLiquefactionViewer/

Carey, J., Massey, C., Lukovic, B., McSaveney, M., Heron, D., Reis, W., & A, M. (2013). *Port Hills Slope Stability: Life-safety risk from rockfalls (boulder rolls) in the Port Hills.* Christchurch: GNS Science Consultancy Report.

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Listed Land Use Register. (2021). Retrieved from Environment Canterbury: https://llur.ecan.govt.nz/

Massey, C., Yetton, M., Carey, J., Lukovic, B., Litchfield, N., Ries, W., & McVerry, G. (2013). *Canterbury Earthquakes 2010/11 Port Hills Slope Stability: Stage 1 Report in the findings from investigations into areas of significant ground damage (mass movements).* Christchurch: GNS Science Consultancy Report.

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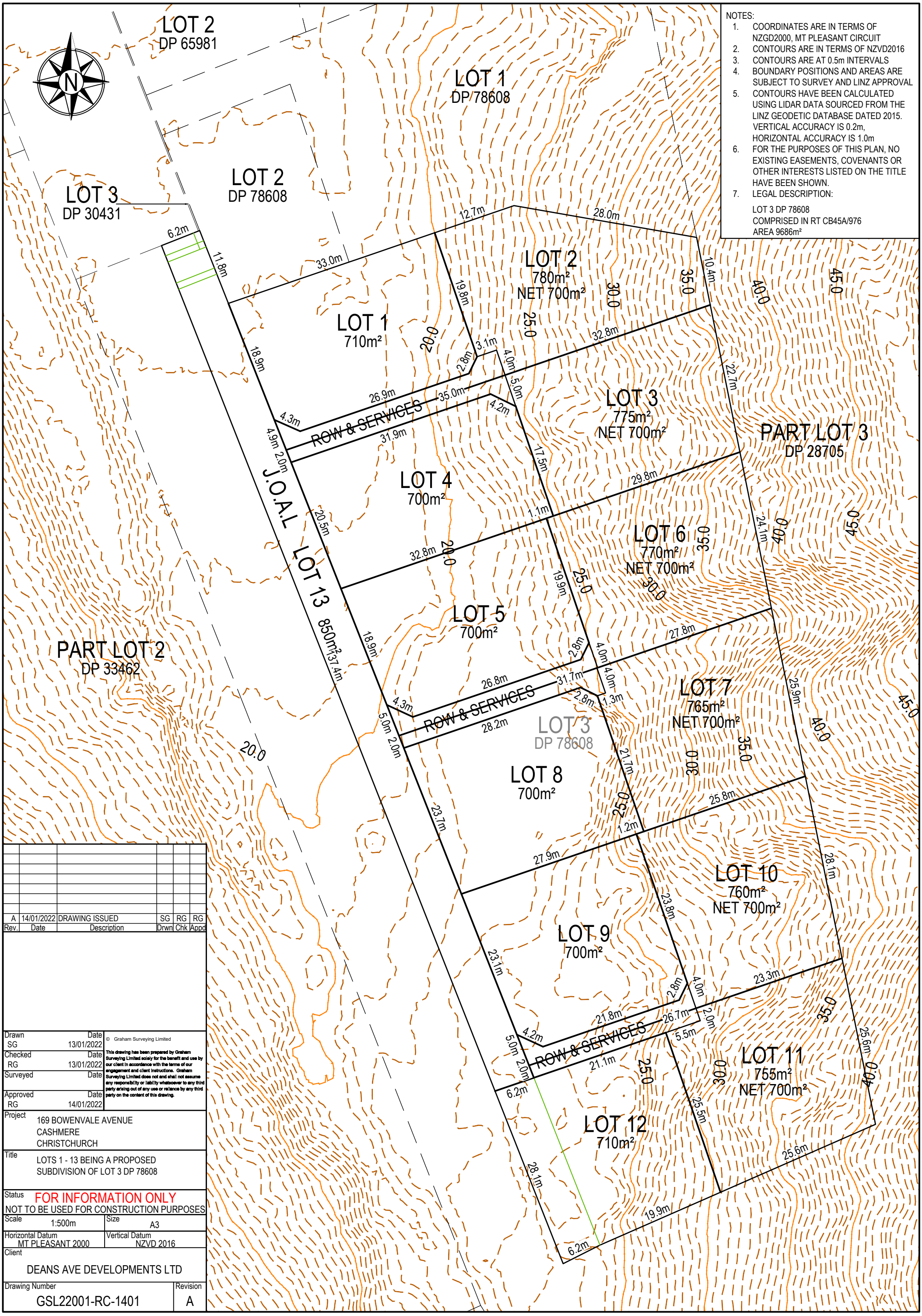
Stockwell, M. (1977). Determination of allowable bearing pressure under small structures. *New Zealand Engineering. V32 I6*.

APPENDIX A

SUBDIVISION SCHEME PLAN



NOTES:

1. COORDINATES ARE IN TERMS OF NZGD2000, MT PLEASANT CIRCUIT
2. CONTOURS ARE IN TERMS OF NZVD2016
3. CONTOURS ARE AT 0.5m INTERVALS
4. BOUNDARY POSITIONS AND AREAS ARE SUBJECT TO SURVEY AND LINZ APPROVAL
5. CONTOURS HAVE BEEN CALCULATED USING LIDAR DATA SOURCED FROM THE LINZ GEODETIC DATABASE DATED 2015. VERTICAL ACCURACY IS 0.2m, HORIZONTAL ACCURACY IS 1.0m
6. FOR THE PURPOSES OF THIS PLAN, NO EXISTING EASEMENTS, COVENANTS OR OTHER INTERESTS LISTED ON THE TITLE HAVE BEEN SHOWN.
7. LEGAL DESCRIPTION:

   LOT 3 DP 78608
   COMPRISED IN RT CB45A/976
   AREA 9686m²

Rev.	Date	Description	Drwn	Chk	Appd
A	14/01/2022	DRAWING ISSUED	SG	RG	RG

Drawn	Date 13/01/2022
Checked	RG Date 13/01/2022
Surveyed	Date
Approved	RG Date 14/01/2022

Project
169 BOWENVALE AVENUE
CASHMERE
CHRISTCHURCH

Title
LOTS 1 - 13 BEING A PROPOSED SUBDIVISION OF LOT 3 DP 78608

Status
FOR INFORMATION ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

Scale	Size
1:500m	A3
Horizontal Datum: MT PLEASANT 2000	Vertical Datum: NZVD 2016

Client
DEANS AVE DEVELOPMENTS LTD

Drawing Number	Revision
GSL22001-RC-1401	A

APPENDIX B

COOK COSTELLO 2015 HAND AUGER LOGS

APPENDIX 1 : SITE PLAN

577 Hills Road
Marshland
Christchurch
P: 09 438 4417
E: info@geocivil.co.nz
M: 027 6565 226

TEST REPORT

Lab Job No:	8020-1400
Your ref.:	12448-116
Date of Issue:	21/07/2015
Date of Re-Issue:	-
Page:	1 of 10

Test Report.

No. 15-1071

PROJECT:	169 Bowenvale Avenue, Christchurch
CLIENT:	Cook Costello Ltd. Unit 4, 155 Blenheim Road, Riccarton, Christchurch
ATTENTION:	Melanie Thrush
INSTRUCTIONS:	Determination of the penetration resistance using a dynamic cone (scala) Penetrometer Augerholes where required (not accredited)
TEST METHOD:	NZS 4402: 1988 Test 6.5.2 NZGS December 2005 (not accredited)
SAMPLING METHOD:	N/A
TEST RESULTS:	As Per Laboratory Sheets attached

T. Smith

Laboratory Technician

T. Taylor

Approved Signatory

IANZ ACCREDITED LABORATORY

Tests indicated as not accredited are outside the scope of the laboratory's accreditation

AUGERHOLE LOG

577 Hills Road,
Christchurch,
M:0276565226
E:info@geocivil.co.nz

Job No.:	**8020-1400**	**Borehole No.:**	**BH1**	**Sheet:**	1 of 1
Report No.:	15-1071				
Client:	Cook Costello Ltd	**Coordinates:**		**Date:**	10/07/15
Client Ref. No.:	12448-116				
Project:	Geotechnical Investigations	**Location:**	169 Bowenvale Avenue	**Ground Level:**	0

Geological Interpretation (In accordance with NZGS 2005)	UCS	Legend	Depth (m)	Water	Vane Shear Strength (kPa) (Tested in accordance with NZGS Aug 2001) 50 100 150 200	Values	Samples
silty TOPSOIL, traces of organics, dark brown, moist	Pt						
SILT, minor clay, traces of fine sand, brown, wet, moderate plasticity (LOESS)	MH		0.5 1.0	Groundwater Not Encountered			
End of Borehole (unable to penetrate)			1.5				

Remarks

Unable to penetrate at 1.1mbgl due to potential bedrock

Water

- Standing Water Level
- Out flow
- In flow

Investigation Type

- [x] Hand Auger
- [ ] Test Pit

Contractor:	Rig/Plant Used:	Page No.:	Logged By:	Checked By:	Hole Depth:
Geocivil	Hand auger	2 of 10	J.M	T.S	1.10 m

AUGERHOLE LOG

577 Hills Road,
Christchurch,
M:0276565226
E:info@geocivil.co.nz

Job No.:	**8020-1400**	**Borehole No.:**	**BH2**	**Sheet:**	1 of 1
Report No.:	15-1071				
Client:	Cook Costello Ltd	**Coordinates:**		**Date:**	10/07/15
Client Ref. No.:	12448-116				
Project:	Geotechnical Investigations	**Location:**	169 Bowenvale Avenue	**Ground Level:**	0

Geological Interpretation (In accordance with NZGS 2005)	UCS	Legend	Depth (m)	Water	Vane Shear Strength (kPa) (Tested in accordance with NZGS Aug 2001) 50 100 150 200	Values	Samples
silty TOPSOIL, traces of organics, dark brown, moist	Pt						
SILT, traces of fine sand, traces of clay, light brown, dry (LOESS)	ML		0.5	Groundwater Not Encountered			
			1.0				
End of Borehole (unable to penetrate)			1.5				

Remarks

Loess becomes too dense to penetrate at 1.2mbgl

Water

- Standing Water Level
- Out flow
- In flow

Investigation Type

- [x] Hand Auger
- [ ] Test Pit

Contractor:	Rig/Plant Used:	Page No.:	Logged By:	Checked By:	Hole Depth:
Geocivil	Hand auger	3 of 10	J.M	T.S	1.20 m

GEO CIVIL

AUGERHOLE LOG

577 Hills Road,
Christchurch,
M:0276565226
E:info@geocivil.co.nz

Job No.:	**8020-1400**	**Borehole No.:**	**BH3**	**Sheet:**	1 of 1
Report No.:	15-1071				
Client:	Cook Costello Ltd	**Coordinates:**		**Date:**	10/07/15
Client Ref. No.:	12448-116				
Project:	Geotechnical Investigations	**Location:**	169 Bowenvale Avenue	**Ground Level:**	0

Geological Interpretation (In accordance with NZGS 2005)	UCS	Legend	Depth (m)	Water	Vane Shear Strength (kPa) (Tested in accordance with NZGS Aug 2001) 50 100 150 200	Values	Samples
SILT, traces of fine sand, traces of clay, light brown, dry (LOESS)	ML		0.5	Groundwater Not Encountered			
			1.0				
End of Borehole (unable to penetrate)			1.5				

Remarks

Loess becomes too dense to penetrate at 1.4mbgl

Water

- Standing Water Level
- Out flow
- In flow

Investigation Type

- [x] Hand Auger
- [ ] Test Pit

Contractor:	Rig/Plant Used:	Page No.:	Logged By:	Checked By:	Hole Depth:
Geocivil	Hand auger	4 of 10	J.M	T.S	1.40 m

AUGERHOLE LOG

577 Hills Road,
Christchurch,
M:0276565226
E:info@geocivil.co.nz

Job No.:	**8020-1400**	**Borehole No.:**	**BH4**	**Sheet:**	1 of 1
Report No.:	15-1071				
Client:	Cook Costello Ltd	**Coordinates:**		**Date:**	10/07/15
Client Ref. No.:	12448-116				
Project:	Geotechnical Investigations	**Location:**	169 Bowenvale Avenue	**Ground Level:**	0

Geological Interpretation (In accordance with NZGS 2005)	UCS	Legend	Depth (m)	Water	Vane Shear Strength (kPa) (Tested in accordance with NZGS Aug 2001) 50 100 150 200 Values	Samples
silty TOPSOIL, traces of organics, dark brown, moist	Pt					
SILT, traces of fine sand, traces of clay, traces of organics, light brown mixed with dark brown, wet, low plasticity (FILL)	ML		0.5	Groundwater Not Encountered		
End of Borehole (unable to penetrate)			1.0 1.5			

Remarks

Unable to penetrate potential gravelly fill material at 0.8mbgl

Water

- Standing Water Level
- Out flow
- In flow

Investigation Type

- [x] Hand Auger
- [ ] Test Pit

Contractor:	Rig/Plant Used:	Page No.:	Logged By:	Checked By:	Hole Depth:
Geocivil	Hand auger	5 of 10	J.M	T.S	0.80 m

577 Hills Road - Marshland - Christchurch
E: info@geocivil.co.nz
M: 027 6565 225

DYNAMIC CONE (SCALA) PENETROMETER

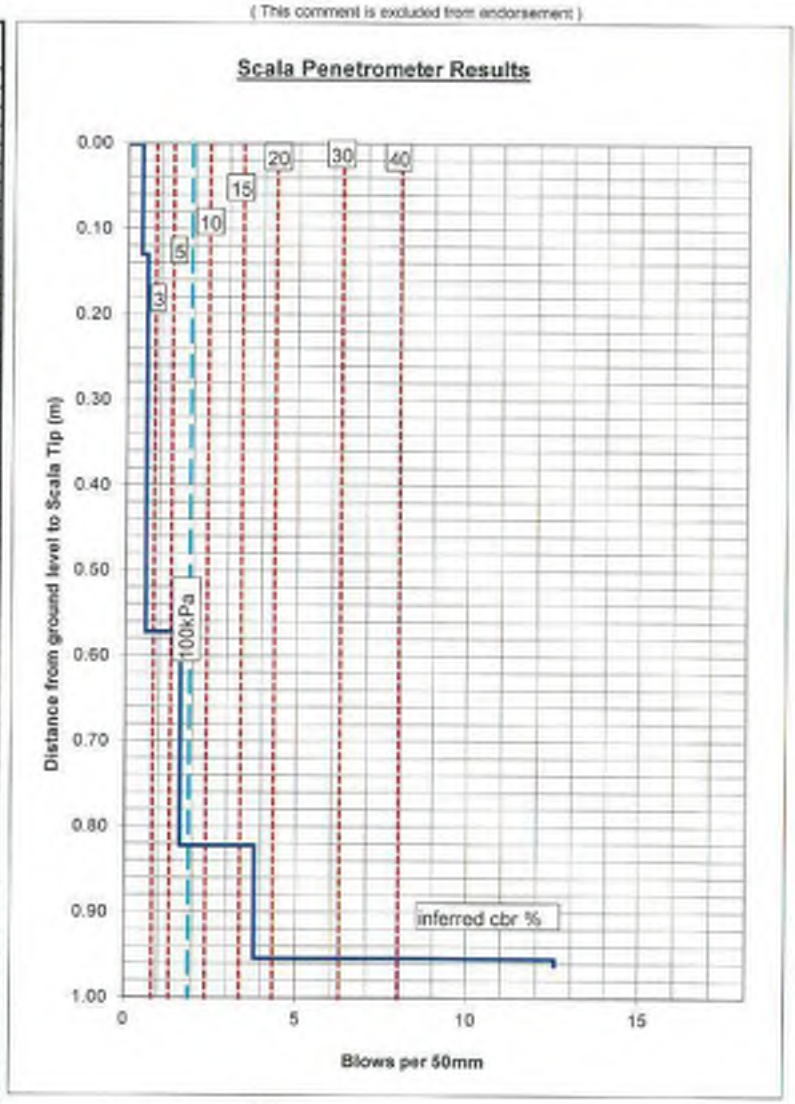
NZS 4402 :1988 Test 6.5.2

Lab Job No: 8020-1400
Client: Cook Costello Ltd
Job: 169 Bowenvale Avenue
Location: BH1
Start Depth (m): 0

Scala No: SP1
Ref : 12448-116
Report No: 15-1071
Page: 6 of 10

The line are the suggested correlation of CBR values based on Figure 5.3, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (2004) "Pavement Design - a guide to the design of road Pavements"
(This comment is excluded from endorsement)

No. Blows	Tip to ref (cm)	mm / blow	blows / 50mm	Blows / 300mm	Total Blows	depth (m)
0	88.7	0	0	0	0	0.00
1	75.8	129	0	2	1	0.13
5	31.6	88	1	3	6	0.57
8	6.6	31	2	10	14	0.82
0	106.6	0	0	0	14	0.82
10	93.4	13	4	23	24	0.95
2	92.6	4	12	75	26	0.96



Recorded By: J.M
Date: 10/07/2015
Checked by: T.S
Date: 21/7/15

Note: All readings taken below 1.5m from start depth are outside the scope of this test

T. Taylor
Approved Signatory

577 Hills Road - Marshland - Christchurch
E: info@geocivil.co.nz
M: 027 6565 226

DYNAMIC CONE (SCALA) PENETROMETER

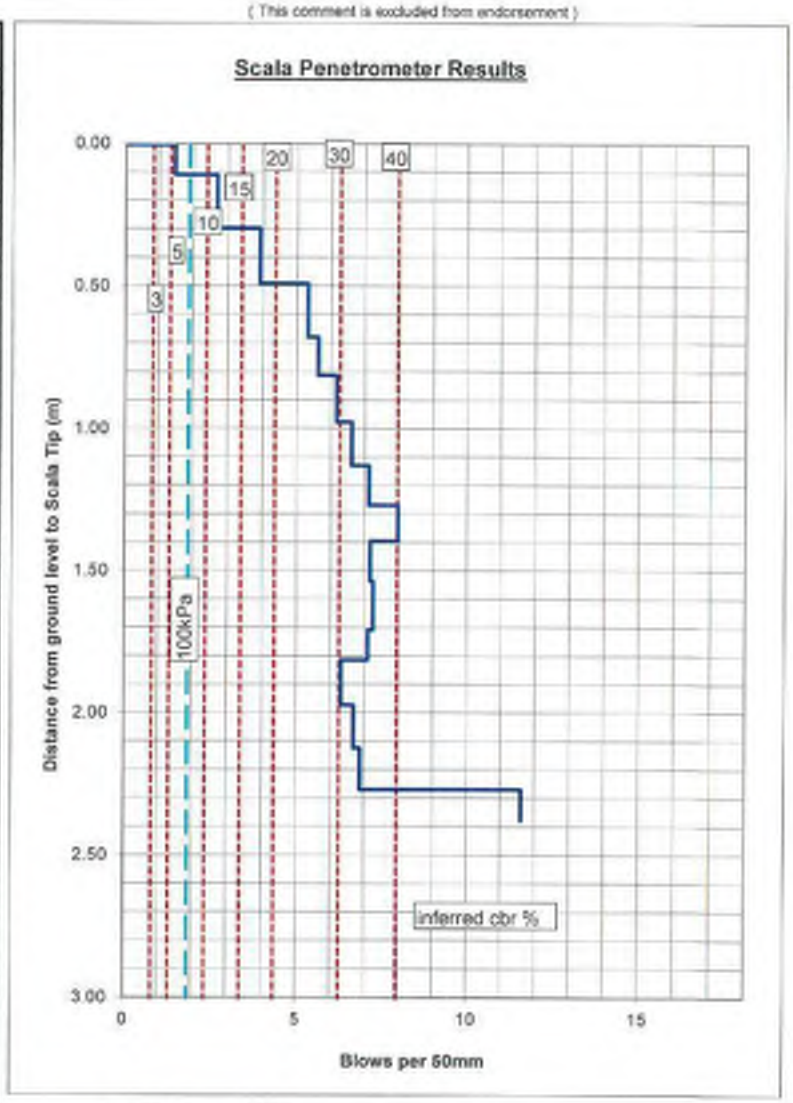
NZS 4402 :1988 Test 6.5.2

Lab Job No: 8020-1400
Client: Cook Costello Ltd
Job: 169 Bowenvale Avenue
Location: BH2
Start Depth (m): 0

Scala No: SP2
Ref : 12448-116
Report No: 15-1071
Page: 7 of 10

The line are the suggested correlation of CBR values based on Figure 5.3, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (2004) "Pavement Design - a guide to the design of road Pavements"
(This comment is excluded from endorsement)

No. Blows	Tip to ref (cm)	mm / blow	blows / 50mm	Blows / 300mm	Total Blows	depth (m)
0	88.7	0	0	0	0	0.00
3	78.2	35	1	9	3	0.11
10	39.4	19	3	16	13	0.29
15	40.1	13	4	23	28	0.49
20	21.2	9	6	32	48	0.66
15	7.8	9	6	34	63	0.81
0	107.8	0	0	0	63	0.81
20	91.5	8	6	37	83	0.97
20	76.3	8	7	39	103	1.12
20	62.2	7	7	43	123	1.27
20	49.6	6	8	46	143	1.39
20	35.6	7	7	43	163	1.53
25	18.3	7	7	43	188	1.70
15	7.7	7	7	42	203	1.81
0	107.7	0	0	0	203	1.81
20	91.8	8	6	38	223	1.97
20	76.8	8	7	40	243	2.12
20	62.2	7	7	41	263	2.27
25	51.4	4	12	69	288	2.37



Recorded By: J.M
Date: 10/07/2015
Checked by: T.S
Date: 21/7/15

Note: All readings taken below 1.5m from start depth are outside the scope of this test

T. Taylor
Approved Signatory

GEO CIVIL

577 Hills Road - Marshland - Christchurch
E: info@geocivil.co.nz
M: 027 8565 226

DYNAMIC CONE (SCALA) PENETROMETER

NZS 4402 :1988 Test 6.5.2

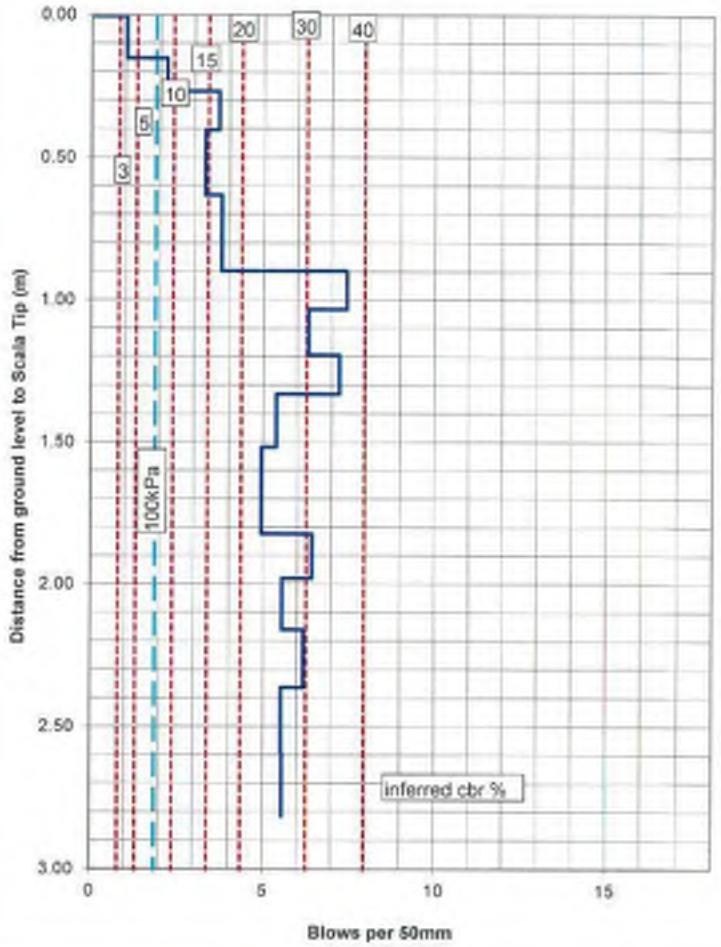
Lab Job No: 8020-1400
Client: Cook Costello Ltd
Job: 169 Bowenvale Avenue
Location: BH3
Start Depth (m): 0

Scala No: SP3
Ref : 12448-116
Report No: 15-1071
Page: 8 of 10

The line are the suggested correlation of CBR values based on Figure 5.3, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (2004) "Pavement Design - a guide to the design of road Pavements"
(This comment is excluded from endorsement)

No. Blows	Tip to ref (cm)	mm / blow	blows / 50mm	Blows / 300mm	Total Blows	depth (m)
0	93.5	0	0	0	0	0.00
3	78.7	49	1	6	3	0.15
5	67.2	23	2	13	8	0.35
10	53.6	14	4	22	18	0.45
15	39.7	15	3	20	33	0.63
20	4.1	13	4	23	53	0.89
0	104.1	0	0	0	53	0.89
20	90.6	7	7	44	73	1.03
20	74.7	8	6	38	93	1.19
20	60.8	7	7	43	113	1.33
20	42.1	9	5	32	133	1.51
30	11.8	10	5	30	163	1.82
0	111.8	0	0	0	163	1.82
20	96	8	6	38	183	1.98
20	77.9	9	6	33	203	2.16
25	57.6	8	6	37	228	2.36
25	34.9	9	6	33	253	2.59
25	12.3	9	6	33	278	2.81

Scala Penetrometer Results



Recorded By: J.M
Date: 10/07/2015
Checked by: T.S
Date: 21/7/15

Note: All readings taken below 1.5m from start depth are outside the scope of this test

577 Hills Road - Marshland - Christchurch
E: info@geocivil.co.nz
M: 027 6565 226

DYNAMIC CONE (SCALA) PENETROMETER

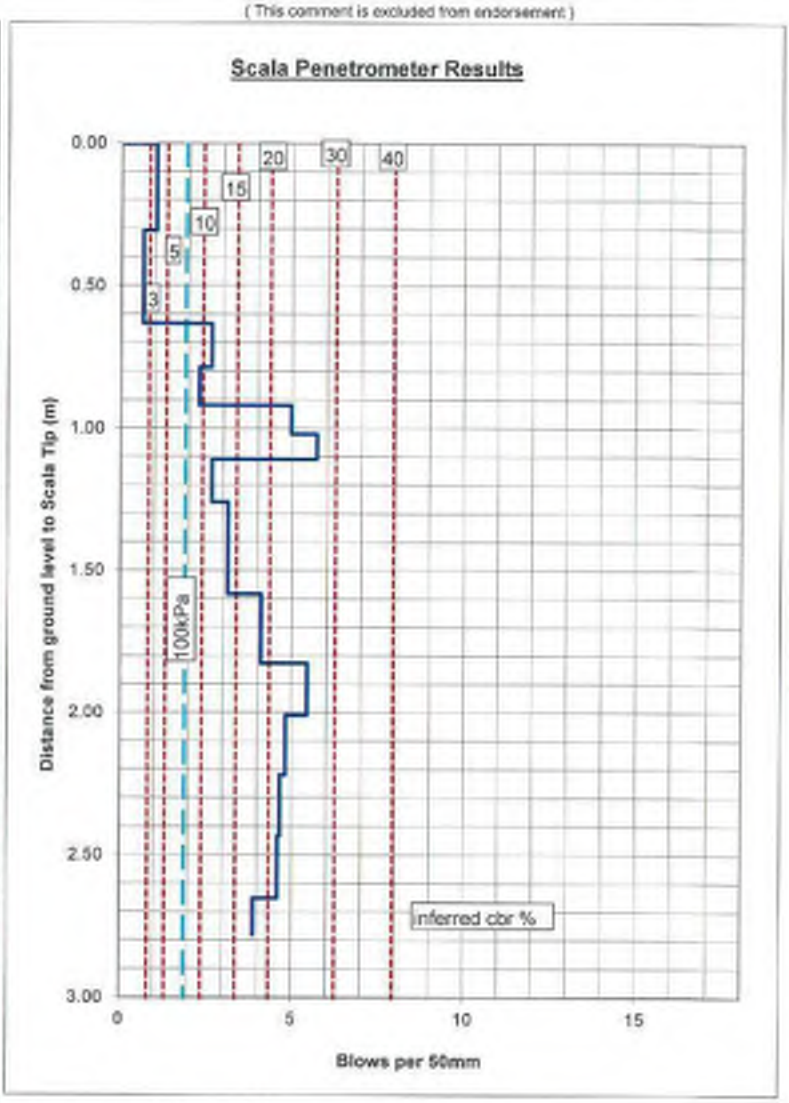
NZS 4402 :1988 Test 6.5.2

Lab Job No: 8020-1400
Client: Cook Costello Ltd
Job: 169 Bowenvale Avenue
Location: BH4
Start Depth (m): 0

Scala No: SP4
Ref : 12448-116
Report No: 15-1071
Page: 9 of 10

The line are the suggested correlation of CBR values based on Figure 5.3, Correlation of Dynamic Cone Penetration and CBR AUSTROADS (2004) "Pavement Design - a guide to the design of road Pavements"
(This comment is excluded from endorsement)

No. Blows	Tip to ref (cm)	mm / blow	blows / 50mm	Blows / 300mm	Total Blows	depth (m)
0	88.5	0	0	0	0	0.00
3	73.4	50	1	6	3	0.15
3	58.2	51	1	6	6	0.30
4	25.6	82	1	4	10	0.63
8	10.3	19	3	16	18	0.78
0	110.3	0	0	0	18	0.78
6	97	22	2	14	24	0.92
10	86.9	10	5	30	34	1.02
10	76.1	9	5	34	44	1.10
8	62.9	19	3	16	52	1.26
20	30.7	16	3	19	72	1.58
20	6.2	12	4	24	92	1.82
0	106.2	0	0	0	92	1.82
20	87.8	9	5	33	112	2.01
20	67	10	5	29	132	2.22
20	45.5	11	5	28	152	2.43
20	23.7	11	5	28	172	2.65
10	10.8	13	4	23	182	2.78



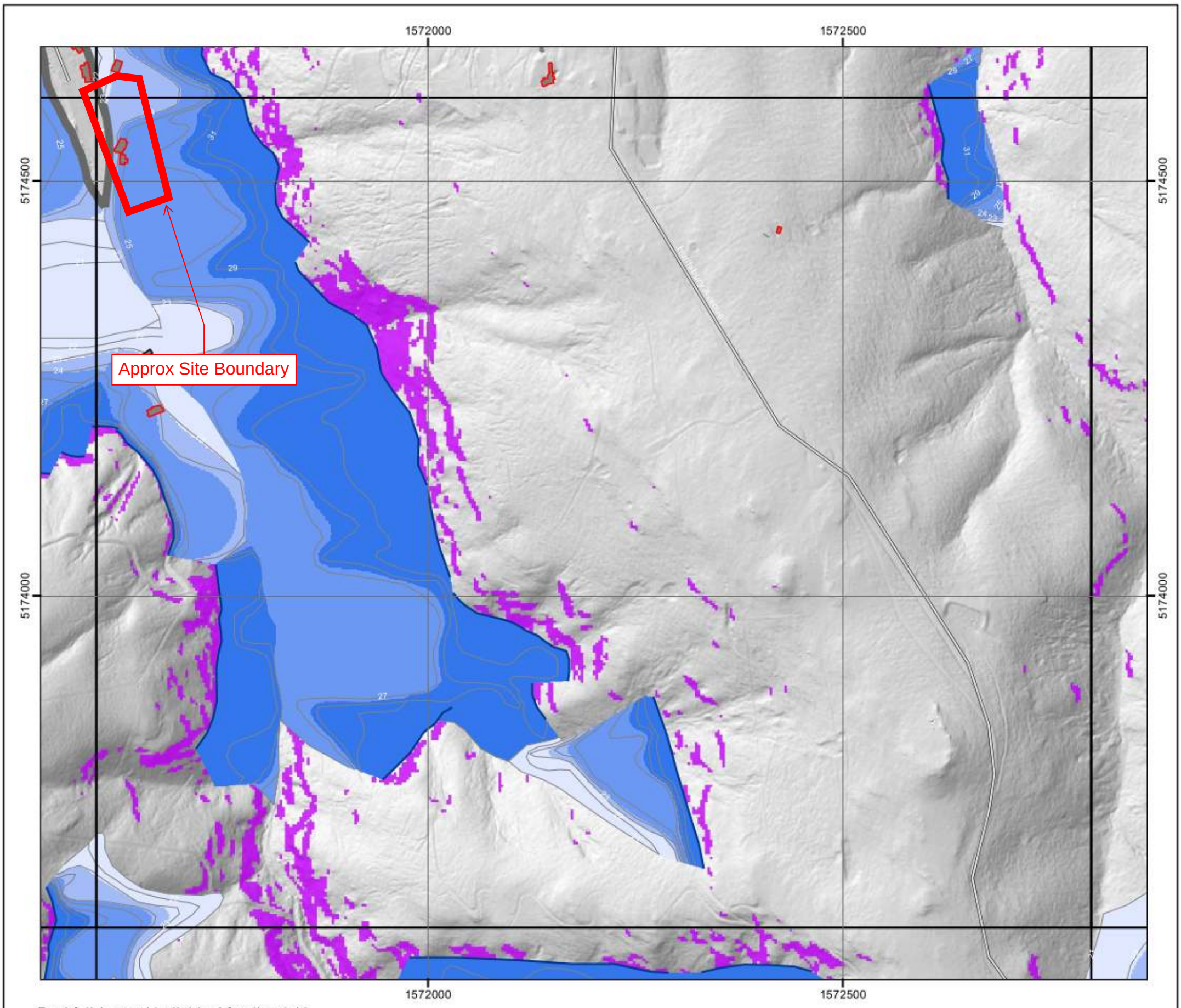
Recorded By: J.M
Date: 10/07/2015
Checked by: T.S
Date: 21/7/15

Note: All readings taken below 1.5m from start depth are outside the scope of this test

T. Taylor
Approved Signatory

APPENDIX C

MAP D6 OF GNS ROCKFALL RISK REPORT



Rockfall (annual individual fatality risk)

- Greater than 10^{-3}
- 10^{-3} to 10^{-4}
- 10^{-4} to 10^{-5}
- Less than 10^{-5}
- 10^{-6} annual individual fatality risk line
- Potential rockfall source areas (slopes > than 35 degrees)
- Toe of lowest rockfall source area
- Shadow angle with values (for example 21 degrees)

Only those areas with dwellings have been field verified and modified accordingly

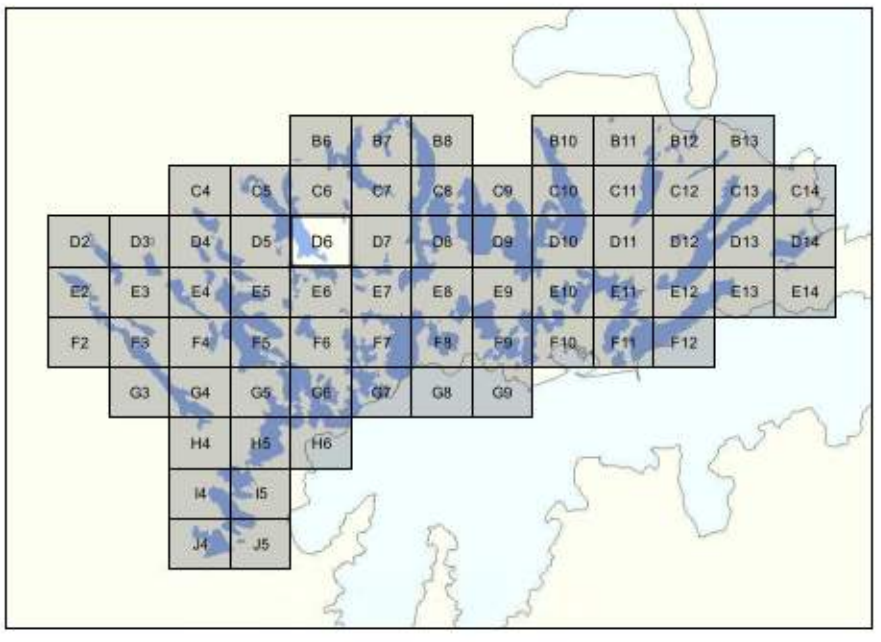
N

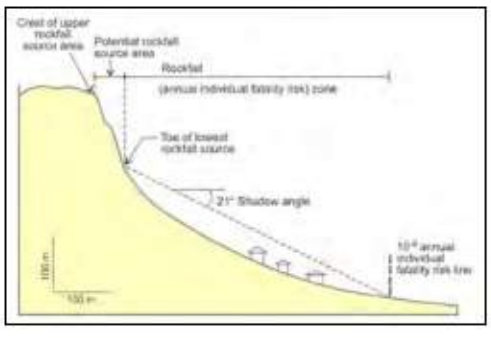
Modifications to modelled risk zones:
The hatched areas are where modelled risk values were changed following field verification

- Areas where the risk decreased
- Areas where the risk increased

Buildings (20/02/2012)

- Dwelling
- Commercial-Industrial
- Accessory building
- Unknown





Annual individual fatality risk bands (e.g. 10^{-3} to 10^{-4}) – The risk of being killed in any one year is expressed as a number such as 10^{-4} ("ten to the minus four"), which is one chance in 10,000 of being killed in any one year.

10^{-6} risk line – Defined as the line beyond which rockfall risk is assessed to be less than an annual individual fatality risk of 10^{-6}. This line represents the furthest distance that rockfalls are likely to reach.

SCALE BAR: 0 100 200 m

EXPLANATION:

Background shade model derived from NZAM post earthquake 2011c (July 2011) LiDAR survey resampled to a 1 m ground resolution. Roads and building footprints and types provided by Christchurch City Council (20/02/2012).

PROJECTION: New Zealand Transverse Mercator 2000

DRW: BL

CHK: CM

GNS SCIENCE TE PŪ AO

ROCKFALL ANNUAL INDIVIDUAL FATALITY RISK

Port Hills
Christchurch

APPENDIX C
Map D6

FINAL ISSUE 2

REPORT: CR2012/123

DATE: July 2013

APPENDIX D

MAP 31 OF CCC BOULDER MAPS

1:5,000 @A3

50 25 0 50 100 150 200 m

PHGG: Location of Fallen and Insitu Boulders and Bluffs

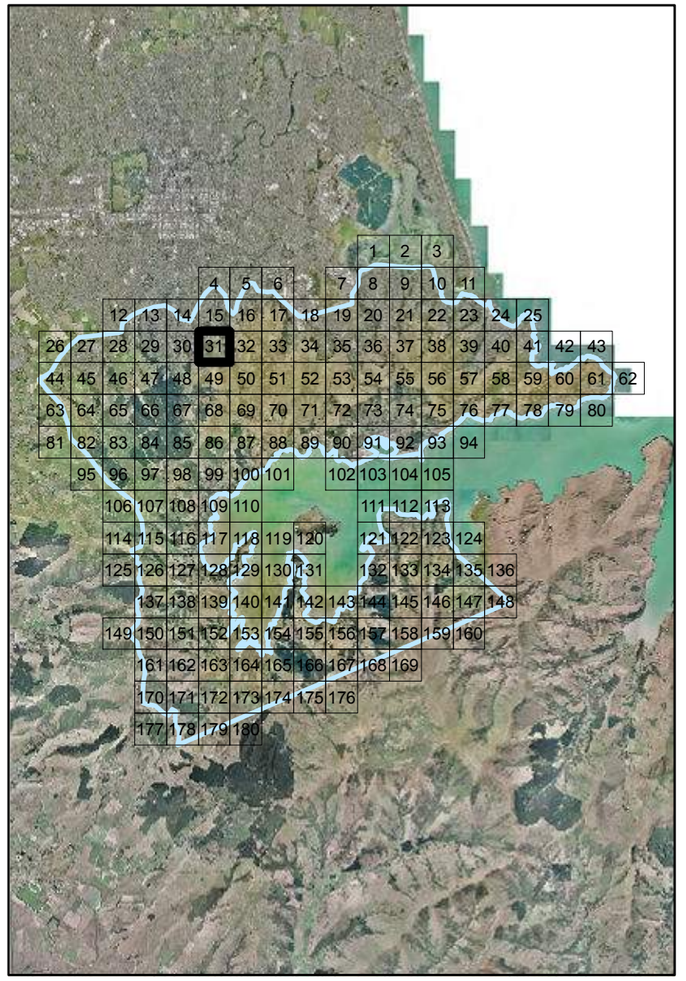
Projection: New Zealand Transverse Mercator
Datum: Geodetic Datum of New Zealand 2000
Map Produced: 14/05/2013

MAP: 31

See Map: 15

See Map: 30

See Map: 32



Legend

- Insitu Boulders (20130422)
- Fallen Boulders (20130422)
- Cliff edge, July 2011
- Address Point
- Extent Of PHGG Study Area
- Property Boundary
- Bluff Talus (20130422)
- Bluff Insitu (20130422)
- Bluff Envelope (20130422)

Disclaimer:

Boulder locations are within approximately 10 metres.

Some boulders may have moved since being recorded, and additional boulders may have fallen.

Some locations represent clusters of boulders. Labels indicate the number of boulders at these locations.

Locations exclude cliff collapse and mass land movement effects.

See Map: 49

Christchurch City Council

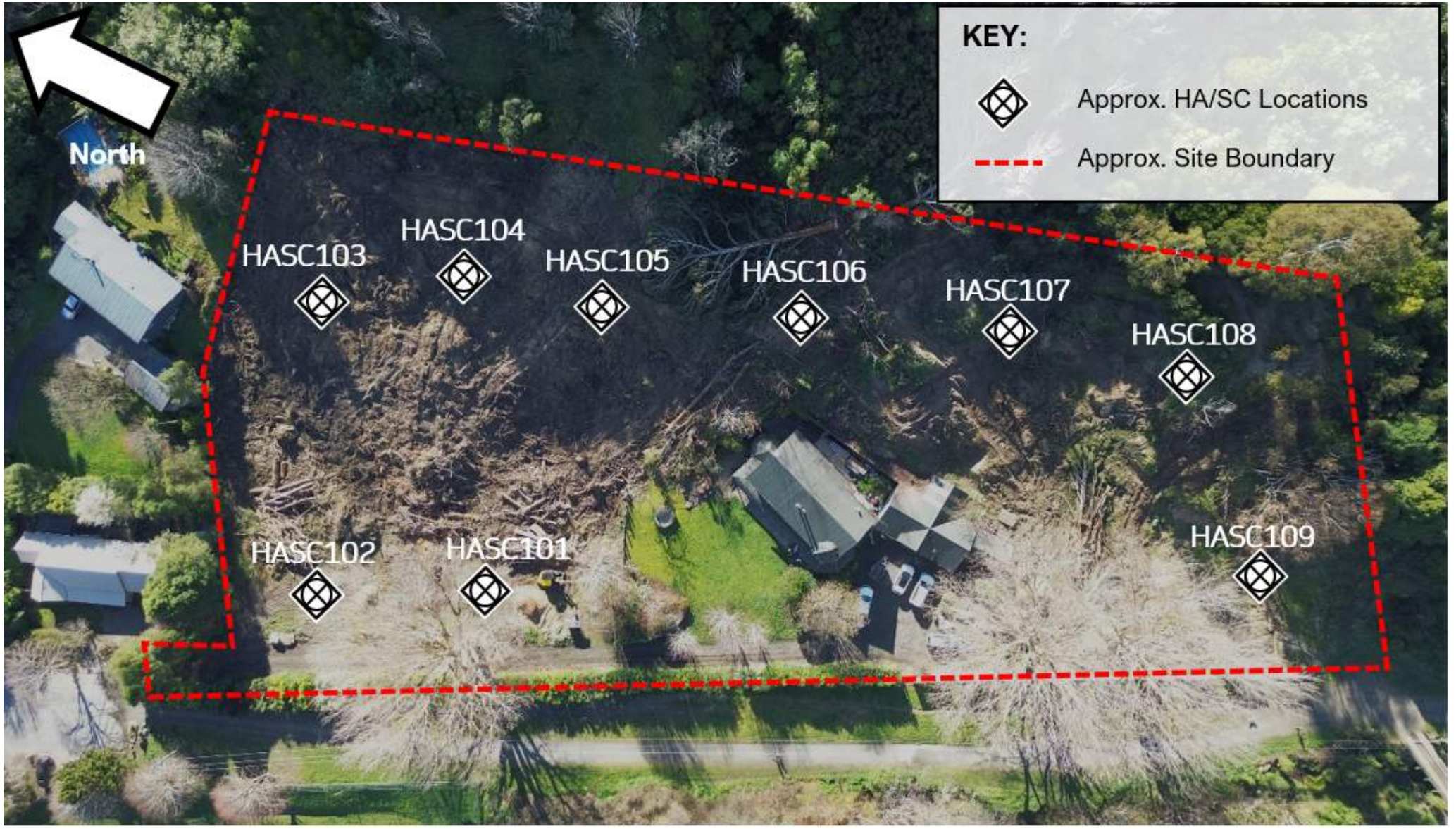
APPENDIX E

HAND AUGER LOG SHEETS

SITE PLAN

JOB NO.: 2023-0395

CLIENT:	Bowenvale Park Estates Ltd
PROJECT:	Geotechnical Investigation
LOCATION:	169 Bowenvale Avenue, Cashmere



INVESTIGATION LOG

HOLE NO.: HASC101

CLIENT: Bowenvale Park Estates Ltd

PROJECT: Geotechnical Investigation

JOB NO.: 2023-0395

SITE LOCATION: 169 Bowenvale Avenue, Cashmere

START DATE: 06/09/2023

CO-ORDINATES:

ELEVATION: Ground

END DATE: 06/09/2023

CONTRACTOR:

RIG:

DRILLER:

LOGGED BY: HG

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	HAND SHEAR VANE (Uncorrected)	WATER
TOPSOIL - Soft, dark brown organic silt with trace rootlets, moist.		0.0		1		
Soft to firm, greyish brown SILT, moist.		0.2		2, 4		
		0.4		4, 3		
Trace orange mottling.		0.6		2, 3		
		0.8		3, 3		
		1.0		3, 4		
Dark greyish brown, trace rootlets. No organic odour.		1.2		5, 4		
		1.4		4, 5		
		1.6		6, 7		
Firm, grey mottled orange SILT with trace sand, dry to moist. Sand fine.		1.8		8, 8		
		2.0		8, 7		
		2.2		7, 7		
Minor sand, moist.		2.4		9, 8		
Trace dark grey streaks. No organic odour.		2.6		8, 8		
		2.8		8, 7		
Streaks absent.		3.0				
End of borehole (target depth). EOH: 3.20m		3.2				
		3.4				
		3.6				
		3.8				
		4.0				
		4.2				

Groundwater Not Encountered

INVESTIGATION LOG

SUBTERRA Geotechnical Investigation

HOLE NO.: HASC102

CLIENT: Bowenvale Park Estates Ltd

PROJECT: Geotechnical Investigation

JOB NO.: 2023-0395

SITE LOCATION: 169 Bowenvale Avenue, Cashmere

START DATE: 06/09/2023

CO-ORDINATES:

ELEVATION: Ground

END DATE: 06/09/2023

CONTRACTOR:

RIG:

DRILLER:

LOGGED BY: HG

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	HAND SHEAR VANE (Uncorrected)	WATER
TOPSOIL - Soft, dark brown organic silt with trace rootlets, dry to moist.		0.0	TS	1		
Soft, greyish brown SILT, moist.		0.2		2, 3, 5, 5		
Dark greyish brown. No organic odour.		0.6		2, 3, 2, 1, 2, 4		
Firm to stiff, pale grey mottled orange SILT with trace sand, dry to moist. Sand fine.		1.2		7, 7, 8, 8, 7, 7		
Moist.		1.8		7, 6, 6, 7, 9		
Grey mottled orange, minor fine sand.		2.2		8, 7, 8, 7		
Trace fine sand.		2.6		6, 6, 6		
Grey to reddish brown.		3.2				
Trace fine, sub-angular gravel.		3.8				
End of borehole (target depth). EOH: 4.20m		4.2				Groundwater Not Encountered

Generated with CORE-GS by Geroc - Hand Auger - scala bar - 12/09/2023 2:12:53 pm

INVESTIGATION LOG

HOLE NO.: HASC103

CLIENT: Bowenvale Park Estates Ltd

PROJECT: Geotechnical Investigation

JOB NO.: 2023-0395

SITE LOCATION: 169 Bowenvale Avenue, Cashmere

START DATE: 06/09/2023

CO-ORDINATES:

ELEVATION: Ground

END DATE: 06/09/2023

CONTRACTOR:

RIG:

DRILLER:

LOGGED BY: HG

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	HAND SHEAR VANE (Uncorrected)	WATER
TOPSOIL - Soft, dark brown organic silt with trace rootlets, moist.		0.0	TS	1		Groundwater Not Encountered
Firm, yellowish brown SILT with trace sand, moist. Sand fine.		0.6		3, 3, 4, 3, 3, 3, 3		
Trace orange mottling.		1.0		4, 5		
Stiff. Grinding noise but no gravel in sample.		1.2		10, 10, 12		
Very stiff.		1.6		13, 16		
End of borehole (unable to penetrate hard silt). EOH: 1.80m		1.8		20		

Scala penetrometer scale: 2 4 6 8 10 12 14 16 18

Depth scale: 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0 3.2 3.4 3.6 3.8 4.0 4.2

INVESTIGATION LOG

HOLE NO.: HASC104

CLIENT: Bowenvale Park Estates Ltd

PROJECT: Geotechnical Investigation

JOB NO.: 2023-0395

SITE LOCATION: 169 Bowenvale Avenue, Cashmere

START DATE: 06/09/2023

CO-ORDINATES:

ELEVATION: Ground

END DATE: 06/09/2023

CONTRACTOR:

RIG:

DRILLER:

LOGGED BY: HG

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	HAND SHEAR VANE (Uncorrected)	WATER
Soft, yellowish brown SILT with trace clay and rootlets, moist.		0.0		1		
Mottled orange, rootlets absent.		0.2		1		
		0.4		3		
		0.6		3		
Firm.		0.8		2		
		1.0		4		
Stiff, yellowish grey.		1.2		5		
		1.4		7		
End of borehole (unable to penetrate hard silt).		1.6		9		
		1.8		10		
EOH: 1.90m		2.0		10		
		2.2		15		
		2.4		10		
		2.6		11		
		2.8		9		
		3.0		15		
		3.2		15		
		3.4				
		3.6				
		3.8				
		4.0				
		4.2				

Groundwater Not Encountered

INVESTIGATION LOG

HOLE NO.: HASC105

CLIENT: Bowenvale Park Estates Ltd
PROJECT: Geotechnical Investigation
JOB NO.: 2023-0395

SITE LOCATION: 169 Bowenvale Avenue, Cashmere
START DATE: 06/09/2023
CO-ORDINATES:
ELEVATION: Ground
END DATE: 06/09/2023
CONTRACTOR:
RIG:
DRILLER:
LOGGED BY: HG

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	HAND SHEAR VANE (Uncorrected)	WATER
Soft, grey mottled orange SILT, moist.		0.0		1		Groundwater Not Encountered
Firm.		0.2		3		
Stiff, trace to minor fine sand.		0.4		3		
		0.6		7		
		0.8		6		
		1.0		8		
End of borehole (unable to penetrate hard silt).		1.2		6		
		1.4		9		
		1.6		10		
EOH: 1.70m		1.8		11		
		2.0		11		
		2.2		11		
		2.4		12		
		2.6		13		
		2.8		20		
		3.0				
		3.2				
		3.4				
		3.6				
		3.8				
		4.0				
		4.2				

INVESTIGATION LOG

HOLE NO.: HASC106

CLIENT: Bowenvale Park Estates Ltd

PROJECT: Geotechnical Investigation

JOB NO.: 2023-0395

SITE LOCATION: 169 Bowenvale Avenue, Cashmere

START DATE: 06/09/2023

CO-ORDINATES:

ELEVATION: Ground

END DATE: 06/09/2023

CONTRACTOR:

RIG:

DRILLER:

LOGGED BY: HG

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	HAND SHEAR VANE (Uncorrected)	WATER
Soft to very stiff, yellowish brown SILT, dry to moist.		0.0 – 1.1		1, 1, 3, 12, 10, 14, 18		Groundwater Not Encountered
End of borehole (unable to penetrate hard silt). EOH: 1.10m						

INVESTIGATION LOG

HOLE NO.: HASC107

CLIENT: Bowenvale Park Estates Ltd
PROJECT: Geotechnical Investigation
JOB NO.: 2023-0395

SITE LOCATION: 169 Bowenvale Avenue, Cashmere
START DATE: 06/09/2023
CO-ORDINATES:
ELEVATION: Ground
END DATE: 06/09/2023
CONTRACTOR:
RIG:
DRILLER:
LOGGED BY: HG

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	HAND SHEAR VANE (Uncorrected)	WATER
Soft, yellowish brown SILT with trace rootlets, dry to moist.		0.0				Groundwater Not Encountered
Soft to firm, grey mottled orange, with trace clay.		0.2		1		
		0.4		2, 2, 2		
Greyish brown, with minor clay, moist.		0.6		2.5, 2.5, 2.5, 2.5, 2.5, 2.5, 2.5, 2.5, 2.5		
		1.4		4, 4, 5, 4, 5		
		1.8		8, 9, 10, 11, 13, 20		
Surface saturated (soil moist). Perched surface water in gully running into hole.		2.2				
End of borehole (unable to penetrate hard silt).		2.4				
EOH: 2.60m		2.6				
		2.8				
		3.0				
		3.2				
		3.4				
		3.6				
		3.8				
		4.0				
		4.2				

INVESTIGATION LOG

HOLE NO.: HASC108

CLIENT: Bowenvale Park Estates Ltd
PROJECT: Geotechnical Investigation
JOB NO.: 2023-0395

SITE LOCATION: 169 Bowenvale Avenue, Cashmere
START DATE: 06/09/2023
CO-ORDINATES:
ELEVATION: Ground
END DATE: 06/09/2023
CONTRACTOR:
RIG:
DRILLER:
LOGGED BY: HG

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	HAND SHEAR VANE (Uncorrected)	WATER
Firm to stiff, yellowish brown mottled orange SILT with trace sand, dry to moist. Sand fine.		0.0		4		undwater Not Encount
		0.2		9		
Very stiff to hard.		0.4		15		
End of borehole (unable to penetrate hard silt). EOH: 0.40m				16		

INVESTIGATION LOG

HOLE NO.: HASC109

CLIENT: Bowenvale Park Estates Ltd
PROJECT: Geotechnical Investigation
JOB NO.: 2023-0395

SITE LOCATION: 169 Bowenvale Avenue, Cashmere
START DATE: 06/09/2023
CO-ORDINATES:
ELEVATION: Ground
END DATE: 06/09/2023
CONTRACTOR:
RIG:
DRILLER:
LOGGED BY: HG

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	HAND SHEAR VANE (Uncorrected)	WATER
Soft to firm, greyish brown SILT with trace clay, moist.		0.0		1		Groundwater Not Encountered
		0.2		2		
				4		
Firm, yellowish brown.		0.4		7		
				10		
		0.6		10		
				11		
Stiff to hard.		0.8		12		
				11		
		1.0		15		
End of borehole (unable to penetrate hard silt).				17		
EOH: 1.10m		1.2				
		1.4				
		1.6				
		1.8				
		2.0				
		2.2				
		2.4				
		2.6				
		2.8				
		3.0				
		3.2				
		3.4				
		3.6				
		3.8				
		4.0				
		4.2				

APPENDIX F

ROCKFALL MODELLING PARAMETERS & RESULTS

Parameters Rockyfor3D

Topography	LIDAR	***Cell size***	Raster 1 m x 1 m

Simulations-Setting	Number of simulations per source area	500
	Initial velocity	0 m s^{-1}
	Additional initial fall height (m)	0
	Simulation with forest	No

Scenarios

	1	2	3	4	5	6
Input source areas	Scr1/Src2	Scr1/Src2	Scr1/Src2	Scr1/Src2/Src3	Scr1/Src2/Src3	Scr1/Src2/Src3
Block settings (Src 1/ Src2/Src3)						
Blockdimensions(in m) (Height, width, length: d1,d2,d3)	1.3/ 1.0 1.0/0.6 0.7/0.4	1.3/ 1.0 1.0/0.6 0.7/0.4	1.3/ 1.0 1.0/0.6 0.7/0.4	1.3/ 1.0/1.0 1.0/0.6/0.6 0.7/0.4/0.4	1.3/ 1.0/1.0 1.0/0.6/0.6 0.7/0.4/0.4	1.3/ 1.0/1.0 1.0/0.6/0.6 0.7/0.4/0.4
Block shape	1/1	1/1	1/1	1/1/1	1/1/1	1/1/1
Rockdensity (kg m^{-3})	2400/2400	2400/2400/-	2400/2400/-	2400/2400/2400	2400/2400/2400	2400/2400/2400
Volumes [m^3]	1/0.25	1/0.25/-	1/0.25/-	1/0.25/0.25	1/0.25/0.25	1/0.25/0.25
Variations of volumens [%]	± 0	± 0	± 0	± 0	± 0	± 0
Soiltype	2	3	3	2	3	3
Rg values (rg70,rg20,rg10)	0,0.05,0.1	0,0.05,0.1	0.05,0.05,0.05	0,0.05,0.1	0,0.05,0.1	0.05,0.05,0.05

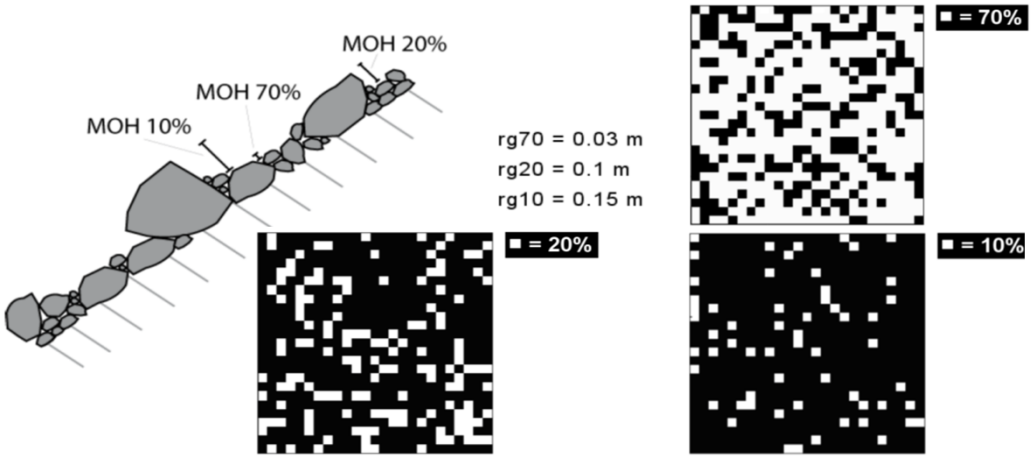
Soiltype

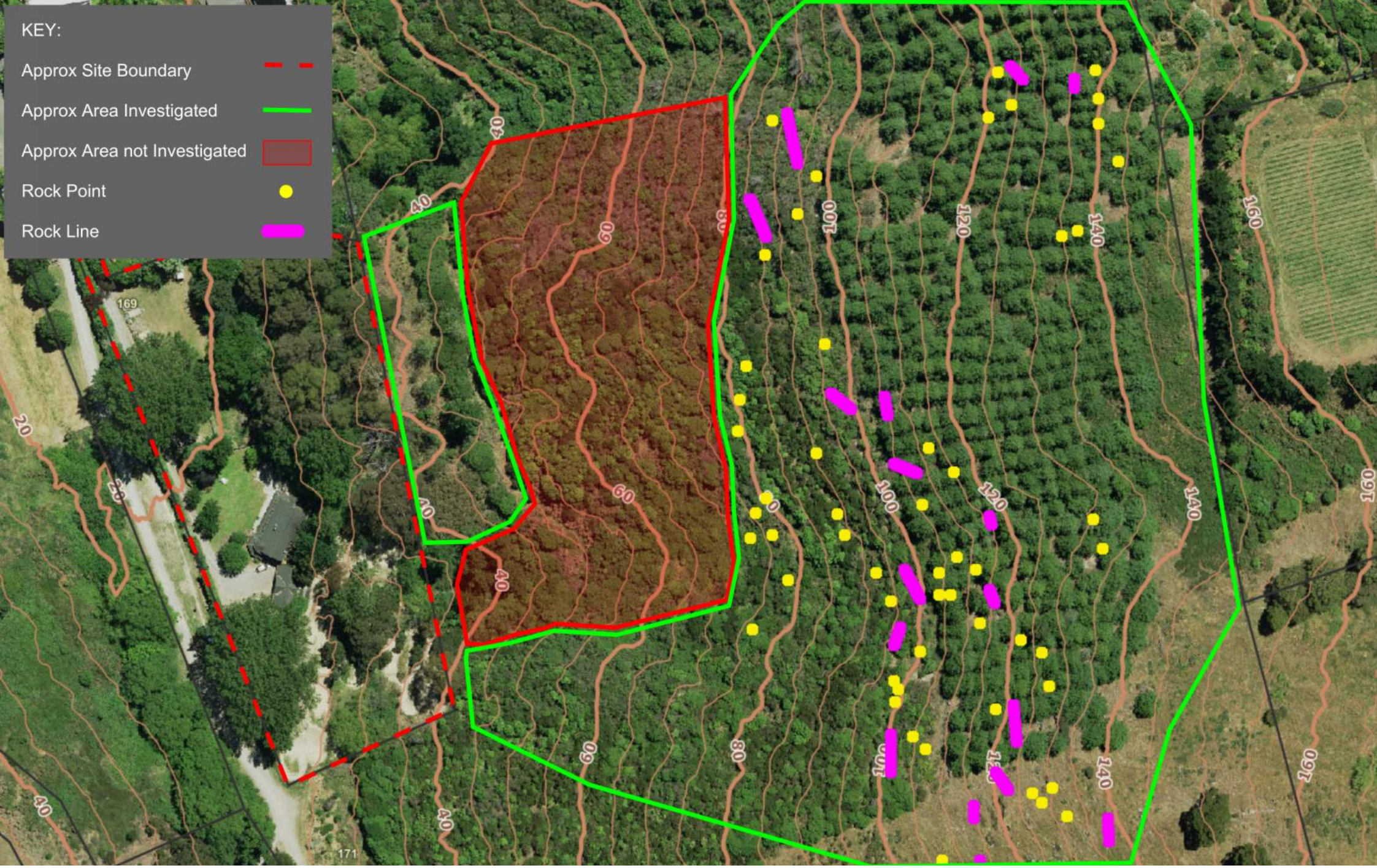
	Normal restitution-coeffient (Rn)	Mean Rn-value	Rn value range
	River, or swamp, or material in which a rock could penetrate completely	0	0
1	*Fine soil material (depth > ~100 cm)*	0.23	0.21 - 0.25
2	*Fine soil material (depth < ~100 cm), or sand/gravel mix in the valley*	0.28	0.25 - 0.31
3	*Scree (Ø < ~10 cm), or medium compact soil with small rock fragments, or forest road*	0.33	0.30 - 0.36
4	*Talus slope (Ø > ~10 cm), or compact soil with large rock fragments*	0.38	0.34 - 0.42
5	*Bedrock with thin weathered material or soil cover*	0.43	0.39 - 0.47
6	*Bedrock*	0.53	0.48 - 0.58
7	*Asphalt road*	0.35	0.32 - 0.39

MOH (Rg-Value)

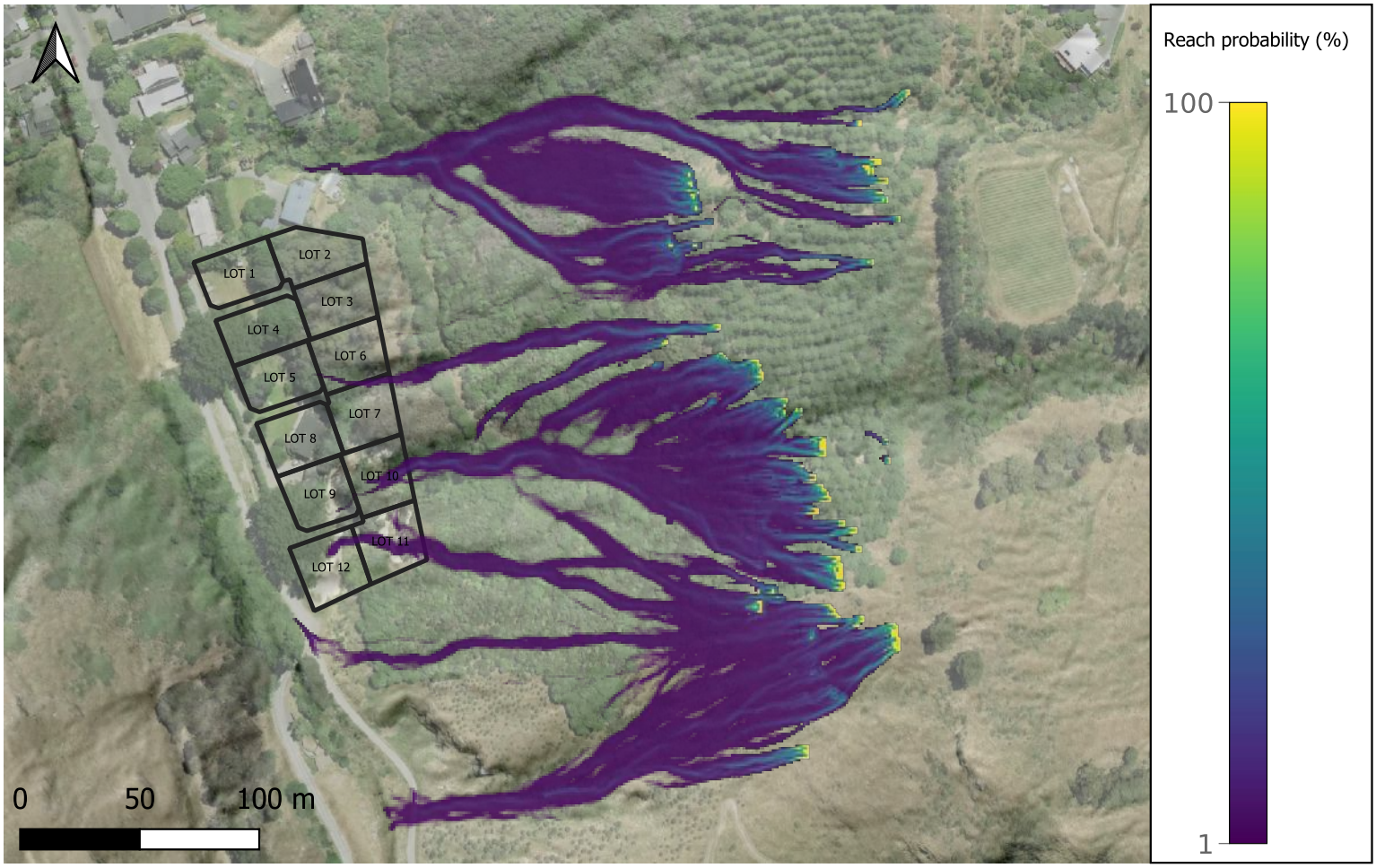
Tangential restitution coefficient (Rg)

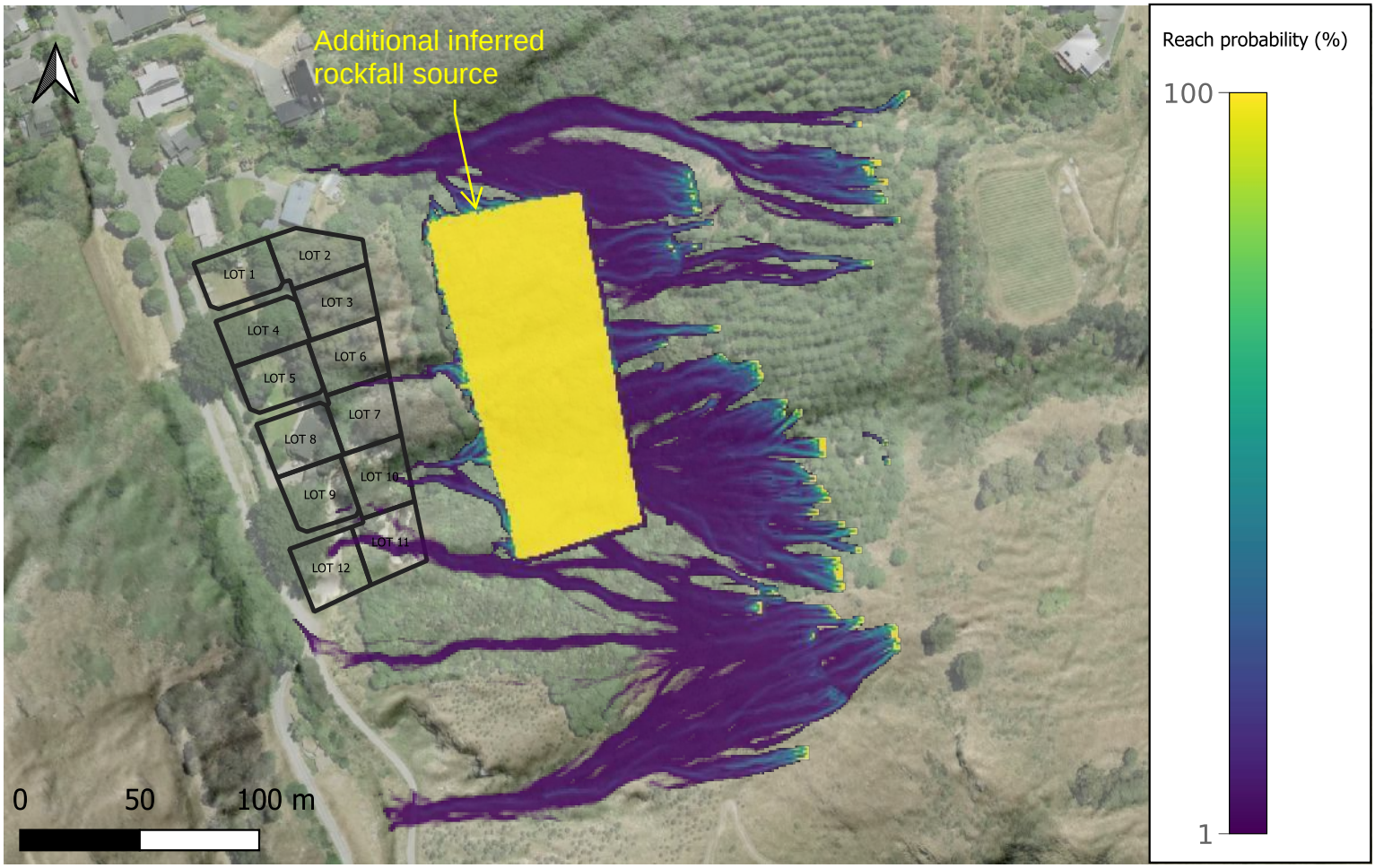
typical obstacle height normal to the slope surface (m) that block encounters in 70%, 20% and 10% of the cases during a rebound on the slope surface



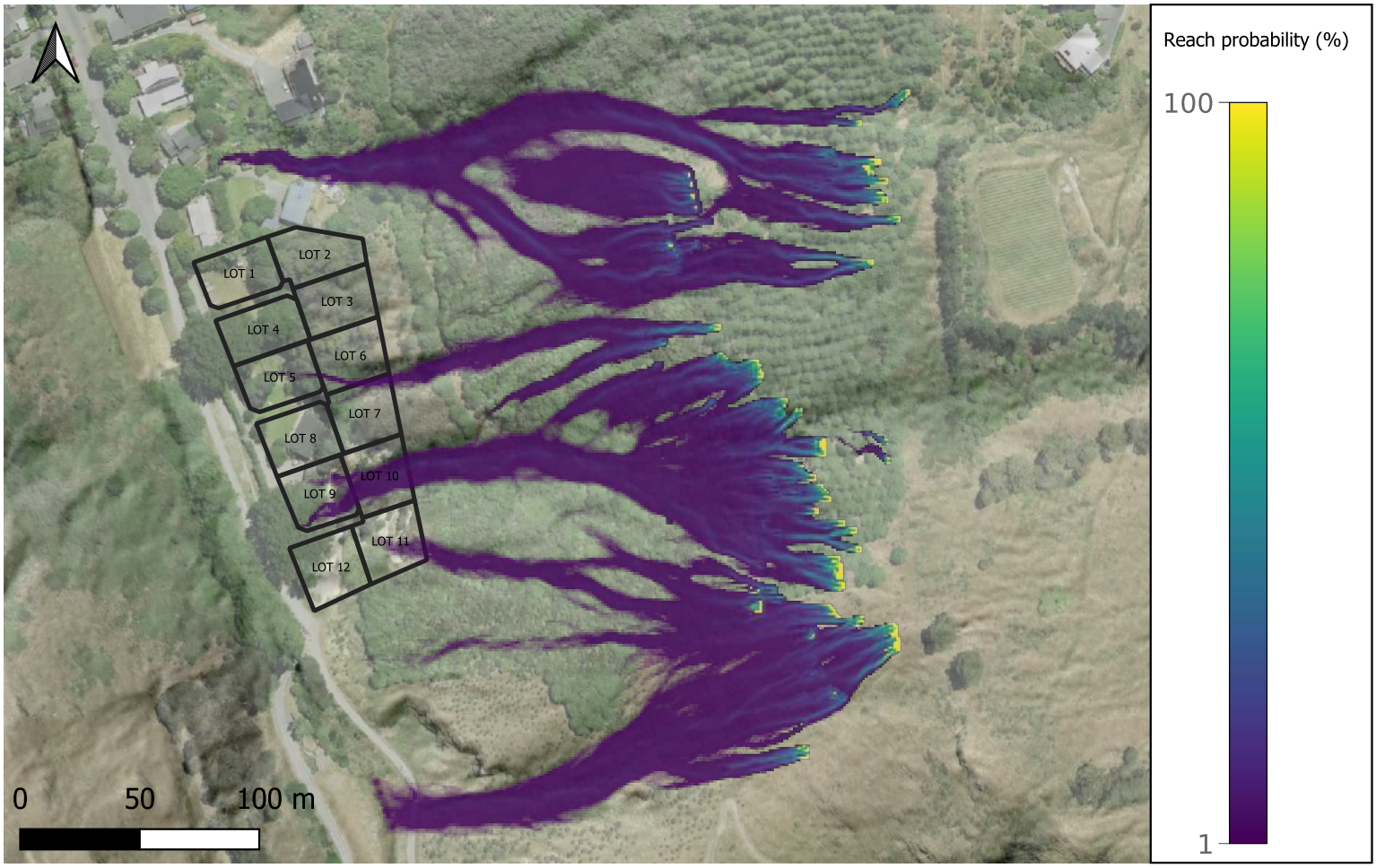

KEY:
Approx Site Boundary
Approx Area Investigated
Approx Area not Investigated
Rock Point
Rock Line

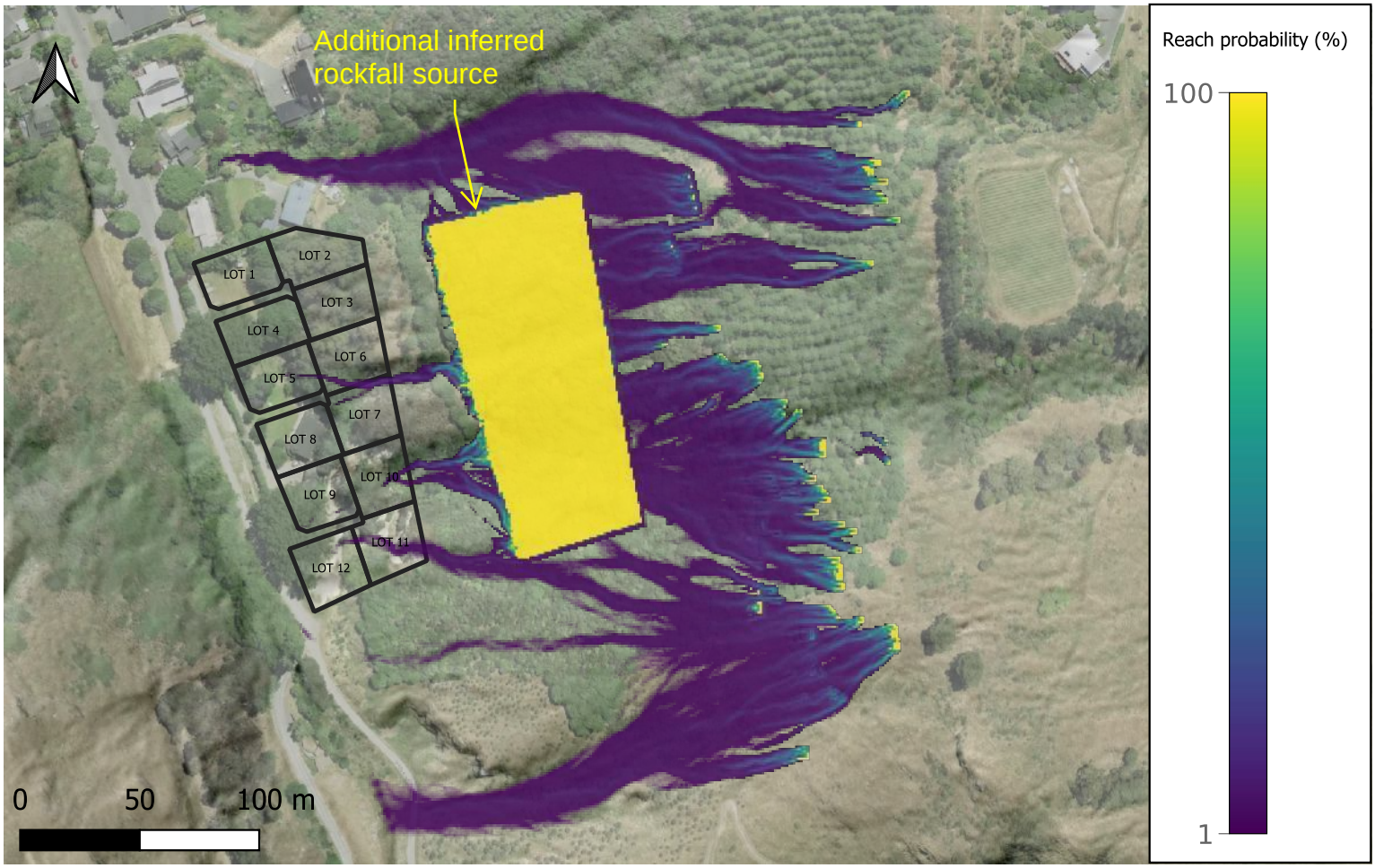
Scenario 1


LOT 1
LOT 2
LOT 3
LOT 4
LOT 5
LOT 6
LOT 7
LOT 8
LOT 9
LOT 10
LOT 11
LOT 12
0
50
100 m
Reach probability (%)
100
1

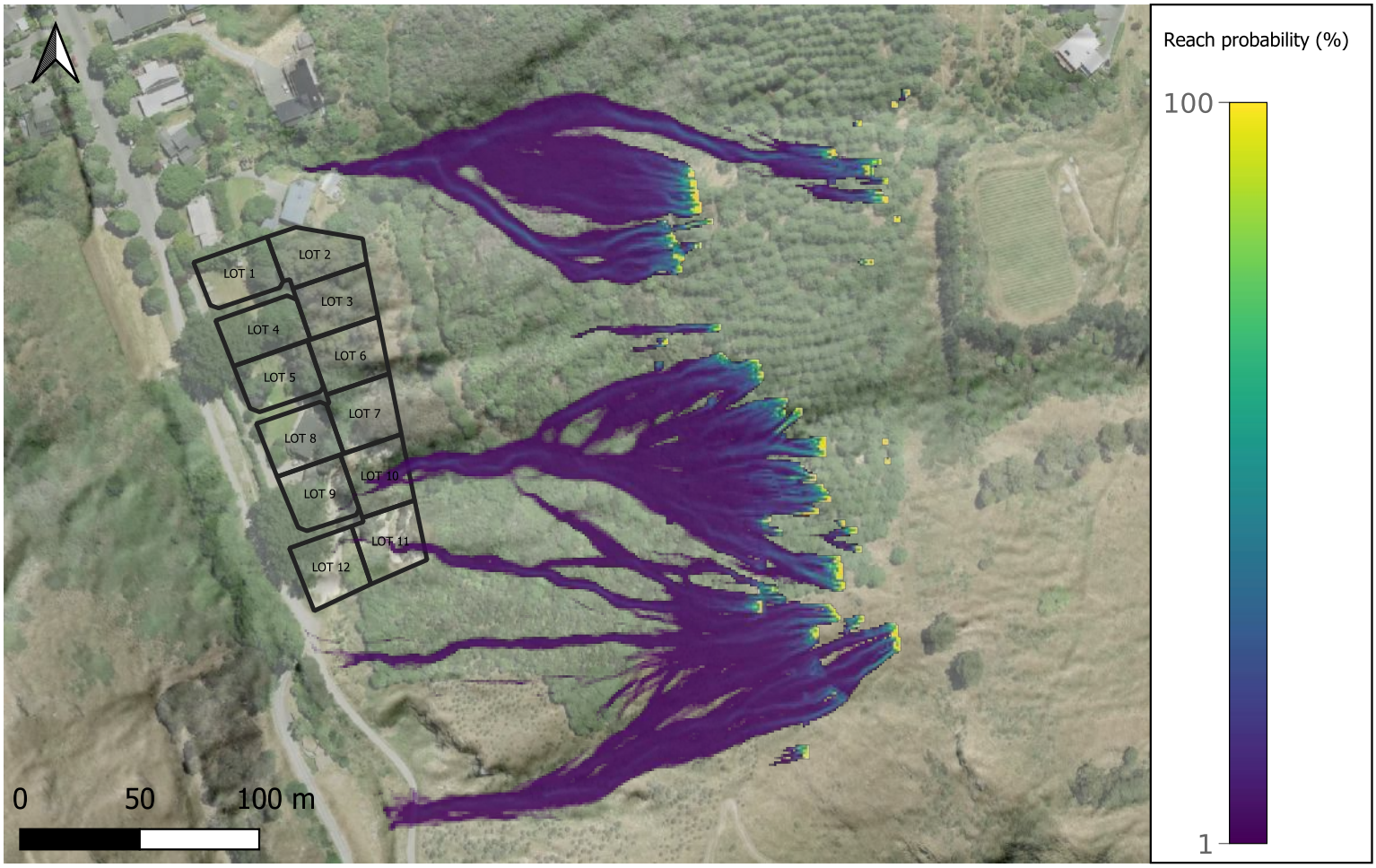

Additional inferred rockfall source
LOT 1
LOT 2
LOT 3
LOT 4
LOT 5
LOT 6
LOT 7
LOT 8
LOT 9
LOT 10
LOT 11
LOT 12
0
50
100 m
Reach probability (%)
100
1

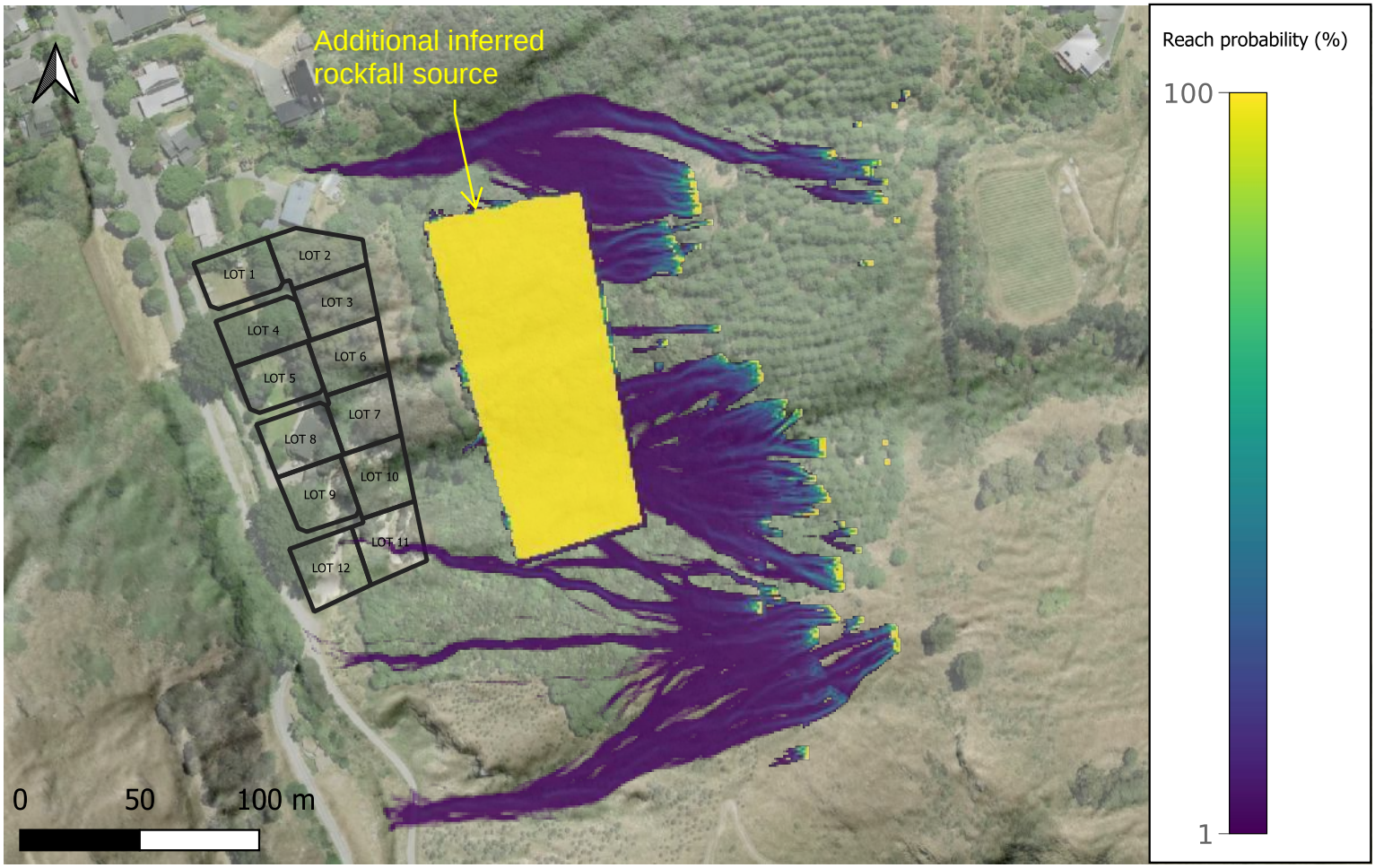
Scenario 2


LOT 1
LOT 2
LOT 3
LOT 4
LOT 5
LOT 6
LOT 7
LOT 8
LOT 9
LOT 10
LOT 11
LOT 12
0
50
100 m
Reach probability (%)
100
1

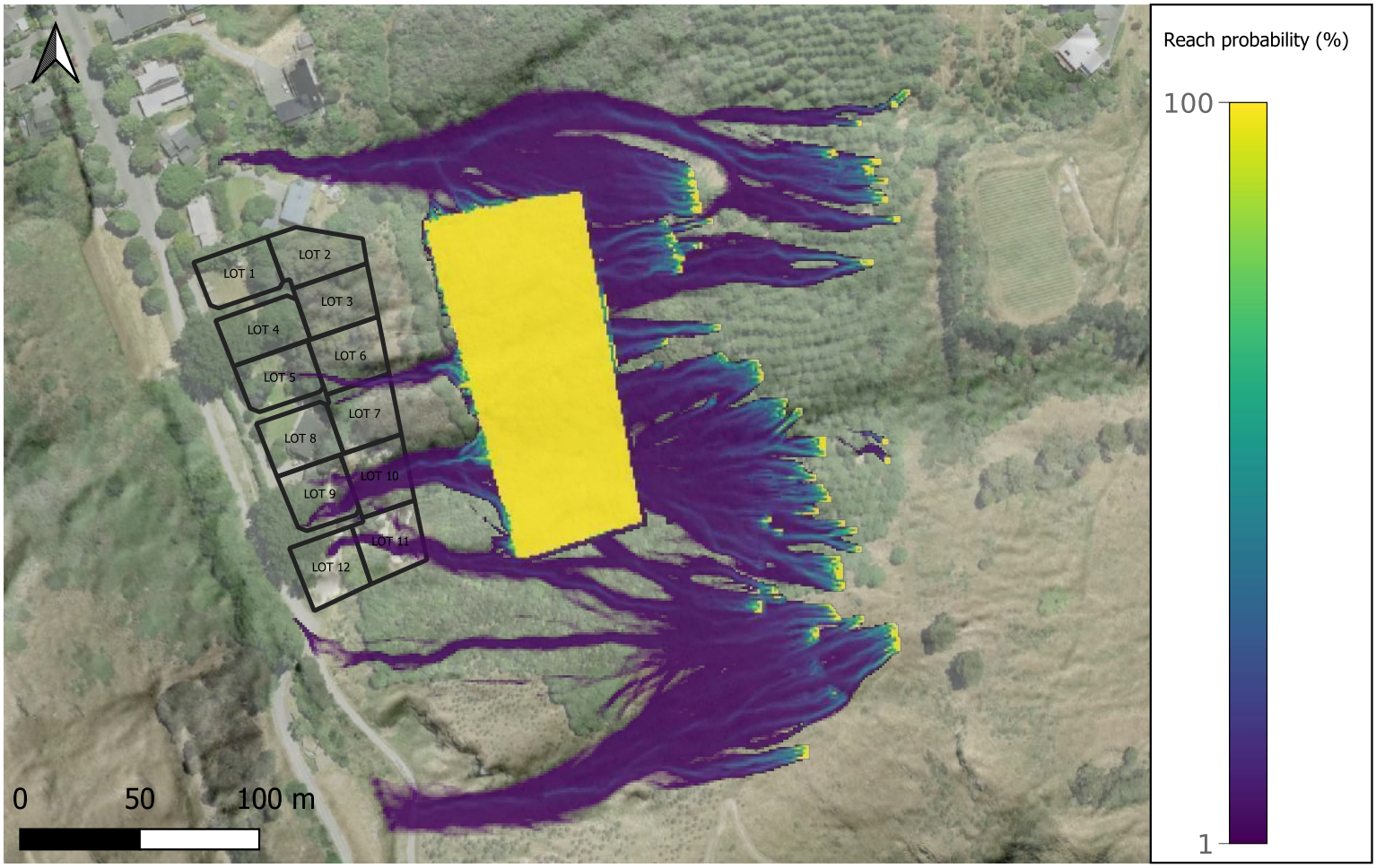

Additional inferred rockfall source
LOT 1
LOT 2
LOT 3
LOT 4
LOT 5
LOT 6
LOT 7
LOT 8
LOT 9
LOT 10
LOT 11
LOT 12
0
50
100 m
Reach probability (%)
100
1

Scenario 3


Reach probability (%)
100
1
LOT 1
LOT 2
LOT 3
LOT 4
LOT 5
LOT 6
LOT 7
LOT 8
LOT 9
LOT 10
LOT 11
LOT 12
0
50
100 m

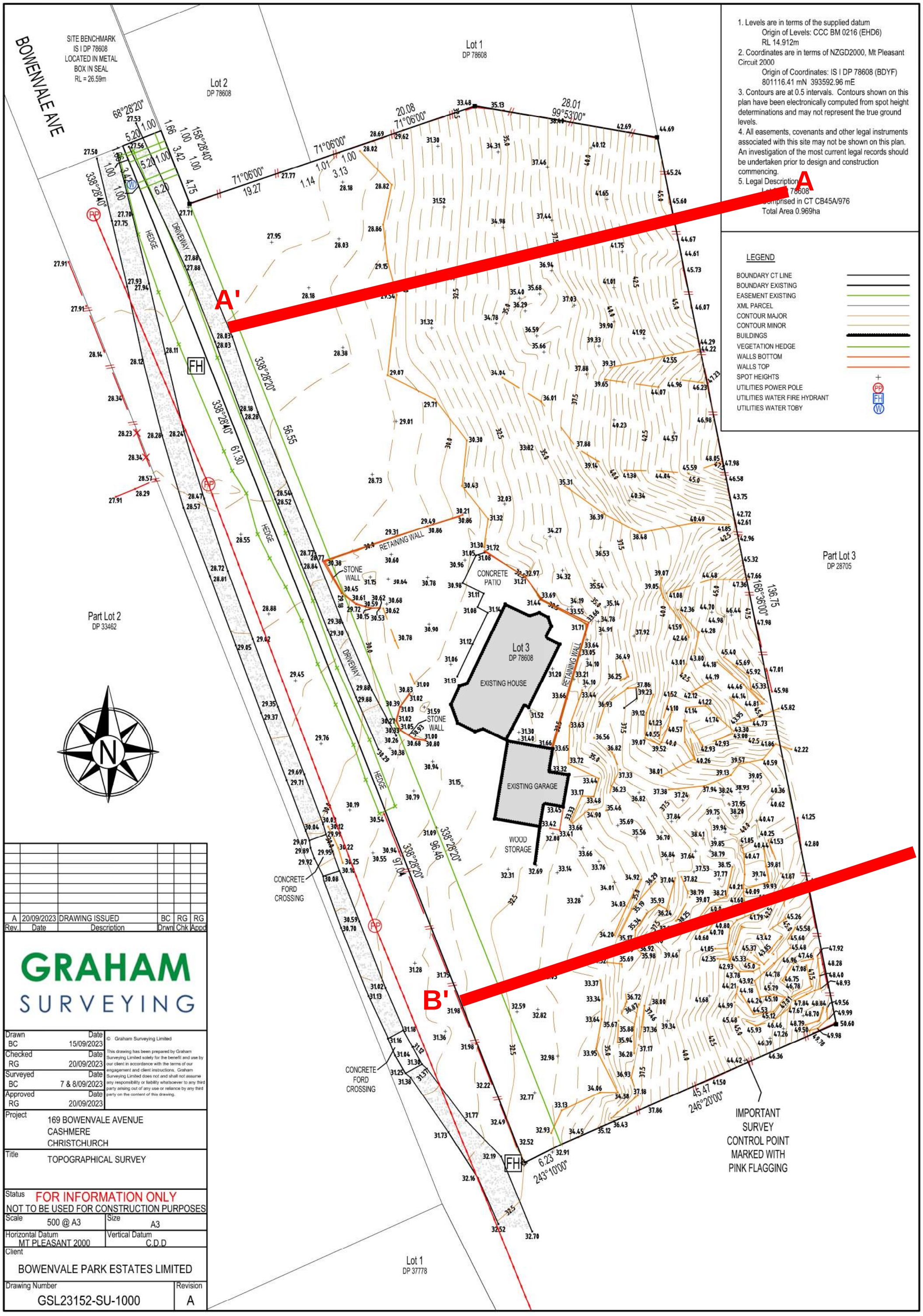

Additional inferred rockfall source
Reach probability (%)
100
1
LOT 1
LOT 2
LOT 3
LOT 4
LOT 5
LOT 6
LOT 7
LOT 8
LOT 9
LOT 10
LOT 11
LOT 12
0
50
100 m

Maximum of all scenarios



APPENDIX G

2023 TOPOGRAPHICAL SURVEY AND SLOPE STABILITY CROSS-SECTIONS



1. Levels are in terms of the supplied datum
   Origin of Levels: CCC BM 0216 (EHD6)
   RL 14.912m
2. Coordinates are in terms of NZGD2000, Mt Pleasant Circuit 2000
   Origin of Coordinates: IS I DP 78608 (BDYF)
   801116.41 mN 393592.96 mE
3. Contours are at 0.5 intervals. Contours shown on this plan have been electronically computed from spot height determinations and may not represent the true ground levels.
4. All easements, covenants and other legal instruments associated with this site may not be shown on this plan. An investigation of the most current legal records should be undertaken prior to design and construction commencing.
5. Legal Description
   Lot [illegible] 78608
   Comprised in CT CB45A/976
   Total Area 0.969ha

LEGEND

- BOUNDARY CT LINE
- BOUNDARY EXISTING
- EASEMENT EXISTING
- XML PARCEL
- CONTOUR MAJOR
- CONTOUR MINOR
- BUILDINGS
- VEGETATION HEDGE
- WALLS BOTTOM
- WALLS TOP
- SPOT HEIGHTS
- UTILITIES POWER POLE (PP)
- UTILITIES WATER FIRE HYDRANT (FH)
- UTILITIES WATER TOBY (W)

Rev.	Date	Description	Drwn	Chk	Appd
A	20/09/2023	DRAWING ISSUED	BC	RG	RG

GRAHAM
SURVEYING

Drawn: BC	Date: 15/09/2023
Checked: RG	Date: 20/09/2023
Surveyed: BC	Date: 7 & 8/09/2023
Approved: RG	Date: 20/09/2023

Project: 169 BOWENVALE AVENUE
CASHMERE
CHRISTCHURCH

Title: TOPOGRAPHICAL SURVEY

Status: FOR INFORMATION ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

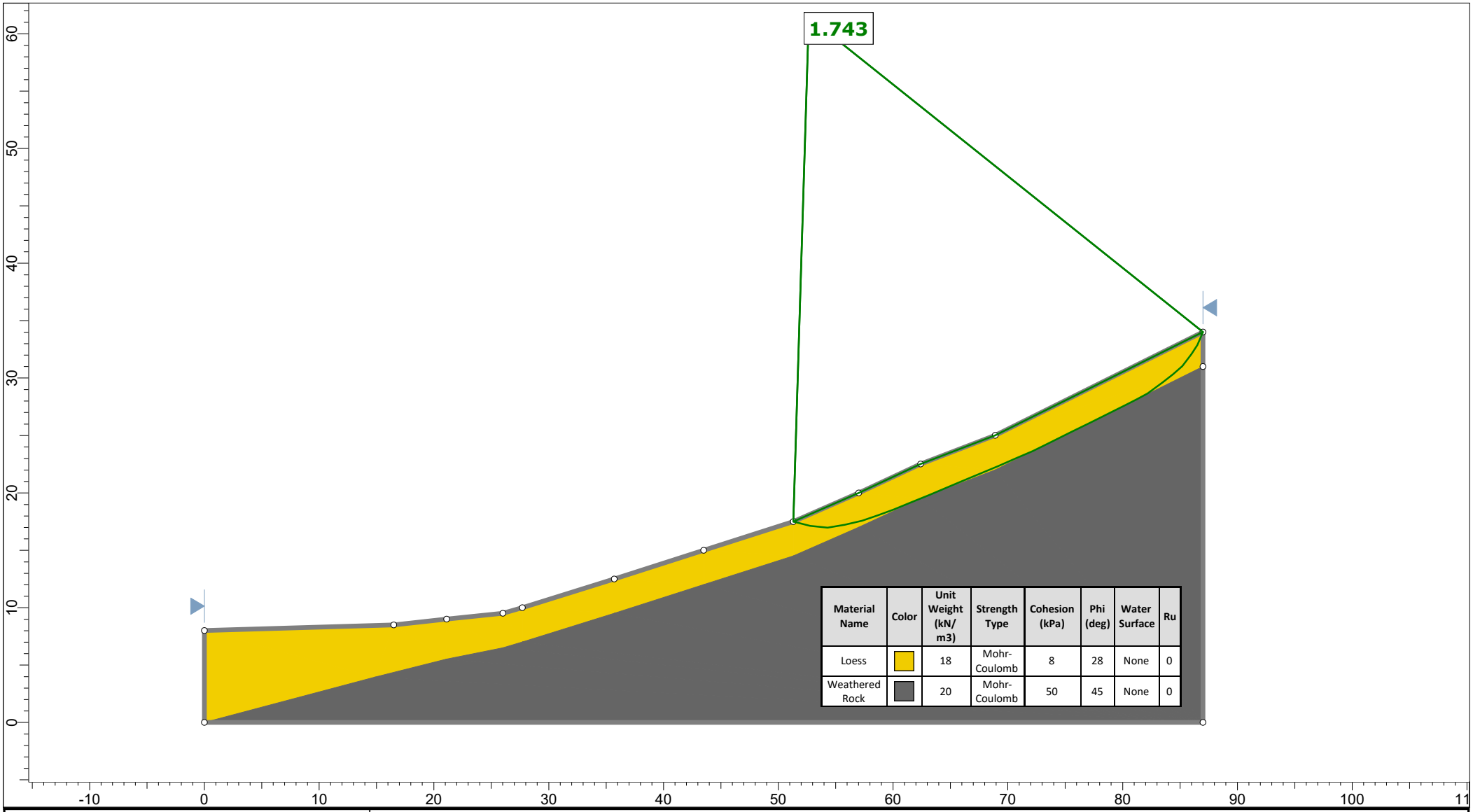
Scale	Size
500 @ A3	A3
Horizontal Datum: MT PLEASANT 2000	Vertical Datum: C.D.D

Client: BOWENVALE PARK ESTATES LIMITED

Drawing Number	Revision
GSL23152-SU-1000	A

APPENDIX H

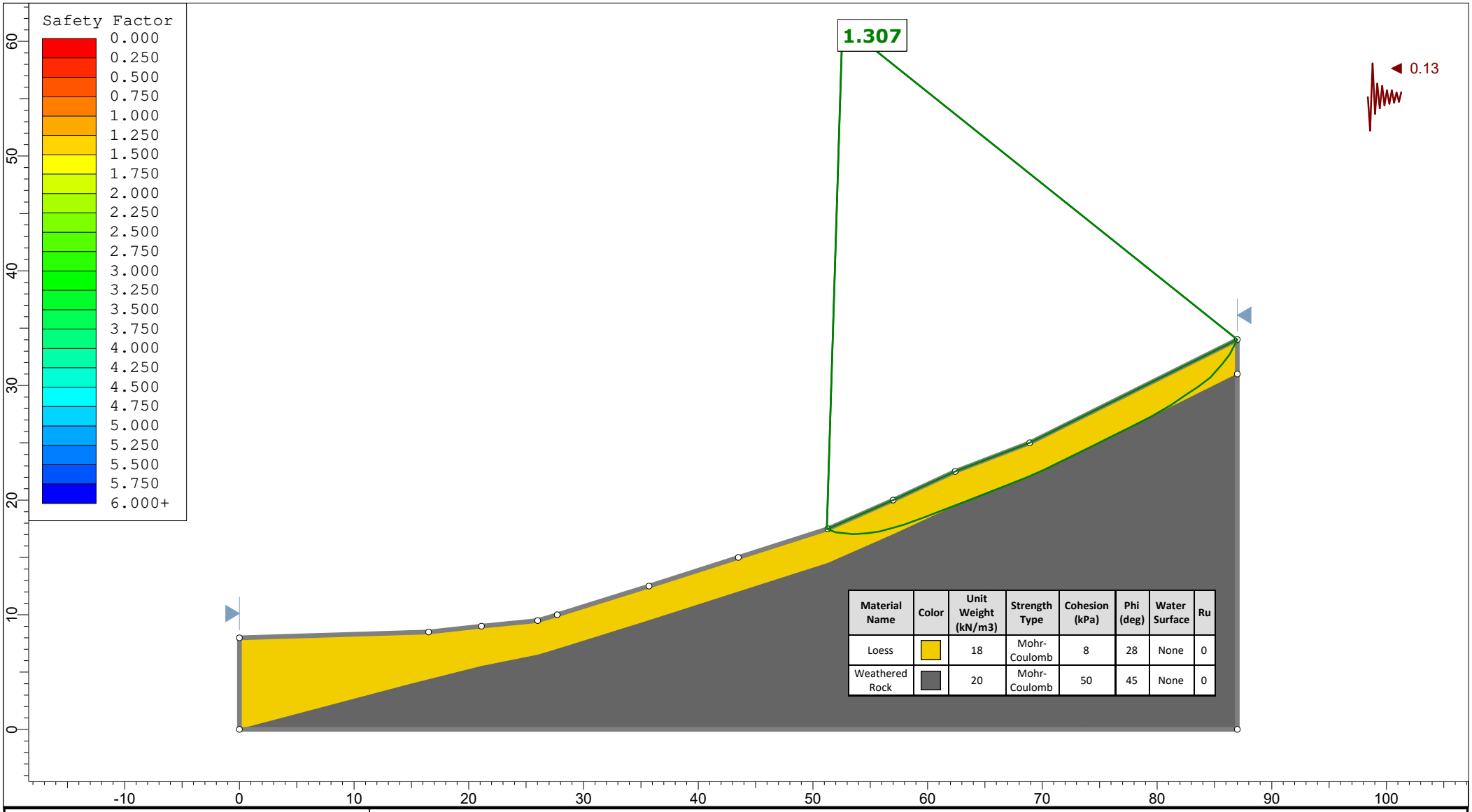
SLOPE STABILITY ANALYSIS GRAPHICAL RESULTS



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Ru
Loess		18	Mohr-Coulomb	8	28	None	0
Weathered Rock		20	Mohr-Coulomb	50	45	None	0

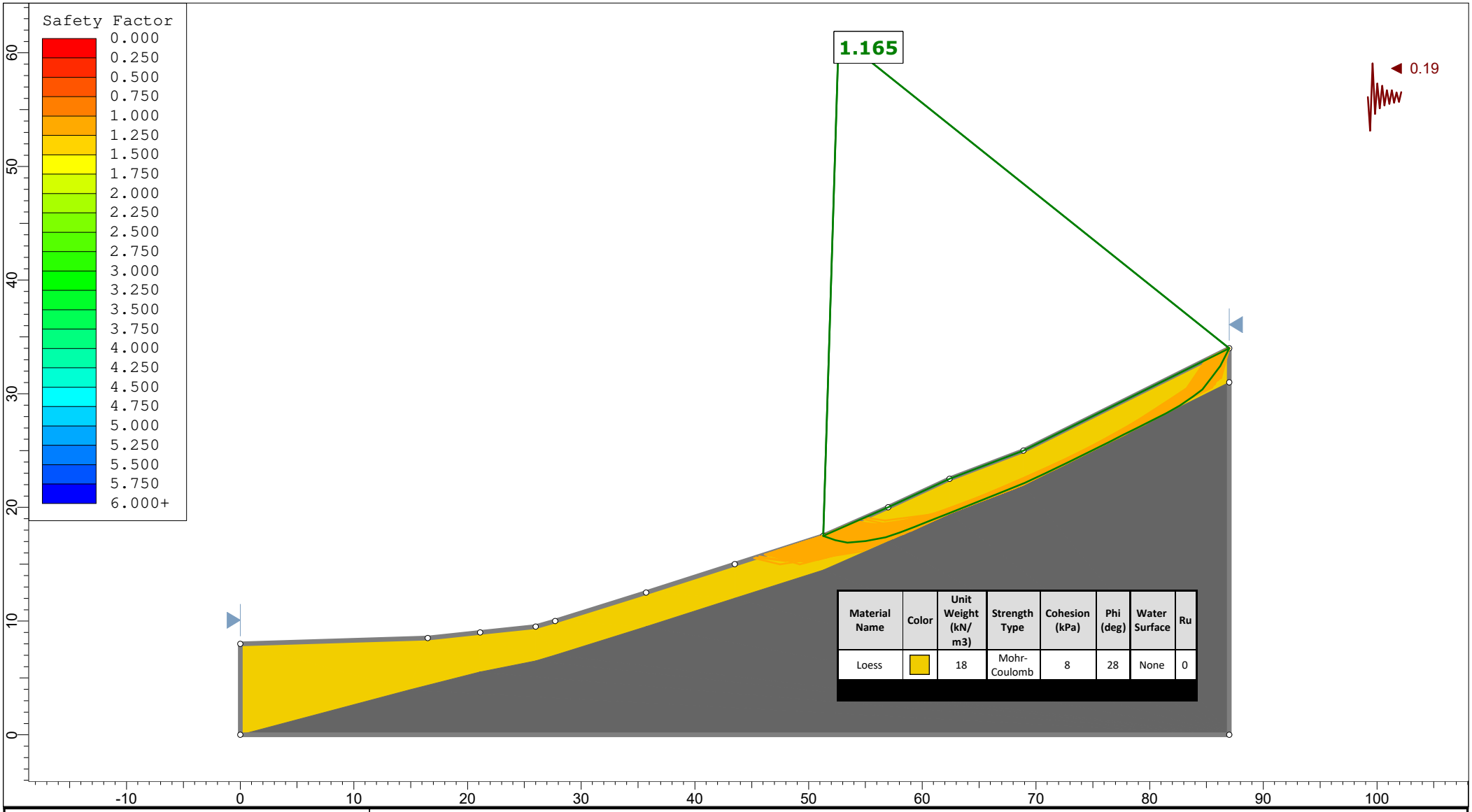
SUBTERRA
Geotechnical Investigation

Project	169 Bowenvale Avenue - Slope Stability Analysis		
Group	Cross Section A-A'	*Scenario*	Static
Drawn By	Harry Greenfield	*Company*	Subterra Ltd
Date	20/10/2023, 12:27:45 pm	*File Name*	2023-0395_Slide2.slmd



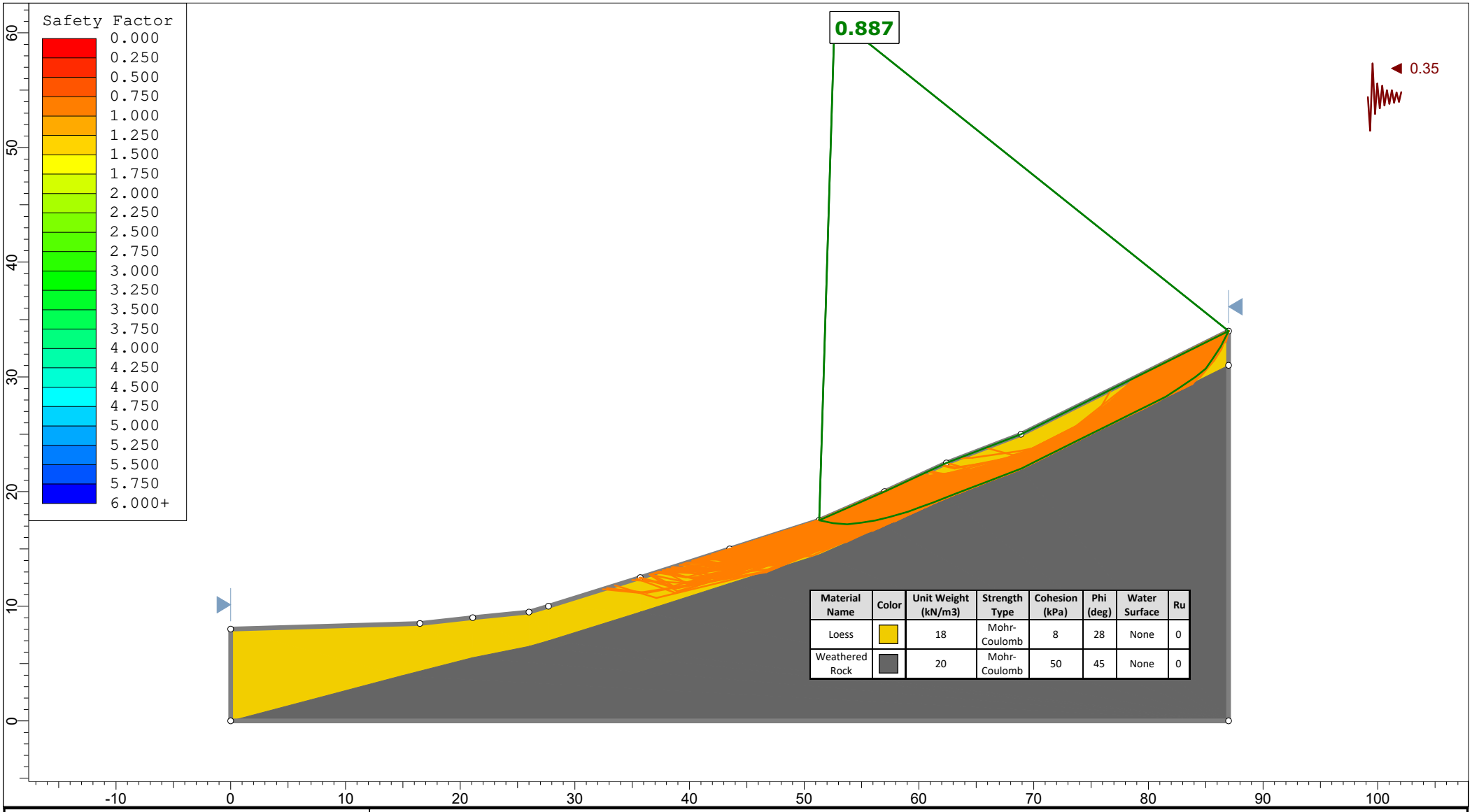
SUBTERRA
Geotechnical Investigation

Project	169 Bowenvale Avenue - Slope Stability Analysis		
Group	Cross Section A-A'	*Scenario*	SLS1
Drawn By	Harry Greenfield	*Company*	Subterra Ltd
Date	20/10/2023, 12:27:45 pm	*File Name*	2023-0395_Slide2.slmd



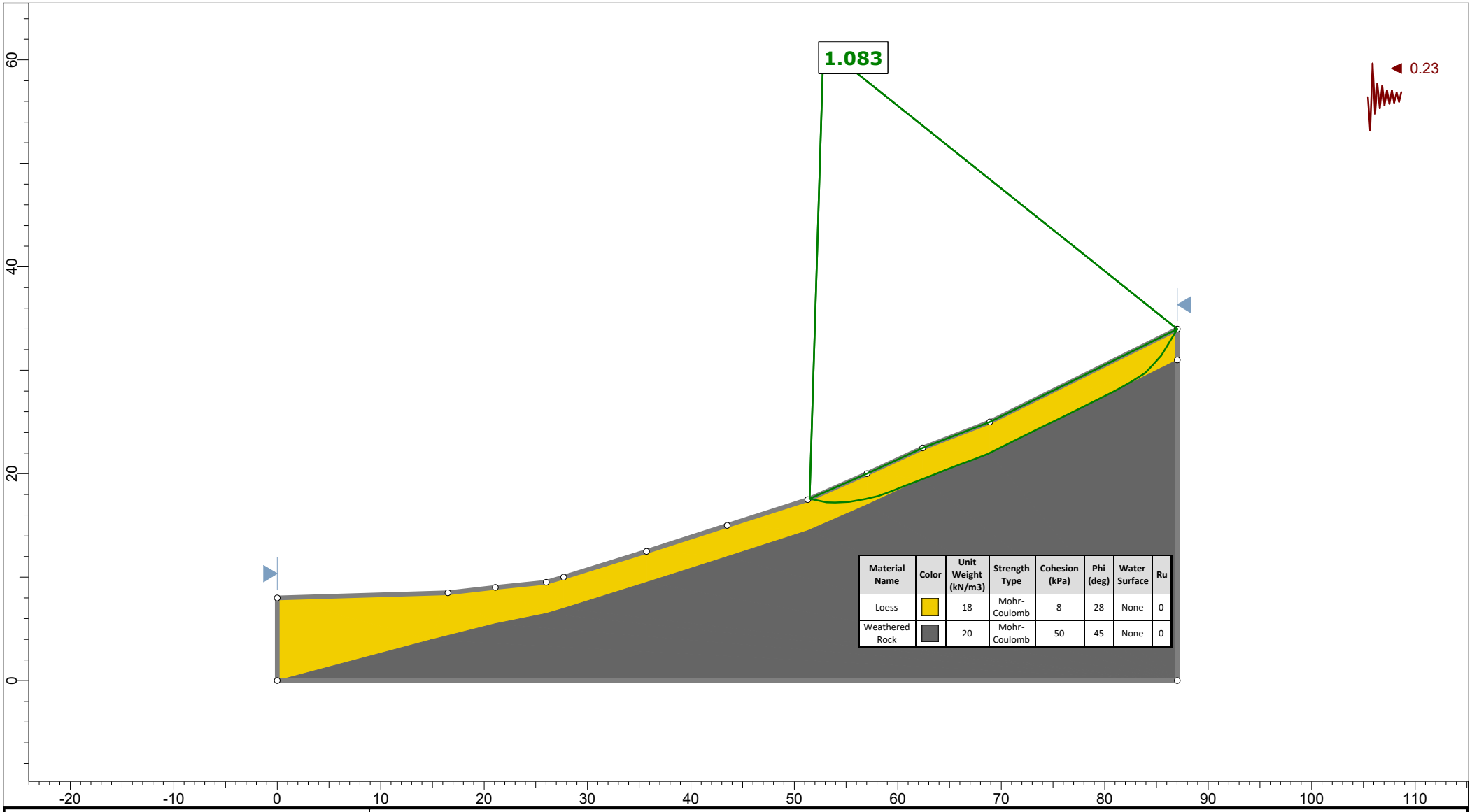
SUBTERRA
Geotechnical Investigation

Project	169 Bowenvale Avenue - Slope Stability Analysis		
Group	Cross Section A-A'	*Scenario*	SLS2
Drawn By	Harry Greenfield	*Company*	Subterra Ltd
Date	20/10/2023, 12:27:45 pm	*File Name*	2023-0395_Slide2.slmd



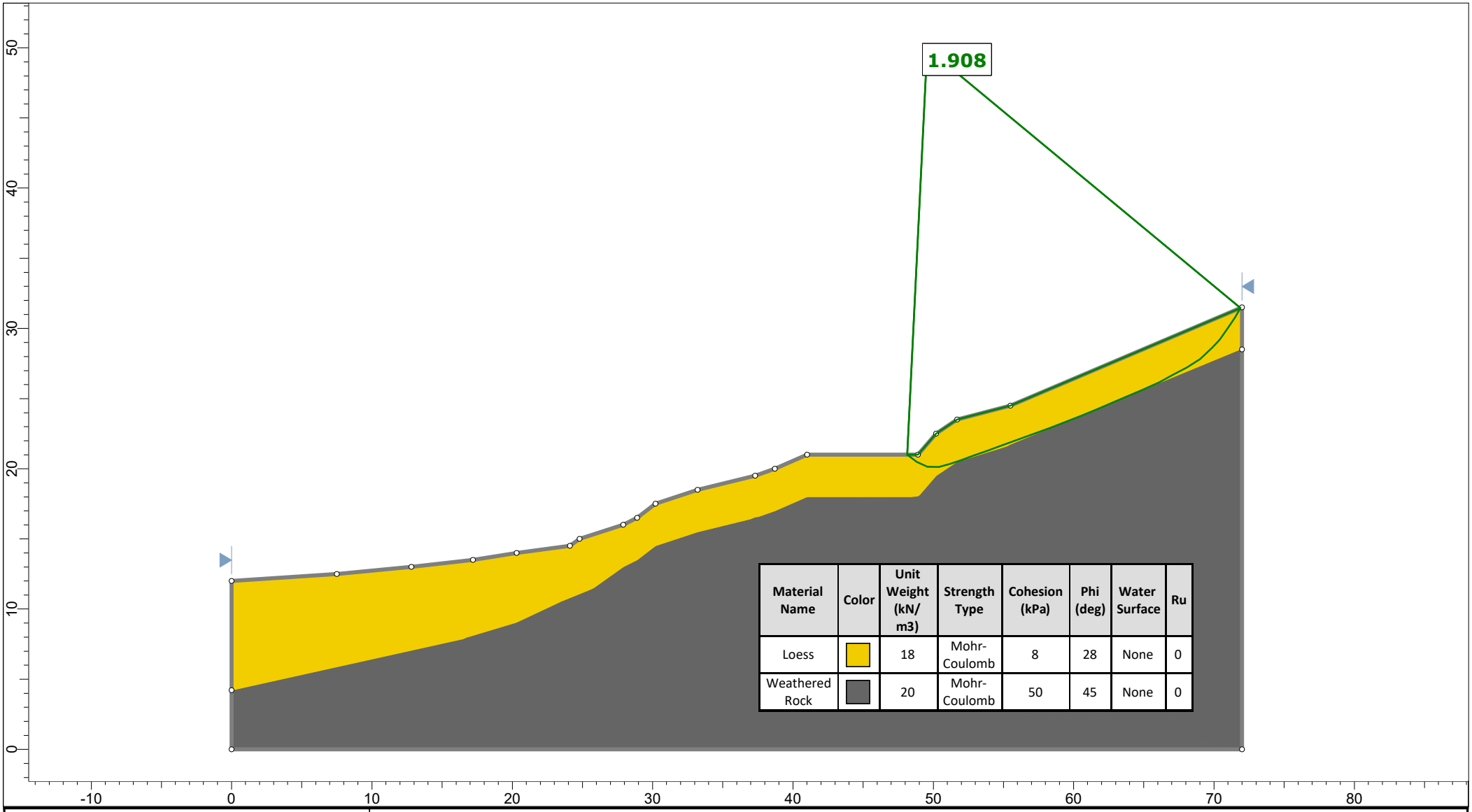
SUBTERRA
Geotechnical Investigation

Project	169 Bowenvale Avenue - Slope Stability Analysis		
Group	Cross Section A-A'	*Scenario*	ULS
Drawn By	Harry Greenfield	*Company*	Subterra Ltd
Date	20/10/2023, 12:27:45 pm	*File Name*	2023-0395_Slide2.slmd



SUBTERRA
Geotechnical Investigation

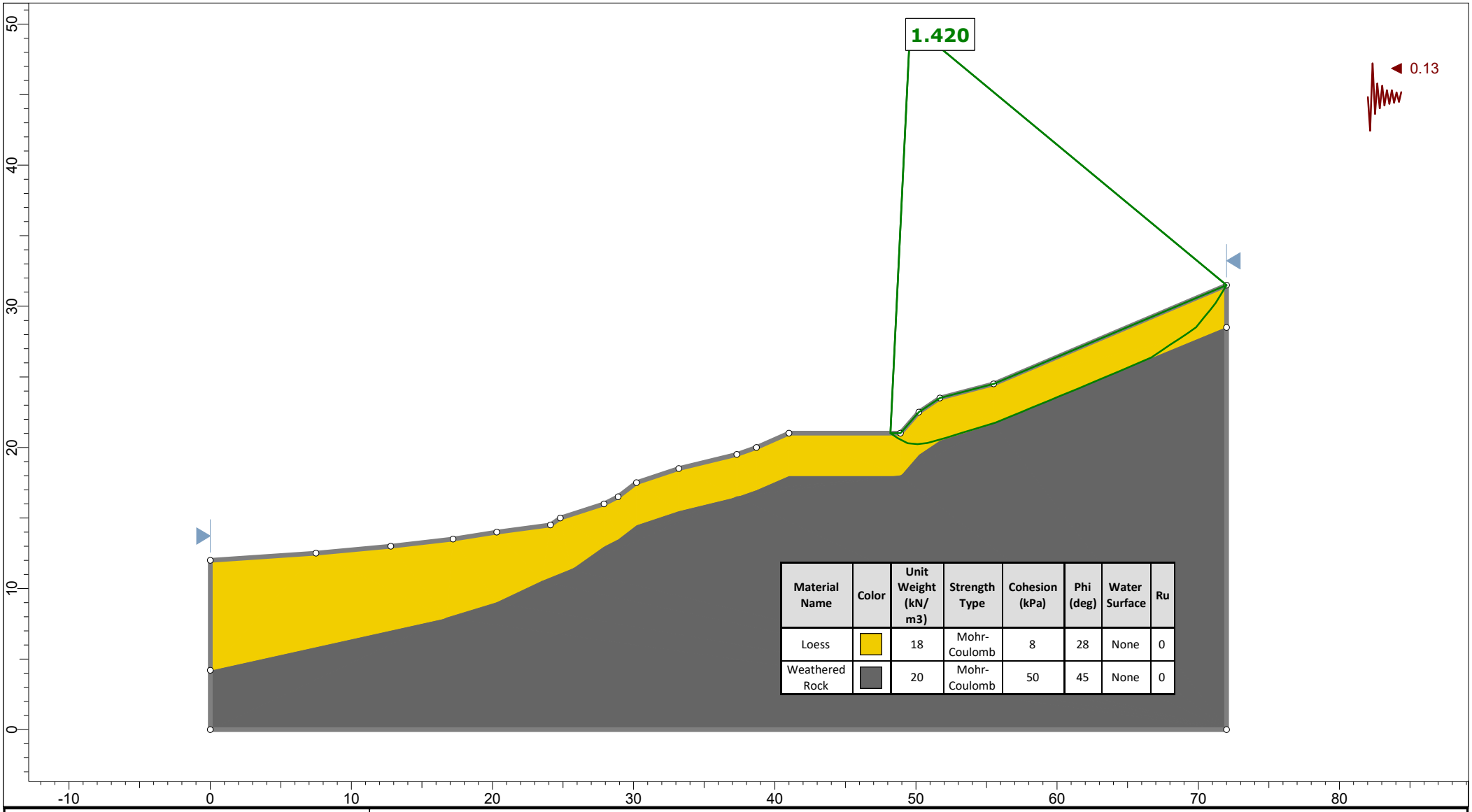
Project	169 Bowenvale Avenue - Slope Stability Analysis		
Group	Cross Section A-A'	*Scenario*	22 Feb 2011
Drawn By	Harry Greenfield	*Company*	Subterra Ltd
Date	20/10/2023, 12:27:45 pm	*File Name*	2023-0395_Slide2.slmd



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Ru
Loess		18	Mohr-Coulomb	8	28	None	0
Weathered Rock		20	Mohr-Coulomb	50	45	None	0

SUBTERRA
Geotechnical Investigation

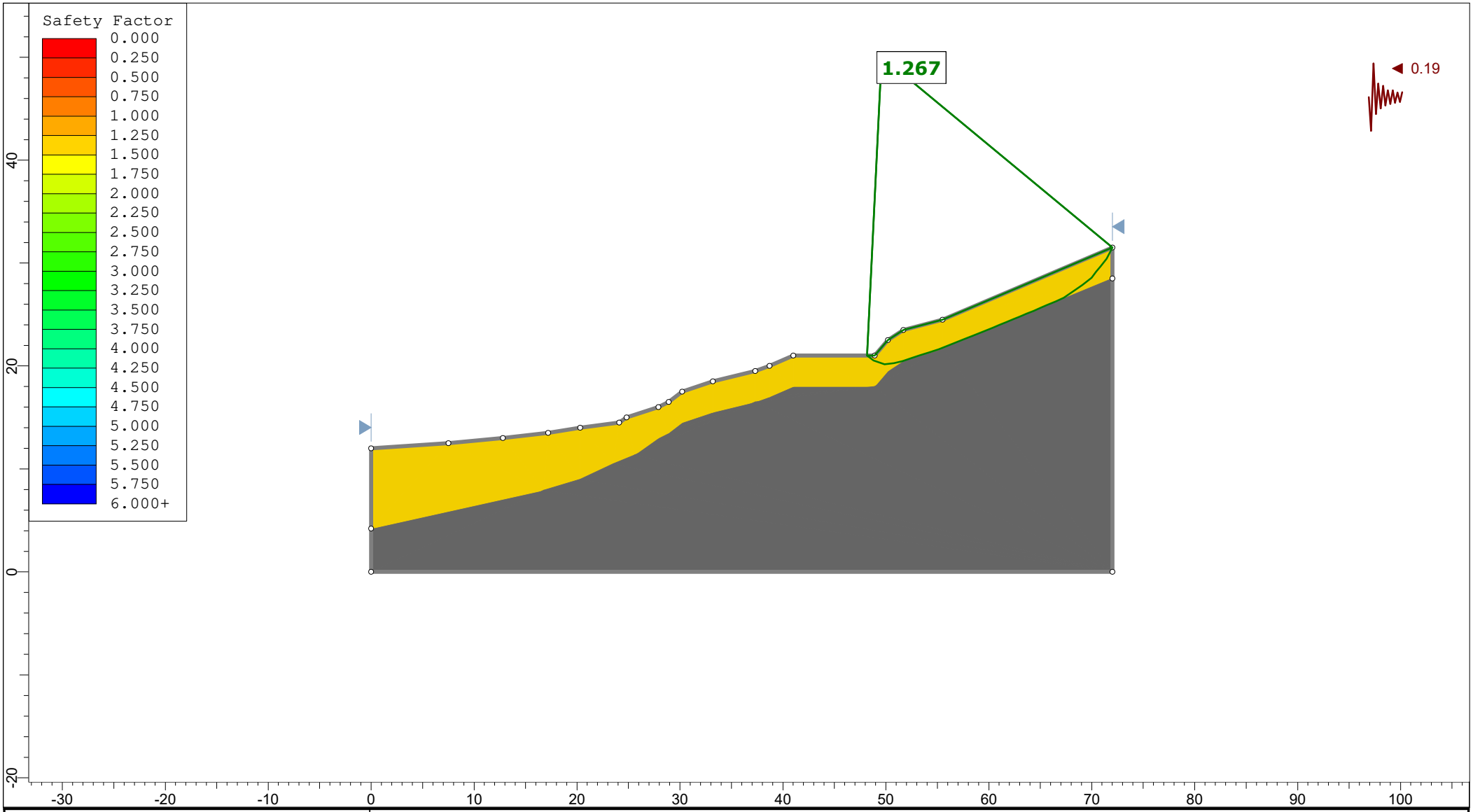
Project	169 Bowenvale Avenue - Slope Stability Analysis		
Group	Cross-Section B-B'	*Scenario*	Static
Drawn By	Harry Greenfield	*Company*	Subterra Ltd
Date	20/10/2023, 12:27:45 pm	*File Name*	2023-0395_Slide2.slmd



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Ru
Loess		18	Mohr-Coulomb	8	28	None	0
Weathered Rock		20	Mohr-Coulomb	50	45	None	0

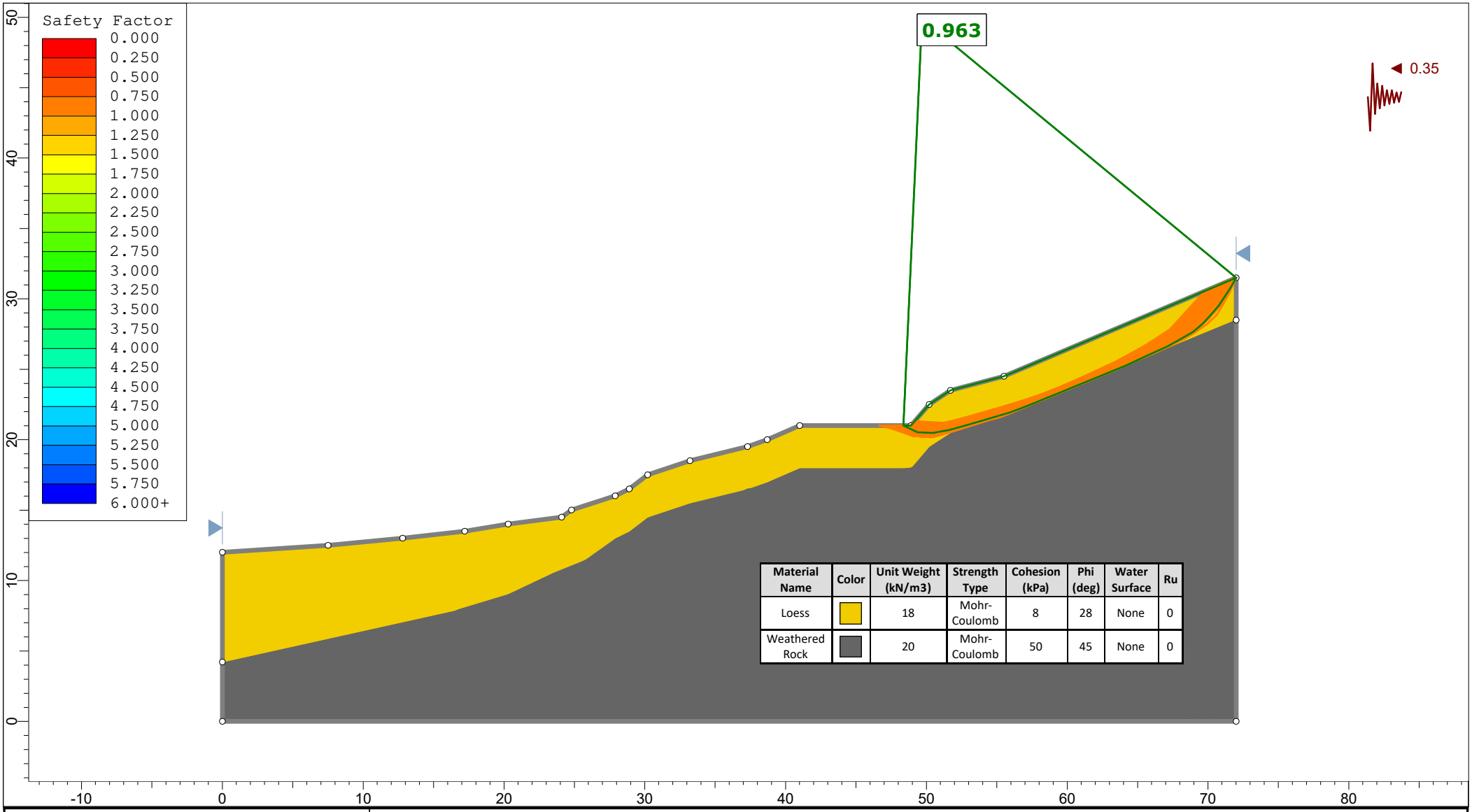
SUBTERRA
Geotechnical Investigation

Project	169 Bowenvale Avenue - Slope Stability Analysis		
Group	Cross-Section B-B'	*Scenario*	SLS1
Drawn By	Harry Greenfield	*Company*	Subterra Ltd
Date	20/10/2023, 12:27:45 pm	*File Name*	2023-0395_Slide2.slmd



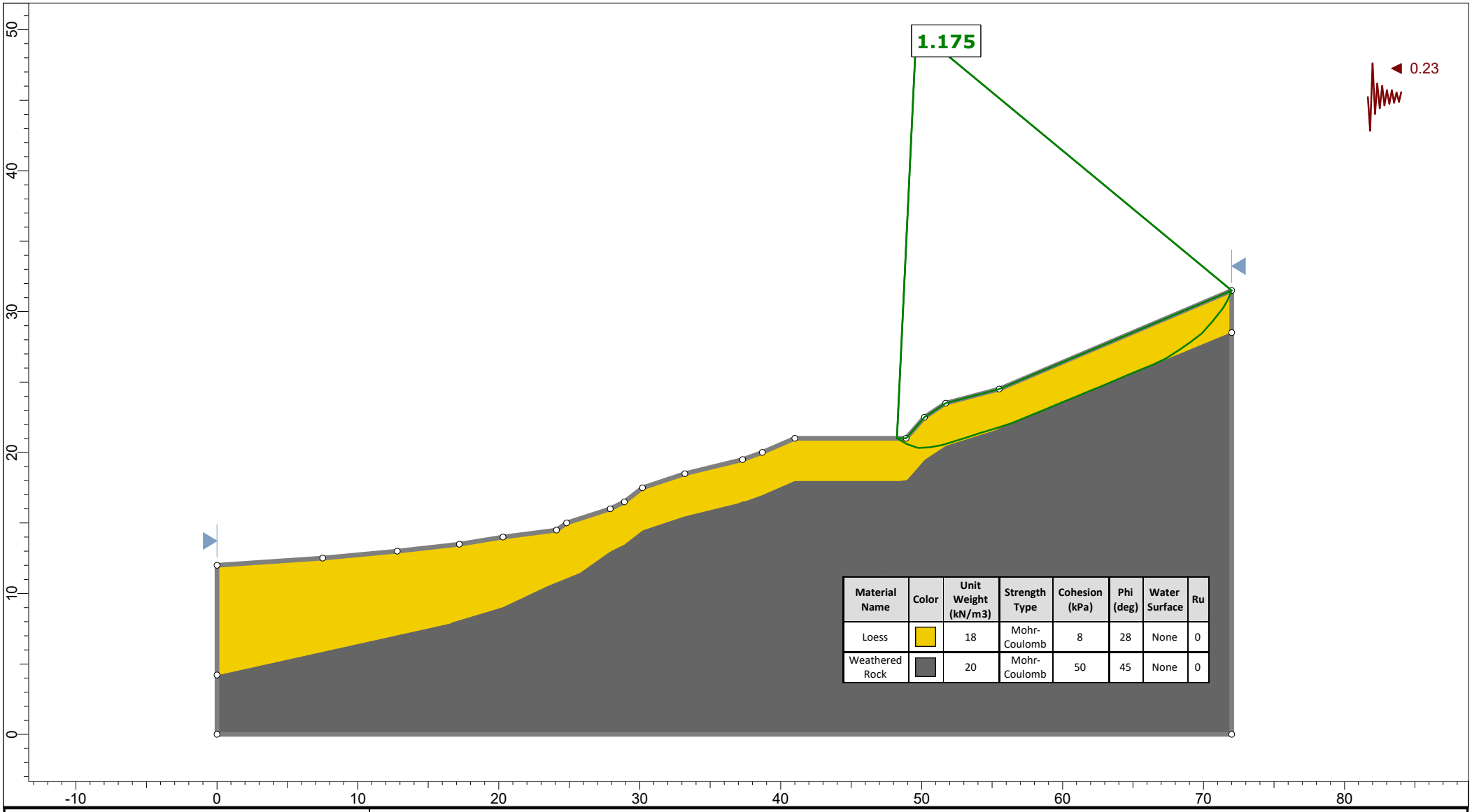
SUBTERRA
Geotechnical Investigation

Project	169 Bowenvale Avenue - Slope Stability Analysis		
Group	Cross-Section B-B'	*Scenario*	SLS2
Drawn By	Harry Greenfield	*Company*	Subterra Ltd
Date	20/10/2023, 12:27:45 pm	*File Name*	2023-0395_Slide2.slmd



SUBTERRA
Geotechnical Investigation

Project	169 Bowenvale Avenue - Slope Stability Analysis		
Group	Cross-Section B-B'	*Scenario*	ULS
Drawn By	Harry Greenfield	*Company*	Subterra Ltd
Date	20/10/2023, 12:27:45 pm	*File Name*	2023-0395_Slide2.slmd



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Ru
Loess		18	Mohr-Coulomb	8	28	None	0
Weathered Rock		20	Mohr-Coulomb	50	45	None	0

SUBTERRA
Geotechnical Investigation

Project	169 Bowenvale Avenue - Slope Stability Analysis		
Group	Cross-Section B-B'	*Scenario*	22 Feb 2011
Drawn By	Harry Greenfield	*Company*	Subterra Ltd
Date	20/10/2023, 12:27:45 pm	*File Name*	2023-0395_Slide2.slmd

APPENDIX I

SUBDIVISION PLAN WITH ROCKFALL BUFFER ZONES

KEY:

- Lots Without Restriction
- No-Build Lots
- Restricted Build Lots
- Rockfall Paths
- 5m Buffer Zones

NOTES:

1. COORDINATES ARE IN TERMS OF NZGD2000, MT PLEASANT CIRCUIT
2. CONTOURS ARE IN TERMS OF NZVD2016
3. CONTOURS ARE AT 0.5m INTERVALS
4. BOUNDARY POSITIONS AND AREAS ARE SUBJECT TO SURVEY AND LINZ APPROVAL
5. CONTOURS HAVE BEEN CALCULATED USING LIDAR DATA SOURCED FROM THE LINZ GEODETIC DATABASE DATED 2015. VERTICAL ACCURACY IS 0.2m, HORIZONTAL ACCURACY IS 1.0m
6. FOR THE PURPOSES OF THIS PLAN, NO EXISTING EASEMENTS, COVENANTS OR OTHER INTERESTS LISTED ON THE TITLE HAVE BEEN SHOWN.
7. LEGAL DESCRIPTION:

   LOT 3 DP 78608
   COMPRISED IN RT CB45A/976
   AREA 9686m²

LOT 1
DP 78608

DP 30431

LOT 1
710m²

LOT 2
780m²
NET 700m²

LOT 3
775m²
NET 700m²

PART LOT 3
DP 28705

LOT 4
700m²

LOT 5
700m²

LOT 6
770m²
NET 700m²

LOT 7
765m²
NET 700m²

LOT 8
700m²

LOT 9
700m²

LOT 10
760m²
NET 700m²

LOT 11
765m²
NET 700m²

LOT 12

LOT 13
850m²

PART LOT 2
DP 33462

LOT 3
DP 78608

J.O.A.L

ROW & SERVICES

ROW & SERVICES

ROW & SERVICES

Rev.	Date	Description	Drwn	Chk	Appd
A	14/01/2022	DRAWING ISSUED	SG	RG	RG

Drawn	Date 13/01/2022
Checked	Date 13/01/2022
Surveyed	Date
Approved	Date 14/01/2022

Project: 169 BOWENVALE AVENUE, CASHMERE, CHRISTCHURCH

Title: LOTS 1 - 13 BEING A PROPOSED SUBDIVISION OF LOT 3 DP 78608

Status: FOR INFORMATION ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

Scale	Size
1:500m	A3

Horizontal Datum	Vertical Datum
MT PLEASANT 2000	NZVD 2016

Client: DEANS AVE DEVELOPMENTS LTD

Drawing Number	Revision
GSL22001-RC-1401	A

APPENDIX J

GEOTECHNICAL STATEMENT OF PROFESSIONAL OPINION

Statement of Professional Opinion on the Suitability of Land for Subdivision

(Appendix I to the Infrastructure Design Standard)

Issued by: Subterra Ltd
(Geotechnical engineering firm or suitably qualified engineer)

To: Bowenvale Park Estates Ltd
(Owner/Developer)

To be supplied to: Christchurch City Council
(Territorial authority)

In respect of: subdivision of residential land
(Description of proposed infrastructure/land development)

At: 169 Bowenvale Avenue, Cashmere (Lot 3 DP 78608)
(Address)

I Firas Salman *(Geotechnical engineer)* on behalf of Subterra Ltd *(Geotechnical engineering firm)*

hereby confirm:

1. I am a suitably qualified and experienced geotechnical engineer and was retained by the owner/developer as the geotechnical engineer on the above proposed development.

2. My/the geotechnical assessment report, dated 10/11/2023 has been carried out in accordance with the Department of Building and Housing *Guidelines for geotechnical investigation and assessment of subdivisions* and includes:
   (i) Details of and the results of my/the site investigations.
   (ii) A liquefaction assessment.
   (iii) An assessment of rockfall and slippage, including hazards resulting from seismic activity.
   (iv) An assessment of the slope stability and ground bearing capacity confirming the location and appropriateness of building sites.
   (v) Recommendations proposing measures to avoid, remedy or mitigate any potential hazards on the land subject to the application, in accordance with the provisions of Section 106 of the Resource Management Act 1991.

3. In my professional opinion, I consider that Council is justified in granting consent incorporating the following conditions:
   Provided any development is constructed in accordance with the recommendations made in Sections 9 and 10 of Subterra's Geotechnical Report for Proposed Subdivision, ref. 2023-0395 dated 10/11/2023

4. This professional opinion is furnished to the territorial authority and the owner/developer for their purposes alone, on the express condition that it will not be relied upon by any other person and does not remove the necessity for the normal inspection of foundation conditions at the time of erection of any building.

5. This certificate shall be read in conjunction with my/the geotechnical report referred to in Clause 2 above, and shall not be copied or reproduced except in conjunction with the full geotechnical completion report.

6. The geotechnical engineering firm issuing this statement holds a current policy of professional indemnity insurance of no less than $ 1 million
(Minimum amount of insurance shall be commensurate with the current amounts recommended by IPENZ, ACENZ, TNZ, INGENIUM.)

..... Date: 10/11/2023

(Signature of Engineer)

Qualifications and experience:

PhD, CMEngNZ, CPEng (1023569)

169 Bowenvale Avenue, Cashmere
Subdivision Servicing Report

Bowenvale Park Estates Ltd

14 December 2023

e2 environmental
CONSULTING ENGINEERS

Quality Control

Author	Peter Harte	Client	Bowenvale Park Estates Ltd
Reviewed by	John Wilson	Date Issued	14 November 2022
Approved by	Andrew Tisch	Revision No.	0.2

e2environmental Ltd.
46 Acheron Drive
PO Box 31159
Christchurch NZ

Project No. 23045

CONTENTS

1 INTRODUCTION

The development at no.169 Bowenvale Avenue (the site) is a proposed 12x lot (fee simple titles) residential subdivision located in Cashmere.

This report details the design parameters and key assumptions for infrastructure servicing to be submitted to Christchurch City Council (CCC) as part of the subdivision consent application. The total site area is 0.97 ha. Please refer to the appended design plan, calculations and communications submitted with this application. The proposed lot layout is shown in Figure 1 below.

Figure 1 – Lot layout Plan extents shown in red

2 ACCESS / RIGHT OF WAY (ROW)

A 6.2m wide jointly owned access lot (J.O.A.L - Lot 13), referred to as the "accessway" running along the western site boundary will service all the lots. Please note:

- The sealed width will be 5.5m wide with a single 3% crossfall draining to kerb and channel located along the western site boundary.
- A 0.5m berm strip will be located behind the back of channel for landscape planting, fencing and other requirements.
- The width of the accessway at 5.5m wide is considered suitable for two way travel, however RoW accesses are spaced at 45-50m wide and can therefore double as passing bays if required.
- A turning head is proposed at the end of the accessway should any vehicles not using individual lot driveways require it where they will be able to perform a three point turn. Refer to drawing 23045-290[A] which shows the design can cater for the 90th percentile vehicles.

The accessway will further service three Right of Ways (RoW) and associated lots. Each RoW will have a minimum sealed width of 3.0m with a single 3% crossfall that will drain to kerb and channel located along the southern access boundary of each RoW.

The RoW will be designed in accordance with Part 8 of the CCC Engineering Code of Practice. The proposed RoW layout is shown in attached plans located in Appendix A. The proposed accessway and RoW layout is shown on the Infrastructure Servicing Plan located in Appendix A (refer drawing 23045-230 [A]).

3 WASTEWATER

Bowenvale Avenue is serviced via a gravity sewer reticulation network. CCC has advised that a development at no.130 Bowenvale Avenue proposes to extend the existing 150mm dia. gravity sewer main up Bowenvale Avenue. The site plans to connect and further extend the line another 40m into the site boundary as instructed by CCC. Refer correspondence in Appendix C. It's uncertain whether no.130 will proceed with construction before no.169 and therefore a full sewer line extension from its current position may be required.

The development proposes to extend a new 150mm dia. gravity sewer main 135m up the accessway. All lots in the development will be serviced via individual 100mm dia. lateral connections to the main including lots serviced by RoWs. The proposed wastewater layout is shown on the Infrastructure Servicing Plan located in Appendix A (refer drawing 23045-230 [A]).

All pipelines, manholes and inspection chambers will be designed and constructed to comply with Part 6 of the CCC Engineering Code of Practice and clause G13 Foul Water of the New Zealand Building Code.

Design wastewater flows for the site have been calculated based on the following parameters:

- 220 L/day per person
- 2.7 persons/Lot
- Dry weather peaking factor of 1.8
- Wet weather peaking factor of 2.78

The design Maximum Flow (MF) from the proposed 12x lot subdivision would be 0.41 L/s. Calculations are located in Appendix B.

Bowenvale Avenue is located within a wastewater capacity constrained area but flows from the street do not directly contribute to parts of the catchment where overflows are predicted. CCC has advised that the additional discharge generated from the proposed 11x additional lots will not be required to be attenuated and that there is sufficient capacity within the receiving public wastewater network to service the development. Refer to Appendix C for CCC correspondence.

4 WATER SUPPLY

The point supply for the development will be a new 150mm water main constructed by the development at no.130 Bowenvale Avenue. This development will further extend the 150mm dia. main 180m into the site and up the new accessway. Council have confirmed that a 150mm line extension is required to future proof the pressure supply in the area should a reduction in pressure occur as a result of further development of the neighbourhood. It's uncertain whether no.130 will proceed with construction before no.169 and therefore a full watermain extension from its current position may be required.

Each lot will be provided with individual toby boxes and associated OD 25mm PE laterals (20mm ID) pipelines installed 1m within the boundary of new lots. The proposed water supply layout is shown on the Infrastructure Servicing Plan located in Appendix A (refer drawing 23045-230 [A]).

The sites classification for firefighting water supply purposes is FW2 (SNZ PAS 4509:2008) for residential. A new fire hydrant will be installed on the 150mm line. An existing hydrant is located within 270m of the furthest proposed dwelling location within the site and will be adequate to service the development.

The water supply design will comply with Part 7 of the CCC Engineering Code of Practice. CCC have advised that there is sufficient capacity within the water supply network to service the development. Correspondence is located in Appendix C.

5 STORMWATER

The existing site slopes in a western direction towards the Bowenvale Track Reserve and is predominately vegetated.

Currently an open drain and stormwater reserve is located at the top of Bowenvale Avenue. The site plans to discharge all runoff associated with the site to the stormwater reserve as indicated on the servicing layout plan.

Stormwater within the RoW will be reticulated via a combination of kerb and channel, sumps and pipework prior to discharge to the public stormwater network within Bowenvale Avenue. Internal pipework sizes and calculations will be provided as part of engineering approval.

The stormwater system will be designed to ensure that the discharge does not cause stormwater from up to and including a 27-hour duration 2% annual exceedance probability (including RCP8.5) rainfall event to enter any other property beyond the boundary of the subdivision or area in which the discharge occurs. All lots will be designed to ensure that a secondary overflow path out to the road network is available for events that exceed a 2% event and the capacity of the new stormwater system.

The primary reticulation system from ROW's will be designed to a 20% AEP level (CCC primary network level of service). The existing overland flow path through the site will be maintained or piped through the site as described in the section below.

The proposed stormwater layout is shown on the Infrastructure Servicing Plan located in Appendix A (refer drawing 23021-101 [A]).

The subdivision will discharge under the CCC global stormwater consent (CRC231955). CCC has advised of treatment and attenuation requirements which are addressed in the following sections.

5.1 Management of Upper Catchment Runoff

The catchment uphill of the development site has a total estimated catchment area of 8.51 ha. Based on a 720 m catchment length and an average catchment slope of 40.7%, a 20-minute time of concentration was calculated using the Friend equation (Eqn 21-3 of the WWDG). The upper catchment was delineated into five sub-catchments based on LiDAR recently flown in 2020. These catchments are shown on a plan provided in Appendix B. Peak flows were estimated using the Rational Method for the 1% annual exceedance probability (AEP) rainfall event including the effects of climate change (scenario RCP8.5 out to 2081 – 2100) (+CC) assuming a runoff coefficient of 0.5 (based on poorly drained soils and a >20% slope). These peak flows are detailed in Table 1 below. Refer to calculations provided in Appendix B.

Table 1 Upper catchment peak runoff flows in the 1% AEP 20-min +CC rainfall event

Sub-catchment	Area (ha)	Peak flow (L/s)
1	0.082	8
2	0.361	34
3	1.231	117
4	6.781	642
5	0.053	5

The proposed management of the upper catchment runoff flows for each sub-catchment through the proposed development are detailed below:

- **Sub-catchment 1:** Overland flow path to be managed within 600 mm wide vee channel with 1:3 (v:h) side slopes, and lined with an appropriate geogrid beneath established grass cover. Minor local earthworks may be required to capture and divert upper catchment runoff into this defined overland flow path. The alignment of this overland flow path is to connect into the lot's driveway / right of way as soon as practical.
- **Sub-catchment 2:** Overland flow path to be managed within trapezoidal channel with 300 mm base width, 1:3 (v:h) side slopes, and lined with an appropriate geogrid beneath established grass cover. Minor local earthworks may be required to capture and divert upper catchment runoff into this defined overland flow path. The alignment of this overland flow path is to connect into the lot's driveway / right of way as soon as practical.
- **Sub-catchment 3:** Piped through a DN300 PVC-U SN8 pipe. A 2.15 m wide by 1.00 m high debris rack will be required at the culvert inlet to achieve a grill area 20x the culvert area.
- **Sub-catchment 4:** Piped through a DN375 PVC-U SN8 pipe across the steep section, and then through a DN475 PVC-U SN8 pipe for the section with a lower grade. A 2.15 m wide by 1.00 m high debris rack will be required at the culvert inlet to achieve a grill area 20x the culvert area.
- **Sub-catchment 5:** Is the smallest catchment with a peak flow of 5 L/s for 1% AEP event. A consent notice will be placed on the lot 11 to ensure that the existing overland flow path through the lot is maintained and can discharge to the RoW to continue downslope. Minor local earthworks may be required to capture and divert upper catchment runoff into this defined overland flow path. The alignment of this overland flow path is to connect into the lot's driveway / right of way as soon as practical.

The discharge of upper catchment runoff from the development at the downstream end of the development will be confirmed with CCC; however, at this stage it is proposed to allow flows to bubble-up out of the pipes and flow across the walking track and into the well-defined channel as the runoff currently does.

5.2 Stormwater Treatment

The first flush flow rate has been calculated as 8 L/s for the site. The treatment of stormwater runoff from hardstand areas is proposed to be done via a Stormwater360 StormFilter proprietary treatment device with six 69 cm cartridges in a trafficable Ø1800 manhole. A treatment device by another supplier may also be used if it provides an equivalent level of service and is approved for use by CCC. Refer to Appendix B for sizing calculations.

5.3 Hydraulic Neutrality

The proposed development is required to achieve hydraulic neutrality for the 2% AEP +CC rainfall event. As this site is greater than 5,000 m², site-specific engineering design is required[1]. Additionally, we understand that the critical rainfall event for this catchment is the 2% AEP 27-hr storm. Communications with CCC (B. Norton, personal communication, September 25, 2023) have confirmed that as this is a relatively small site, the reduction of all peak post-development flows below pre-development peak flows will be sufficient. This is proposed to be achieved through the use of roof tanks

A minimum volume of 1 m³ of water (i.e., 90 mm water depth for a 30 m³ tank) must be left in the tank's sludge zone to ensure its stability. To minimise blockage risks, and as per CCC guidance, a minimum orifice outlet size of 15 mm is required. However, discussions with Promax Plastics have revealed that their tank design with a self-cleaning orifice would provide the option to have a orifice outlet size less than 15 mm[3]. As discussed below, this would be required to achieve hydraulic neutrality in longer duration rainfall events.

Detailed analysis has shown that in 2% AEP rainfall events longer than 2-hrs, the roof runoff water heads up in the roof tank behind the 15 mm orifice and causes a peak flow rate greater than the allowable tank discharge per lot. A 30 m³ roof tank was trailed to maximise storage capacity and minimise the amount of heading up that roof water can do behind the tank's outlet orifice.

As shown in the attached calculations, the tanks each have a maximum discharge of 0.4 L/s in the 2% AEP 12-hr rainfall event, with 1.27 m of water above the orifice level. Similarly, the maximum discharge in the 2% AEP 24-hr rainfall event is 0.36 L/s, with 1.03 m of water above the orifice level. These correspond to total increases in discharges off-site of 2.8 L/s and 3.0 L/s respectively. Alternatively, if a smaller 10 m³ tank was accepted by CCC, the total increases in discharges off-site for the 2% AEP 12-hr and 24-hr rainfall events would increase to 4.6 L/s and 3.6 L/s respectively, which is not a significant increase given the much smaller roof tanks that could be used for each lot. However, in this alternative scenario hydraulic neutrality would only be achieved up to the 2% AEP 1-hr rainfall event, rather than up to the 2% AEP 2-hr rainfall event.

[1] Christchurch City Council Onsite Stormwater Mitigation Guide June 2021

[3] Self-cleaning orifices work by a siphon effect in an overflow pipe which can wash leaves away from the orifice, allowing the orifice to function freely again.

If CCC were to approve the use of smaller self-cleaning orifices (< 15 mm), hydraulic neutrality can be achieved for the 2% AEP 27-hr rainfall event. A 5.5 mm self-cleaning orifice fitted to a 30 m³ tank would discharge out of the tank at 0.09 L/s and 0.10 L/s for the 12-hr and 24-hr duration rainfall events. These flow rates ensure that the subdivision achieves hydraulic neutrality. This approach would be subject to CCC approval. We understand the self-cleaning siphon is currently approved by Auckland City Council.

Overall:

- Hydraulic neutrality can be achieved with 30 m³ roof tanks with a 15 mm orifice for 2% AEP rainfall events between the 10-minute and 2-hrs.
- A maximum increase in discharge above the pre-development discharge from the site of 3.0 L/s has been estimated across the 2% AEP rainfall events, with this increase occurring for the 24-hr rainfall event even when trialled using a 30 m³ roof tanks. This increase represents an 18% increase in flow above the pre-development scenario from the site.
- If acceptable to CCC, the applicant would like to further consider the use of 10 m³ tanks. In this scenario, the increase in discharge from site above the pre-development would increase to 24% in the 2% AEP 24-hr event.
- A third option, subject to CCC approval, is to use 30 m³ roof tanks fitted with 5.5 mm self-cleaning orifices. This would allow the site to achieve hydraulic neutrality.

6 EARTHWORKS

Earthworking of the subdivision will be kept minimal and limited to cutting/filling out for the pavement construction and drainage. Minimal re-contouring of the lots towards the RoW is proposed as the topography blends mostly into the new RoW design. A proposed earthworks layout plan is located in Appendix A (refer drawing 23045-211 [A]).

All earthwork/exposed areas will be covered with a minimum of 200mm topsoil and grassed with a 95% strike rate.

7 POWER AND PHONE

There are existing power and telecommunications services located in Bowenvale Avenue that will be available to service the development. Orion (electricity) and Enable (telecommunications) will be engaged to provide design plans for construction once the resource consent has been granted.

APPENDIX A – CONCEPT DRAWINGS

NOTES

1. THE INFORMATION SHOWN ON THIS DRAWING IS CONCEPTUAL ONLY AND SUBJECT TO DETAILED DESIGN.
2. ALL PARCELS, AREAS AND DIMENSIONS ARE SUBJECT TO FINAL SURVEY.
3. ALL EARTHWORKS TO BE CARRIED OUT IN ACCORDANCE WITH NZS 4431:2022 ENGINEERED FILL CONSTRUCTION FOR LIGHTWEIGHT STRUCTURES.
4. EARTHWORKS VOLUMES ARE APPROXIMATE:
   FILL = 200 cu.m
   CUT = 600 cu.m
5. LEVELS ARE IN TERMS THE SUPPLIED DATUM
   ORIGIN OF LEVELS: CCC BM 0216 (EHD6)
   RL 14.912m
6. COORDINATES ARE IN TERMS OF NZGD2000, MOUNT PLEASANT CIRCUIT 2000
7. ORIGIN OF COORDINATES: IS 1 DP 78608 (BDYF)
   801116.41mN
   393592.96 mE
8. CONTOURS ARE SHOWN AT 1m INTERVALS. CONTOURS WITHIN HATCHED AREAS ARE DESIGN CONTOURS WHILE CONTOURS OUTSIDE OF HATCHED ARE EXISTING

LEGEND

- CUT
- ENGINEERED FILL
- TOPSOIL CUT/FILL
- DESIGN CONTOURS
- OVERLAND FLOWPATH
- DRAINAGE PATH
- DRAIN EXISTING
- TOP OF BANK
- EXISTING BUILDING

DRAFT
DRAWINGS ARE CONCEPT ONLY AND SUBJECT TO FINAL DESIGN

N

PART 3
DP 28705

45.0 44.0 43.0 42.0 41.0 40.0 39.0 38.0 37.0 36.0 35.0 34.0 33.0 32.0 31.0 30.0 29.0 28.0

ROW 1

ROW 2

ROW 3

)WENVALE AVENUE

ACCESS WAY

BOWENVALE AVENUE

29.0 30.0 31.0 32.0

BOWENVALE RESERVE TRACK

27.0 26.0 25.0

STORMWATER RESERVE AREA

10 8 6 4 2 0m 10 20 30 40 50

Scale 1:500 m (A3)

e2environmental CONSULTING CIVIL ENGINEERS
Christchurch, Blenheim, Ashburton
www.e2environmental.com

Client: BOWENVALE PARK ESTATES LTD

Project: 169 BOWENVALE AVENUE CASHMERE

Title: EARTHWORKS PLAN CUT/FILL

Rev	Comments	Approved	Date
A	FOR COUNCIL REVIEW	AJT	9.11.23

Designed by	Drawn by	Checked by	Approved by	Approved by Date
PH	HN	JW	AJT	9.11.2023

Status: RESOURCE CONSENT

Scale: 1:250 (A1) 1:500 (A3)

Project No: 23045-01

Drawing No: 211

Revision: A

LEGEND

	PROPOSED KERB & CHANNEL	FH	PROPOSED FIRE HYDRANT	—S—	EXISTING SEWER
	EXISTING TRACK	GV SV	PROPOSED GATE/SLUICE VALVE	S	EXISTING SEWER MANHOLE
—S—	PROPOSED SEWER		PROPOSED SINGLE SUMP	—W—	EXISTING WATER MAIN
S	PROPOSED SEWER MH/IC	D	PROPOSED MH OR IC	FH	EXISTING FIRE HYDRANT
—W—	PROPOSED WATER MAIN	—D—	EXISTING STORMWATER	WM	EXISTING WATER METER
WM	PROPOSED WATER METER	—D—	EXISTING STORMWATER		EXISTING WATER VALVE
		D	EXISTING STORMWATER MANHOLE		

DRAFT

DRAWINGS ARE CONCEPT ONLY AND SUBJECT TO FINAL DESIGN

PART 3
DP 28705

BOWENVALE AVENUE

CONNECTS TO NEW SSMH (BY OTHERS)

CONNECTS TO NEW WATER (BY OTHERS)

ø375

FIRST FLUSH (FF)

1x FF TREATED PIPELINE & 1x BYPASS PIPELINE

SUMP (SS1)

SUMP (SS4)

ø150 WATER
ø150 SEWER

WINGWALL OUTLET WITH SCOUR PROTECTION

10 8 6 4 2 0m 10 20 30 40 50

Scale 1:500 m (A3)

2 4 6 7 10 11

1 3 5 8 9 12

INTAKE GRILLS

ø300

ø375

ø450

HOUSE DRAIN (HS1)
DIRECT CONN. TO LOT SW

HOUSE DRAIN (HS2)
DIRECT CONN. TO LOT SW

HOUSE DRAIN (HS3)
DIRECT CONN. TO LOT SW

2 x WATER LATERALS ø100

ø100 UNDERCHANNEL SW

ROW 1

ROW 2

ROW 3

165 BOWENVALE AVENUE

ACCESS WAY (JOAL)

POTENTIAL PASSING BAY HERE

SUMP (SS5)

SUMP (SS6)

SUMP (SS2)

SUMP (SS3)

BUBBLE-UP STRUCTURE FOR DISCHARGING UPHILL CATCHMENT

BOWENVALE RESERVE TRACK

e2environmental CONSULTING CIVIL ENGINEERS
Christchurch, Blenheim, Ashburton
www.e2environmental.com

Client: BOWENVALE PARK ESTATES LTD

Project: 169 BOWENVALE AVENUE CASHMERE

Title: 3-WATERS SERVICES PLAN

Rev	Comments	Approved	Date
A	FOR COUNCIL REVIEW	AJT	9.11.23

Designed by: PH | Drawn by: HN | Checked by: JW | Approved by: AJT | Approved by Date: 9.11.2023

Status: RESOURCE CONSENT

Scale: 1:250 (A1) 1:500 (A3)

Project No: 23045-01

Drawing No: 230

Revision: A

DRAFT
DRAWINGS ARE CONCEPT ONLY AND SUBJECT TO FINAL DESIGN

e2environmental CONSULTING CIVIL ENGINEERS
Christchurch, Blenheim, Ashburton
www.e2environmental.com

Client: BOWENVALE PARK ESTATES LTD

Project: 169 BOWENVALE AVENUE CASHMERE

Title: TURNING CIRCLE 90th PERCENTILE CAR

Rev	Comments	Approved	Date

Designed by	Drawn by	Checked by	Approved by	Approved by Date
PH	HN			

Status: FOR INFORMATION

Scale: 1:250 (A1) 1:500 (A3)

Project No: 23045-01

Drawing No: 290

Revision: P1

APPENDIX B – CALCULATIONS

Calculation Sheet

Project/Job:	169 Bowenvale Avenue, Cashmere	Date:	22-Sep-23		
Subject/Task:	**Wastewater Flows**	Job No:	23045	By:	PH
Client/Ref:	Bowenvale Park Estates Ltd	Sheet No:	1	of	1

Site Area **0.9686** **ha**
Lots **12**

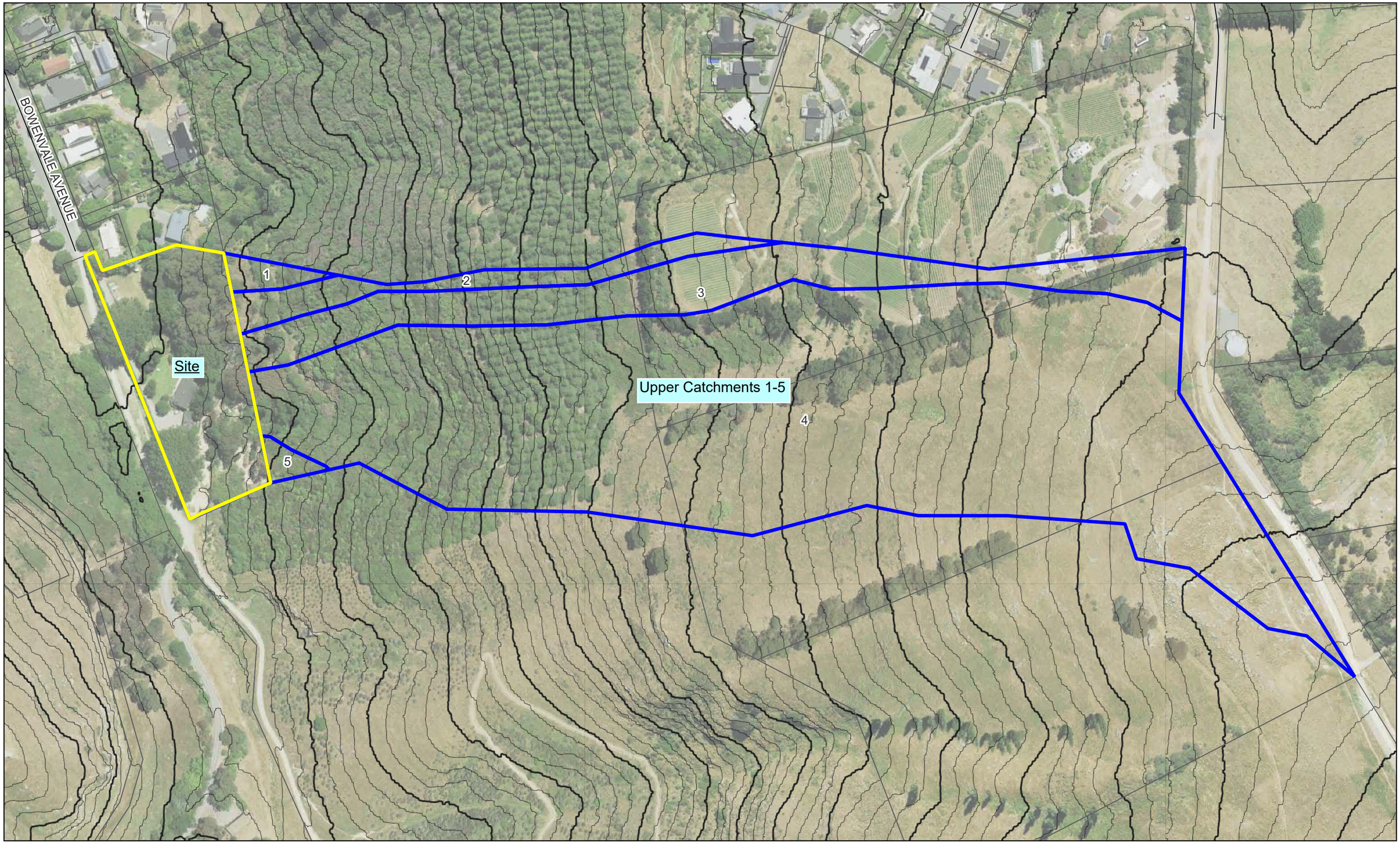
Average Sewage Flow (ASF = lots x L/person/day x 2.7 persons/lot) *CCC IDS 6.4.4 - Equation 5*

Lots	12	
Demand	220	L/person/day
Persons	2.7	persons/lot
ASF	0.0825	L/s

Maximum Flow (MF = P/A x SPF x ASF)

P/A	1.8	CCC IDS 6.4.1	Dry weather diurnal peak to average ratio
SPF	2.78		Storm peak factor (2.78 std).
MF	0.41 L/s		Max flow occurring during wet weather

Calculations - Upper Stormwater Catchments



Paper Size A3

20 0 20 40 60 80 m

Scale: 1 : 2000 (A3)
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

N

Legend

Upper Catchment Extents
Site
LiDAR Contours
5 m
20 m

e2 environmental CONSULTING CIVIL ENGINEERS

Bowenvale Park Estates
169 Bowenvale Ave

Upper Catchment Extents

Job Number	23045
Revision	1
Date	07/11/2023

e2 Environmental Ltd. Unit 1/46 Acheron Drive PO Box 31159. ChristchurchP 64 3 358 4955 W www.e2environmental.com

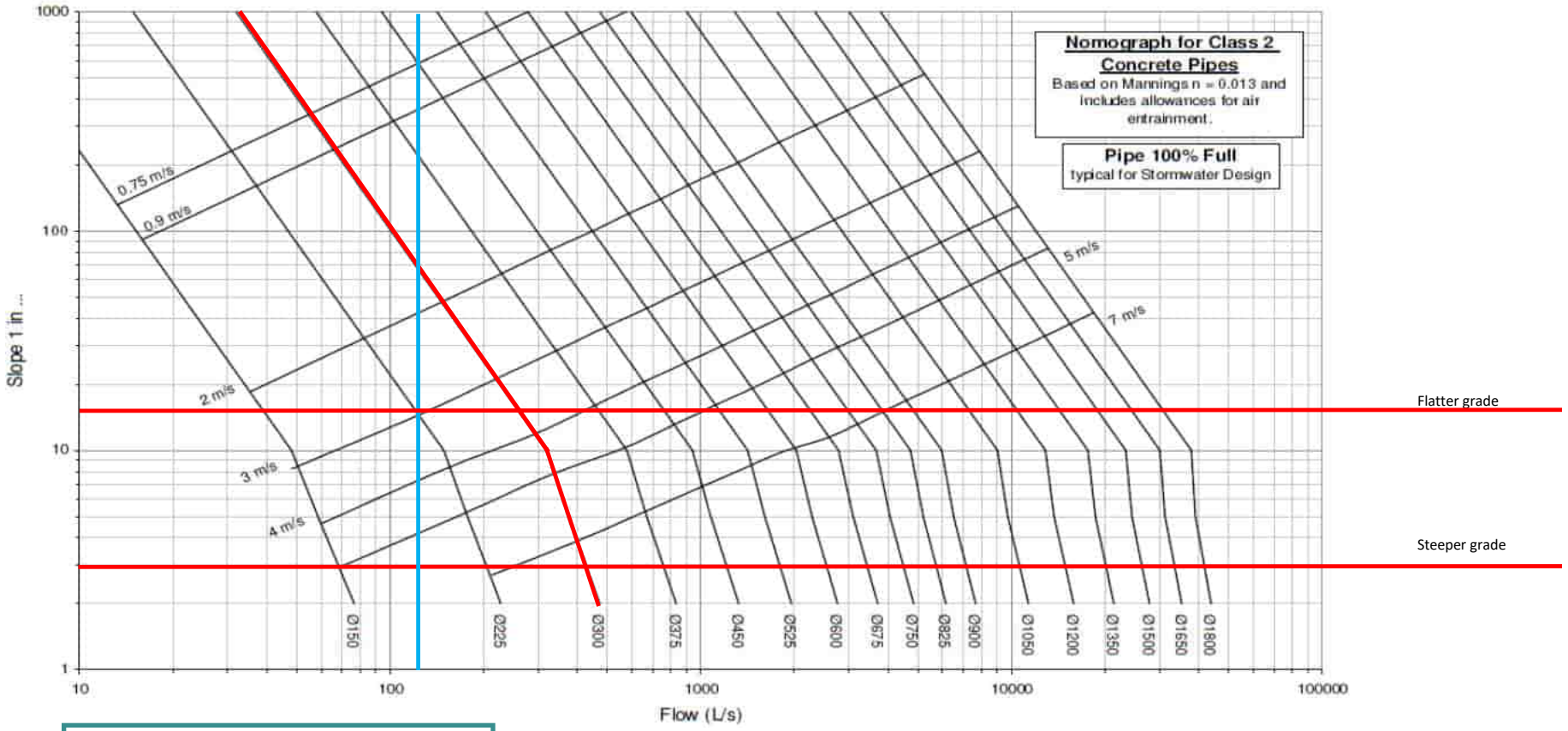
FULL PIPE FLOW SPREADSHEET

NOTE: This spreadsheet should be used for general design purposes only and must be used with engineering judgement.

PROJECT DETAILS

Description:	Management of overland flow paths	**Project Number:**	23045
Client:	Bowenvale Park Estates Ltd	**Ref. Number:**	1
Site:	169 Bowenvale Avenue, Christchurch	**Assessed by:**	DHM
Coordinates:		**Date:**	3/11/2023

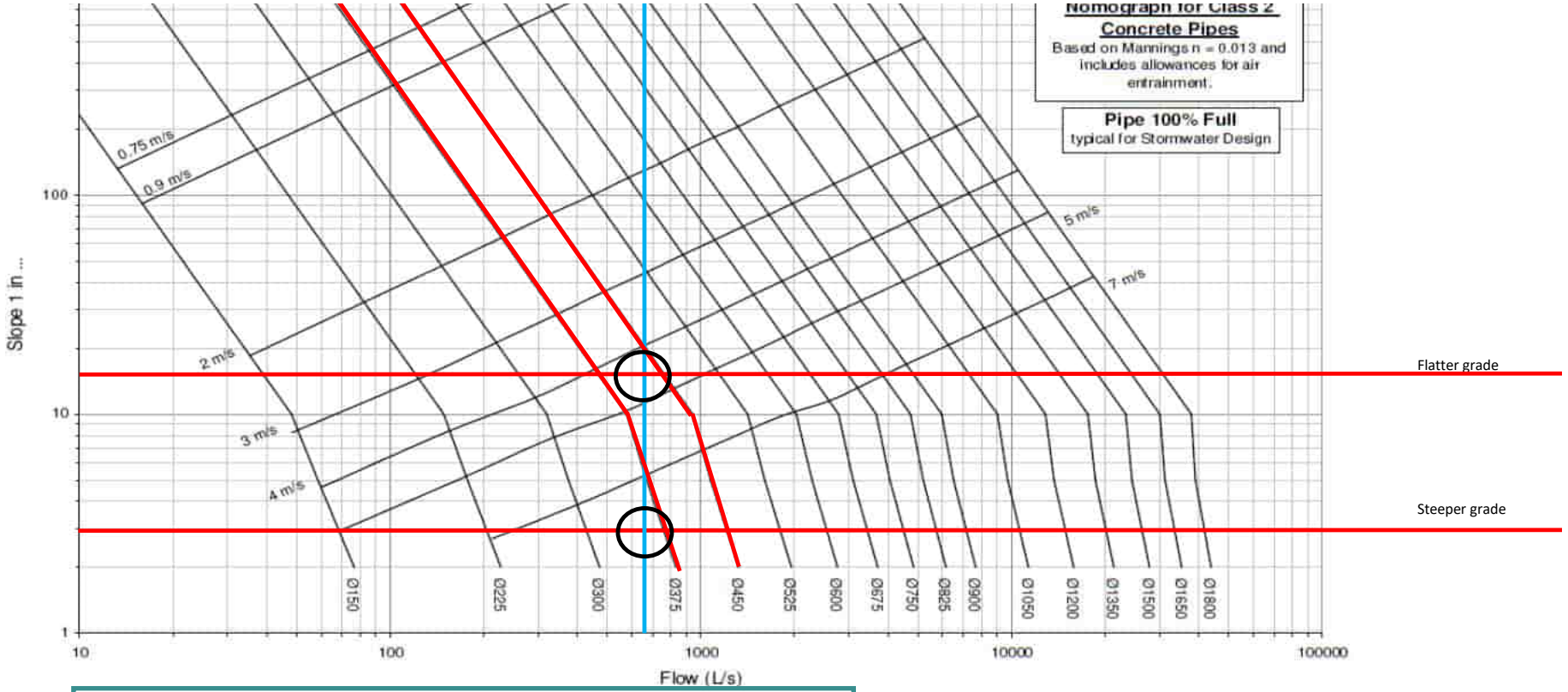
Sub-catchment 3



Conclusion: DN300 pipe sufficient for sub-catchment 3.

Sub-catchment 4

Sub-catchment 4



Conclusion: DN375 pipe on the steeper grade and then a DN450 pipe on the flatter grade sufficient for sub-catchment 4.

MANNING'S CALCULATOR SPREADSHEET

NOTE: This spreadsheet should be used for general design purposes only and must be used with engineering judgement.

PROJECT DETAILS

Description:	Management of overland flow paths	**Project Number:**	23045
Client:	Bowenvale Park Estates Ltd	**Ref. Number:**	1
Site:	169 Bowenvale Avenue, Christchurch	**Assessed by:**	DHM
Coordinates:		**Date:**	27/10/2023

Channel Description: Sub-catchment 2

INPUT DATA

Channel Slope, s:	0.40 m/m	
Manning's n, n:	0.040	*WWDG - III. D. 2*
Channel Slope, s:	40.00%	
Channel Slope, s:	1 in 2.5	
Manning's M, M:	25.0	*M = 1 / n*

CHANNEL GEOMETRY AND FLOW

Trapezoidal Channel

Base width, B:	0.300	m
Water depth, D:	0.050	m
Side slope, z:	3.000	H:1V
Freeboard, F:	0.100	m
Area, A:	0.023	m²
Wetted Perimeter, P:	0.616	m
Hydraulic Radius, R:	0.037	m

Flow rate, Q:	0.039	m³/s
Flow rate, Q:	39	L/s
Flow velocity, v:	1.740	m/s
Top width:	0.600	m
Top channel width:	1.200	m

Manning's equation

$$Flow, Q = \frac{AR^{\frac{2}{3}}\sqrt{s}}{n}$$

MANNING'S CALCULATOR SPREADSHEET

NOTE: This spreadsheet should be used for general design purposes only and must be used with engineering judgement.

PROJECT DETAILS

Description:	Management of overland flow paths	**Project Number:**	23045
Client:	Bowenvale Park Estates Ltd	**Ref. Number:**	1
Site:	169 Bowenvale Avenue, Christchurch	**Assessed by:**	DHM
Coordinates:		**Date:**	27/10/2023

Channel Description: Sub-catchment 1

INPUT DATA

Channel Slope, s:	0.40 m/m	
Manning's n, n:	0.040	*WWDG - III. D. 2*
Channel Slope, s:	40.00%	
Channel Slope, s:	1 in 2.5	
Manning's M, M:	25.0	*M = 1 / n*

CHANNEL GEOMETRY AND FLOW

Trapezoidal Channel

Base width, B:	0.000	m
Water depth, D:	0.050	m
Side slope, z:	3.000	H:1V
Freeboard, F:	0.050	m
Area, A:	0.008	m²
Wetted Perimeter, P:	0.316	m
Hydraulic Radius, R:	0.024	m

Flow rate, Q:	0.010	m³/s
Flow rate, Q:	10	L/s
Flow velocity, v:	1.305	m/s
Top width:	0.300	m
Top channel width:	0.600	m

Manning's equation

$$Flow, Q = \frac{AR^{\frac{2}{3}}\sqrt{s}}{n}$$

Site Calculations - Stormwater Treatment

Spreadsheet to detail stormwater treatment sizing calculation

Lot areas + ROW:	0.885	ha
Road	0.085	ha
CCC zone:	Residential Hills Zone	
CCC zone runoff coefficient:	0.57	
Hardstand runoff coefficient:	0.85	
First flush rainfall intensity:	5	mm/hr
First flush flow rate:	8.0	L/s

SW 360 module flow rates

69 cm module:	1.42	L/s per cartridge
Selected device:	69cm Standard StormFilter Cartridge (Trafficable)	
Number of modules required:	6	
Manhole size:	DN1800	
Drawing:	https://www.stormwater360.co.nz/assets/Uploads/SF-MH-69-1800-T-20-REV1.pdf	

Site Calculations - Stormwater Neutrality

Spreadsheet to calculate hydraulic neutrality of 169 Bowenvale Ave

Number of lots	12	
Assumed roof area per lot	220	m²
Assumed hardstand area per lot	80	m²
Hardstand area for ROWs	423	m²
Hardstand area for road	850	m²

Pre-development hydrology

Landuse	Runoff coefficient	2% AEP 20-min CC (mm/hr)	Area (m²)	Area (ha)	Flow rate (L/s)
Roof	0.9	57.9	339	0.0339	4.9
Hardstand	0.85	57.9	900	0.0900	12.3
Pervious area	0.4	57.9	8,439	0.8439	54.3
			9,678	0.9678	71.6

Weighted runoff coefficient	0.46	
Total impervious area	1,239	m²

Post-development hydrology (without attenuation)

Landuse	Runoff coefficient	2% AEP 20-min CC (mm/hr)	Area (m²)	Area (ha)	Flow rate (L/s)
Roof	0.9	57.9	2,640	0.2640	38.2
Hardstand	0.85	57.9	2,233	0.2233	30.6
Pervious area	0.4	57.9	4,805	0.4805	30.9
			9,678	0.9678	99.7

Weighted runoff coefficient	0.64		
Total impervious area	4,873	m²	
Total increase in impervious area	3,634	m²	
Roof tank storage volume required	218	m³	
Roof tank storage volume required per lot	18	m³	
Orifice size	15	mm	*Minimum allowed to prevent blockage*

Post-development hydrology (with attenuation, and assuming no flow out of roof tanks at time of peak flow)

Landuse	Runoff coefficient	2% AEP 20-min CC (mm/hr)	Area (m²)	Area (ha)	Flow rate (L/s)
Roof	0.9	57.9	-	-	-
Hardstand	0.85	57.9	2,233	0.2233	30.6
Pervious area	0.4	57.9	4,805	0.4805	30.9
			7,038	0.7038	61.5

Rainfall intensities (mm/hr) :: RCP8.5 for the period 2081-2100

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	27hr	48h
50	0.02	72.7	57.9	50.1	38.5	28.7	16.7	11.4	7.58	7.25	4.92
Event duration (hrs):		0.17	0.33	0.5	1	2	6	12	24	27	48
Pre-development flow rates (L/s):		89.9	71.6	61.9	47.6	35.5	20.6	14.1	9.4	9.0	6.1
Post-development flow rates without attenuation (L/s):		125.2	99.7	86.3	66.3	49.4	28.8	19.6	13.1	12.5	8.5
Increase in flow rates (L/s):		35.4	28.2	24.4	18.7	14.0	8.1	5.5	3.7	3.5	2.4
Post-development flow rates minus roof flow (L/s):		77.2	61.5	53.2	40.9	30.5	17.7	12.1	8.0	7.7	5.2
Increase in flow rates from pre-development (L/s):		-12.6	-10.1	-8.7	-6.7	-5.0	-2.9	-2.0	-1.32	-1.26	-0.9
Allowable tank discharge rate per lot:		**1.05**	**0.84**	**0.73**	**0.56**	**0.42**	**0.24**	**0.17**	**0.11**	**0.11**	**0.07**
Runoff volume per roof (m³):		2.4	3.8	5.0	7.6	11.4	19.8	27.1	36.0	38.7	46.8
Assumed tank size:	30 m³										
Tank plan area:	11.2 m²										
Depth of water in roof tank above orifice when discharge rate is exceeded:		-	3.1	2.3	1.4	0.8	0.3	0.1	< 0.1	< 0.1	< 0.1
Water depth in tank if no discharge out of tank (m):		0.21	0.34	0.44	0.68	1.01	1.77	2.41	Full tank / spilling	Full tank / spilling	Full tank / spilling

Outcome of peak flow through orifice at max tank water depth vs allowable tank discharge per lot:	Hydraulic neutrality achieved.	Hydraulic neutrality achieved.	Hydraulic neutrality achieved.	Hydraulic neutrality achieved.	Further investigation required.	Further investigation required.	Further investigation required.	Further investigation required.	Further investigation required.	Further investigation required.
Discharge from roof tank with 15mm orifice (L/s):	0.16	0.2	0.23	0.28	0.33	0.4	0.4	0.36		0.27
Increase in discharge from total site with 15mm orifice (L/s):	-10.7	-7.7	-6.0	-3.3	-1.0	1.9	2.8	3.0		2.4
Tank analysis outcome with 15mm orifice:	Hydraulic neutrality achieved.	Hydraulic neutrality achieved.	Hydraulic neutrality achieved.	Hydraulic neutrality achieved.	Hydraulic neutrality achieved.	Exceeded	Exceeded	Exceeded		Exceeded
Modelled depth in water tank (m):	0.21	0.32	0.41	0.61	0.86	1.22	1.27	1.03		0.56

Note 1: tank analysis calculator is not set up for 27-hr duration rainfall event so outcome for this event needs to be determined from 24-hr and 48-hr rainfall events.
Note 2: tank analysis calculator is not set up for 15mm orifice, so a 13mm orifice has been used in its place.

TANK ANALYSIS

CATCHMENT PARAMETERS

Tank Treatment Area =	220	m^2
Pre-development Runoff Coefficient =	0.46	(-)
Post-development Runoff Coefficient =	0.90	(-)

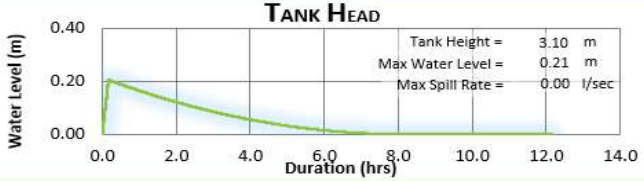
DESIGN CONDITIONS

Design Rainfall Zone =	Alternative Rainfall	
Design Storm Duration =	10min	
Design Storm Return Period =	50	

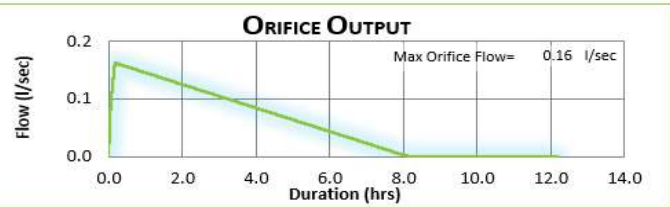
TANK DETAILS

Tank Size =	30,000	litres
Orifice Size =	(Drilled Hole) 13.0	mm
Orifice Type =	Sharp-edged (C=0.61)	(-)

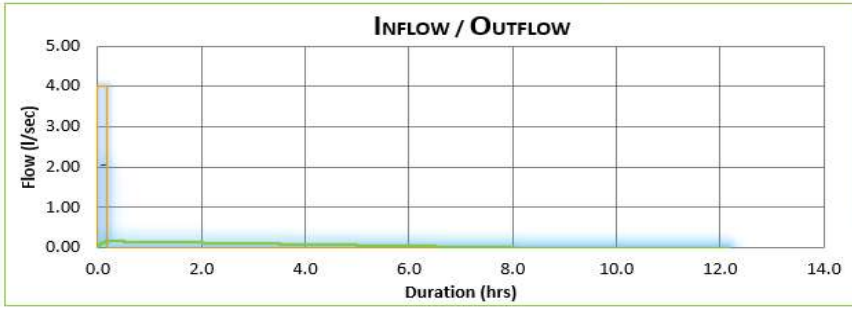
TANK HEAD



ORIFICE OUTPUT



INFLOW / OUTFLOW



RUNOFF RESULTS

Pre-Developed Peak Flow =	2.05	l/sec
Pre-Developed Runoff Volume =	1.23	m^3
Without Tank		
Post-Developed Peak Flow =	4.00	l/sec
Post-Developed Runoff Volume =	2.40	m^3
With Tank		
Post-Developed Peak Flow =	0.16	l/sec
Post-Developed Runoff Volume =	2.40	m^3

----- Pre Development Runoff
Post Development Runoff (without tank)
Post Development Runoff (with tank)

TANK ANALYSIS

CATCHMENT PARAMETERS

Tank Treatment Area =	220	m^2
Pre-development Runoff Coefficient =	0.46	(-)

TANK HEAD

Tank Height = 3.10 m
Max Water Level = 0.32 m

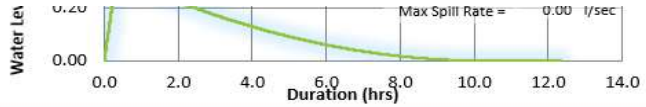
Post-development Runoff Coefficient = 0.90 (-)

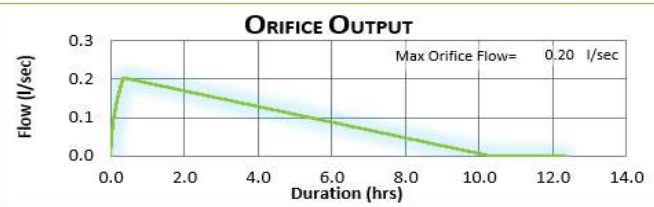
Design Conditions

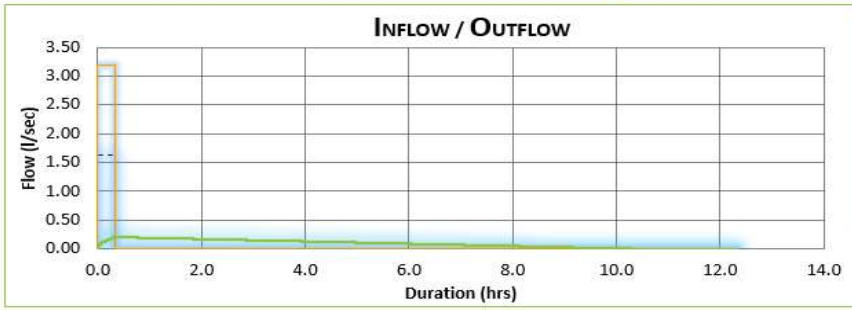
Design Rainfall Zone =	Alternative Rainfall	
Design Storm Duration =	20min	
Design Storm Return Period =	50	yr

Tank Details

Tank Size =	30,000	litres
Orifice Size =	(Drilled Hole) 13.0	mm
Orifice Type =	Sharp-edged (C=0.61)	(-)







Runoff Results

Pre-Developed Peak Flow =	1.63	l/sec
Pre-Developed Runoff Volume =	1.95	m³
Without Tank		
Post-Developed Peak Flow =	3.19	l/sec
Post-Developed Runoff Volume =	3.82	m³
With Tank		
Post-Developed Peak Flow =	0.20	l/sec
Post-Developed Runoff Volume =	3.82	m³

----- Pre Development Runoff
Post Development Runoff (without tank)
Post Development Runoff (with tank)

Tank Analysis

Catchment Parameters

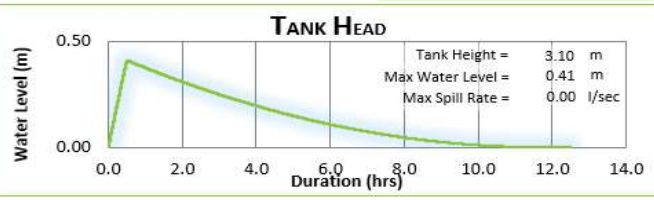
Tank Treatment Area =	220	m²
Pre-development Runoff Coefficient =	0.46	(-)
Post-development Runoff Coefficient =	0.90	(-)

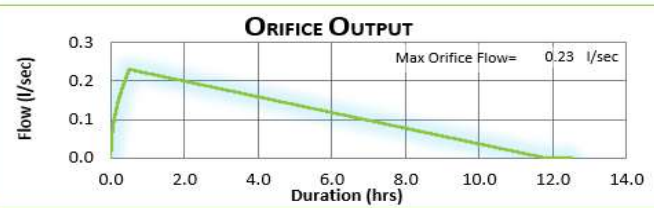
Design Conditions

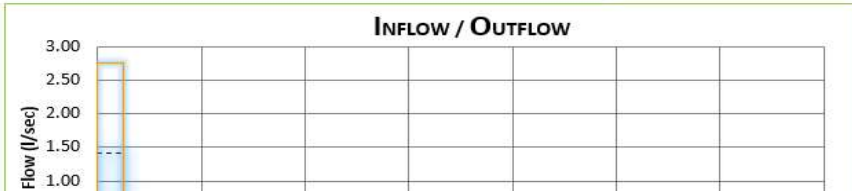
Design Rainfall Zone =	Alternative Rainfall	
Design Storm Duration =	30min	
Design Storm Return Period =	50	yr

Tank Details

Tank Size =	30,000	litres
Orifice Size =	(Drilled Hole) 13.0	mm
Orifice Type =	Sharp-edged (C=0.61)	(-)

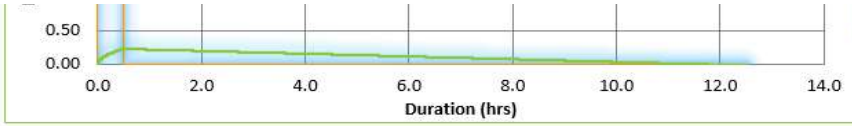






Runoff Results

Pre-Developed Peak Flow =	1.41	l/sec
Pre-Developed Runoff Volume =	2.54	m³
Without Tank		
Post-Developed Peak Flow =	2.76	l/sec
Post-Developed Runoff Volume =	4.96	m³
With Tank		
Post-Developed Peak Flow =	0.23	l/sec



Post-Developed Runoff Volume = 4.96 m³

----- Pre Development Runoff
Post Development Runoff (without tank)
Post Development Runoff (with tank)

TANK ANALYSIS

CATCHMENT PARAMETERS

Tank Treatment Area =	220	m²
Pre-development Runoff Coefficient =	0.46	(-)
Post-development Runoff Coefficient =	0.90	(-)

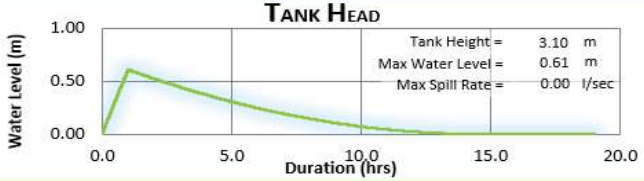
DESIGN CONDITIONS

Design Rainfall Zone =	Alternative Rainfall	
Design Storm Duration =	1hr	
Design Storm Return Period =	50	yr

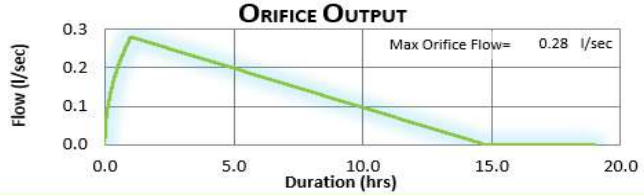
TANK DETAILS

Tank Size =	30,000	litres
Orifice Size =	(Drilled Hole) 13.0	mm
Orifice Type =	Sharp-edged (C=0.61)	(-)

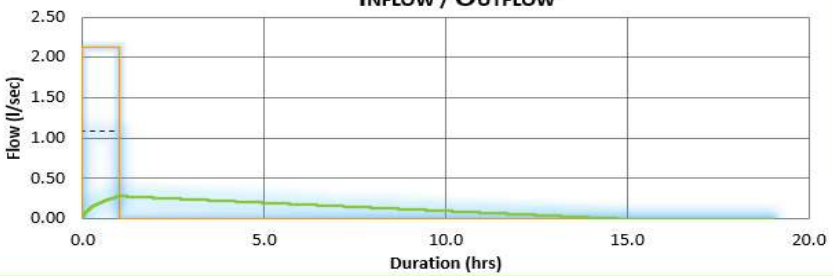
TANK HEAD



ORIFICE OUTPUT



INFLOW / OUTFLOW



RUNOFF RESULTS

Pre-Developed Peak Flow =	1.08 l/sec
Pre-Developed Runoff Volume =	3.90 m³
Without Tank	
Post-Developed Peak Flow =	2.12 l/sec
Post-Developed Runoff Volume =	7.63 m³
With Tank	
Post-Developed Peak Flow =	0.28 l/sec
Post-Developed Runoff Volume =	7.63 m³

----- Pre Development Runoff
Post Development Runoff (without tank)
Post Development Runoff (with tank)

TANK ANALYSIS

CATCHMENT PARAMETERS

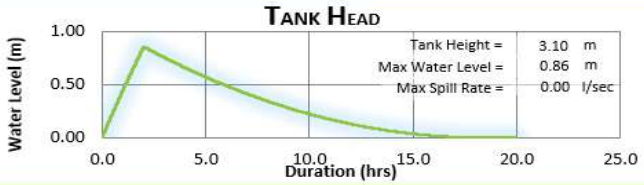
Tank Treatment Area =	220	m²
Pre-development Runoff Coefficient =	0.46	(-)
Post-development Runoff Coefficient =	0.90	(-)

DESIGN CONDITIONS

Design Rainfall Zone =	Alternative Rainfall	
Design Storm Duration =	2hrs	
Design Storm Return Period =	50	yr

TANK DETAILS

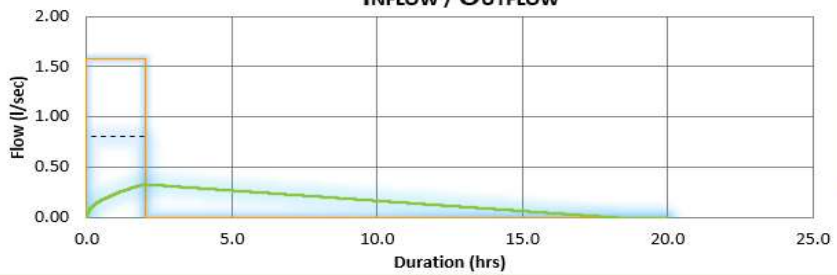
TANK HEAD



ORIFICE OUTPUT

Tank Size =	30,000	litres
Orifice Size =	(Drilled Hole) 13.0	mm
Orifice Type =	Sharp-edged (C=0.61)	(-)

Inflow / Outflow



Runoff Results

Pre-Developed Peak Flow =	0.81	l/sec
Pre-Developed Runoff Volume =	5.81	m³
Without Tank		
Post-Developed Peak Flow =	1.58	l/sec
Post-Developed Runoff Volume =	11.37	m³
With Tank		
Post-Developed Peak Flow =	0.33	l/sec
Post-Developed Runoff Volume =	11.37	m³

----- Pre Development Runoff
Post Development Runoff (without tank)
Post Development Runoff (with tank)

Tank Analysis

Catchment Parameters

Tank Treatment Area =	220	m²
Pre-development Runoff Coefficient =	0.46	(-)
Post-development Runoff Coefficient =	0.90	(-)

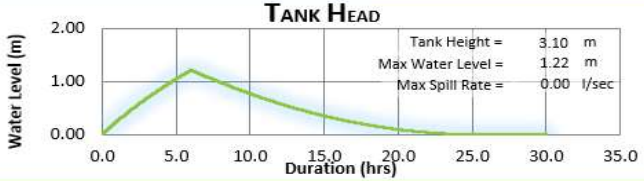
Design Conditions

Design Rainfall Zone =	Alternative Rainfall
Design Storm Duration =	6hrs
Design Storm Return Period =	50 yr

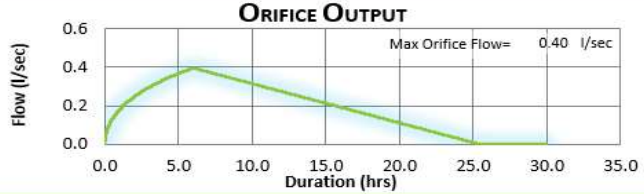
Tank Details

Tank Size =	30,000	litres
Orifice Size =	(Drilled Hole) 13.0	mm
Orifice Type =	Sharp-edged (C=0.61)	(-)

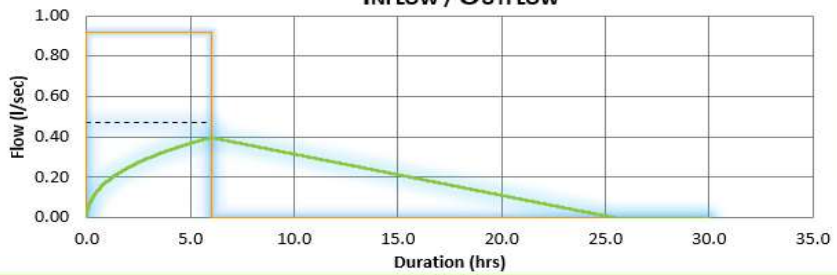
Tank Head



Orifice Output



Inflow / Outflow



Runoff Results

Pre-Developed Peak Flow =	0.47	l/sec
Pre-Developed Runoff Volume =	10.15	m³
Without Tank		
Post-Developed Peak Flow =	0.92	l/sec
Post-Developed Runoff Volume =	19.85	m³
With Tank		
Post-Developed Peak Flow =	0.40	l/sec
Post-Developed Runoff Volume =	19.85	m³

----- Pre Development Runoff
Post Development Runoff (without tank)
Post Development Runoff (with tank)

Tank Analysis

Catchment Parameters

Tank Treatment Area =	220	m^2
Pre-development Runoff Coefficient =	0.46	(-)
Post-development Runoff Coefficient =	0.90	(-)

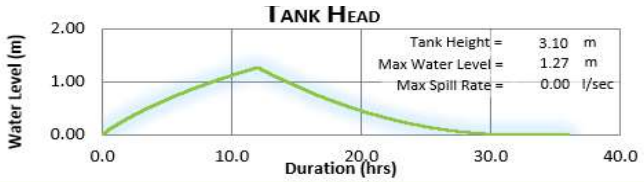
Design Conditions

Design Rainfall Zone =	Alternative Rainfall	
Design Storm Duration =	12hrs	
Design Storm Return Period =	50	yr

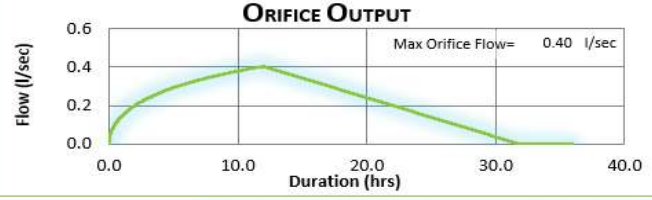
Tank Details

Tank Size =	30,000	litres
Orifice Size =	(Drilled Hole) 13.0	mm
Orifice Type =	Sharp-edged (C=0.61)	(-)

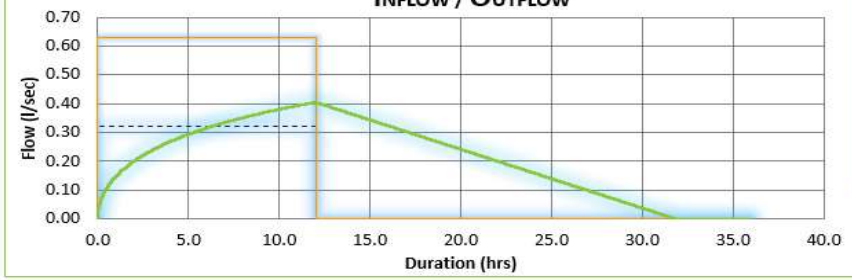
Tank Head



Orifice Output



Inflow / Outflow



Runoff Results

Pre-Developed Peak Flow =	0.32	l/sec
Pre-Developed Runoff Volume =	13.85	m^3
Without Tank		
Post-Developed Peak Flow =	0.63	l/sec
Post-Developed Runoff Volume =	27.11	m^3
With Tank		
Post-Developed Peak Flow =	0.40	l/sec
Post-Developed Runoff Volume =	27.11	m^3

----- Pre Development Runoff
Post Development Runoff (without tank)
Post Development Runoff (with tank)

Tank Analysis

environmental CONSULTING ENGINEERS

Catchment Parameters

Tank Treatment Area =	220	m^2
Pre-development Runoff Coefficient =	0.46	(-)
Post-development Runoff Coefficient =	0.90	(-)

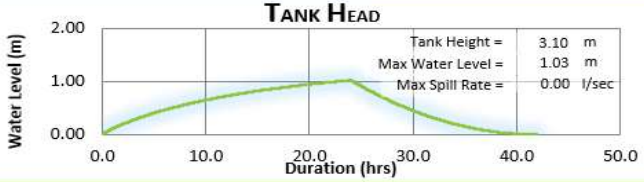
Design Conditions

Design Rainfall Zone =	Alternative Rainfall	
Design Storm Duration =	24hrs	
Design Storm Return Period =	50	yr

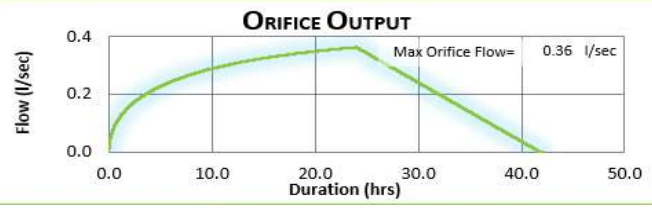
Tank Details

Tank Size =	30,000	litres
Orifice Size =	(Drilled Hole) 13.0	mm
Orifice Type =	Sharp-edged (C=0.61)	(-)

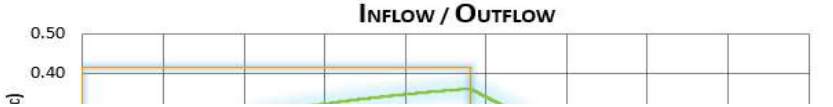
Tank Head



Orifice Output

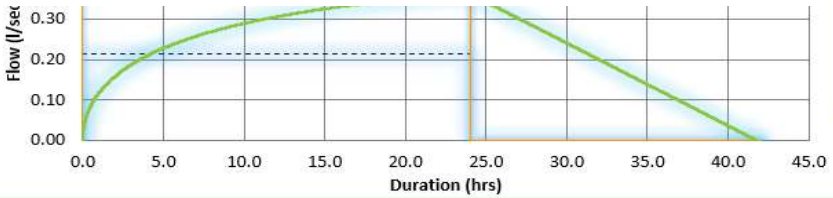


Inflow / Outflow



Runoff Results

Pre-Developed Peak Flow =	0.21	l/sec
Pre-Developed Runoff Volume =	18.42	m^3
Without Tank		



Post-Developed Peak Flow = 0.42 l/sec
Post-Developed Runoff Volume = 36.05 m³

With Tank

Post-Developed Peak Flow = 0.36 l/sec
Post-Developed Runoff Volume = 36.05 m³

----- Pre Development Runoff
Post Development Runoff (without tank)
Post Development Runoff (with tank)

TANK ANALYSIS

CATCHMENT PARAMETERS

Tank Treatment Area =	220	m²
Pre-development Runoff Coefficient =	0.46	(-)
Post-development Runoff Coefficient =	0.90	(-)

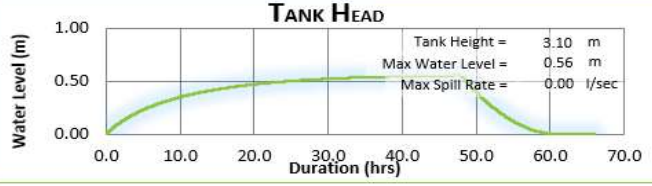
DESIGN CONDITIONS

Design Rainfall Zone =	Alternative Rainfall	
Design Storm Duration =	48hrs	
Design Storm Return Period =	50	yr

TANK DETAILS

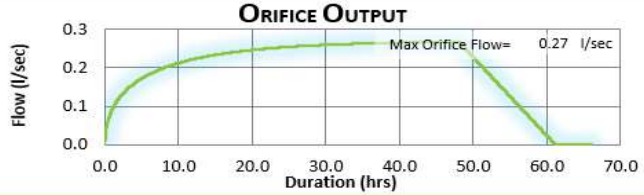
Tank Size =	30,000	litres
Orifice Size =	(Drilled Hole) 13.0	mm
Orifice Type =	Sharp-edged (C=0.61)	(-)

TANK HEAD



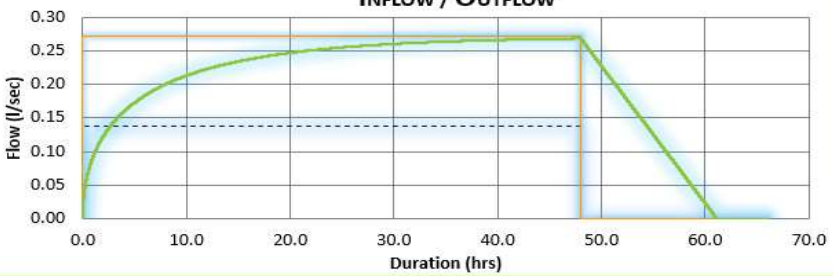
Tank Height = 3.10 m
Max Water Level = 0.56 m
Max Spill Rate = 0.00 l/sec

ORIFICE OUTPUT



Max Orifice Flow= 0.27 l/sec

INFLOW / OUTFLOW



RUNOFF RESULTS

Pre-Developed Peak Flow = 0.14 l/sec
Pre-Developed Runoff Volume = 23.92 m³

Without Tank

Post-Developed Peak Flow = 0.27 l/sec
Post-Developed Runoff Volume = 46.79 m³

With Tank

Post-Developed Peak Flow = 0.27 l/sec
Post-Developed Runoff Volume = 46.79 m³

----- Pre Development Runoff
Post Development Runoff (without tank)
Post Development Runoff (with tank)

Alternative scenario: 10m³ tanks

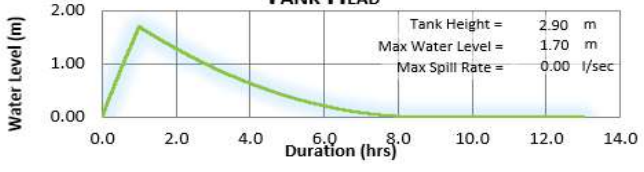
TANK ANALYSIS

CATCHMENT PARAMETERS

Tank Treatment Area =	220	m²
Pre-development Runoff Coefficient =	0.46	(-)
Post-development Runoff Coefficient =	0.90	(-)

DESIGN CONDITIONS

TANK HEAD



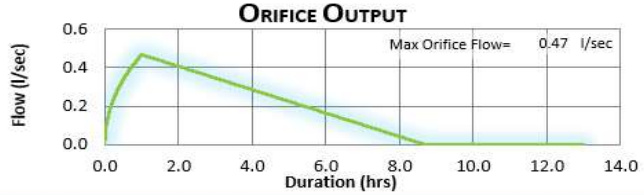
Tank Height = 2.90 m
Max Water Level = 1.70 m
Max Spill Rate = 0.00 l/sec

Design Rainfall Zone =	Alternative Rainfall
Design Storm Duration =	1hr
Design Storm Return Period =	50 yr

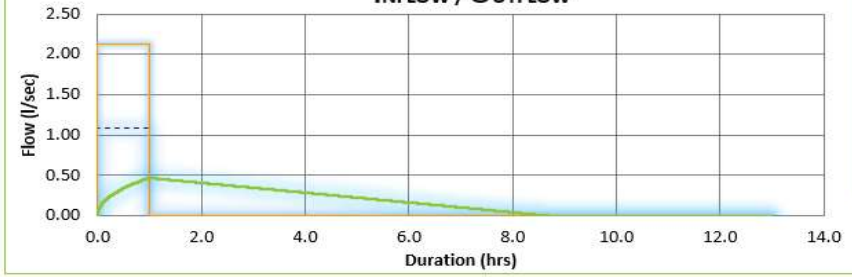
Tank Details

Tank Size =	10,000	litres
Orifice Size =	(Drilled Hole) 13.0	mm
Orifice Type =	Sharp-edged (C=0.61)	(-)

Orifice Output



Inflow / Outflow



Runoff Results

Pre-Developed Peak Flow =	1.08	l/sec
Pre-Developed Runoff Volume =	3.90	m³
Without Tank		
Post-Developed Peak Flow =	2.12	l/sec
Post-Developed Runoff Volume =	7.63	m³
With Tank		
Post-Developed Peak Flow =	0.47	l/sec
Post-Developed Runoff Volume =	7.63	m³

----- Pre Development Runoff
Post Development Runoff (without tank)
Post Development Runoff (with tank)

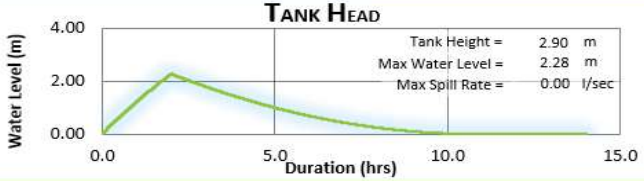
Tank Analysis

e2 environmental CONSULTING ENGINEERS

Catchment Parameters

Tank Treatment Area =	220	m²
Pre-development Runoff Coefficient =	0.46	(-)
Post-development Runoff Coefficient =	0.90	(-)

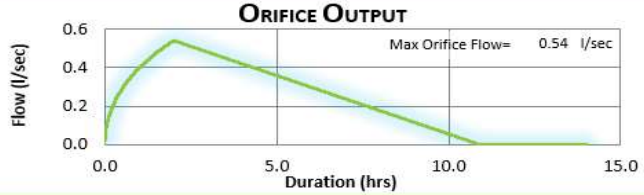
Tank Head



Design Conditions

Design Rainfall Zone =	Alternative Rainfall
Design Storm Duration =	2hrs
Design Storm Return Period =	50 yr

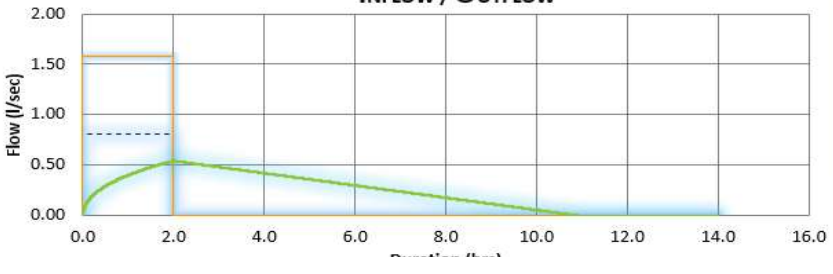
Orifice Output



Tank Details

Tank Size =	10,000	litres
Orifice Size =	(Drilled Hole) 13.0	mm
Orifice Type =	Sharp-edged (C=0.61)	(-)

Inflow / Outflow



Runoff Results

Pre-Developed Peak Flow =	0.81	l/sec
Pre-Developed Runoff Volume =	5.81	m³
Without Tank		
Post-Developed Peak Flow =	1.58	l/sec
Post-Developed Runoff Volume =	11.37	m³
With Tank		
Post-Developed Peak Flow =	0.54	l/sec
Post-Developed Runoff Volume =	11.37	m³

----- Pre Development Runoff
Post Development Runoff (without tank)

Duration (hrs)

Post Development Runoff (with tank)

TANK ANALYSIS

CATCHMENT PARAMETERS

Tank Treatment Area =	220	m^2
Pre-development Runoff Coefficient =	0.46	(-)
Post-development Runoff Coefficient =	0.90	(-)

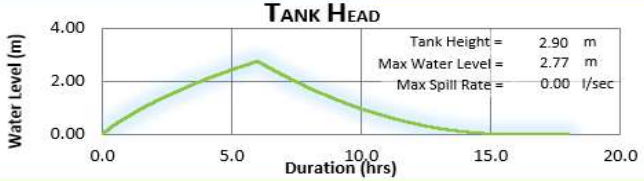
DESIGN CONDITIONS

Design Rainfall Zone =	Alternative Rainfall	
Design Storm Duration =	6hrs	
Design Storm Return Period =	50	yr

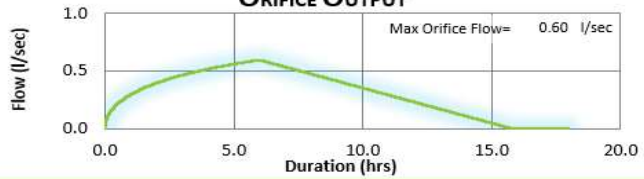
TANK DETAILS

Tank Size =	10,000	litres
Orifice Size =	(Drilled Hole) 13.0	mm
Orifice Type =	Sharp-edged (C=0.61)	(-)

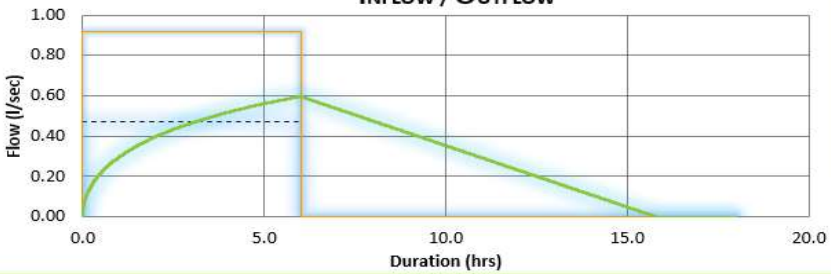
TANK HEAD



ORIFICE OUTPUT



INFLOW / OUTFLOW



RUNOFF RESULTS

Pre-Developed Peak Flow =	0.47	l/sec
Pre-Developed Runoff Volume =	10.15	m^3
Without Tank		
Post-Developed Peak Flow =	0.92	l/sec
Post-Developed Runoff Volume =	19.85	m^3
With Tank		
Post-Developed Peak Flow =	0.60	l/sec
Post-Developed Runoff Volume =	19.85	m^3

----- Pre Development Runoff

Post Development Runoff (without tank)

Post Development Runoff (with tank)

TANK ANALYSIS

CATCHMENT PARAMETERS

Tank Treatment Area =	220	m^2
Pre-development Runoff Coefficient =	0.46	(-)
Post-development Runoff Coefficient =	0.90	(-)

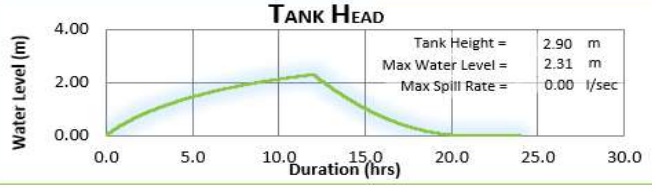
DESIGN CONDITIONS

Design Rainfall Zone =	Alternative Rainfall	
Design Storm Duration =	12hrs	
Design Storm Return Period =	50	yr

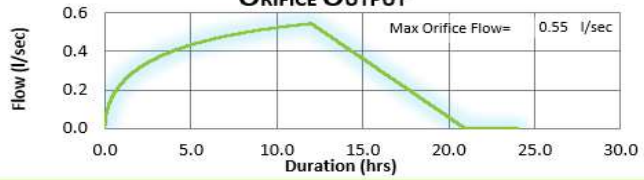
TANK DETAILS

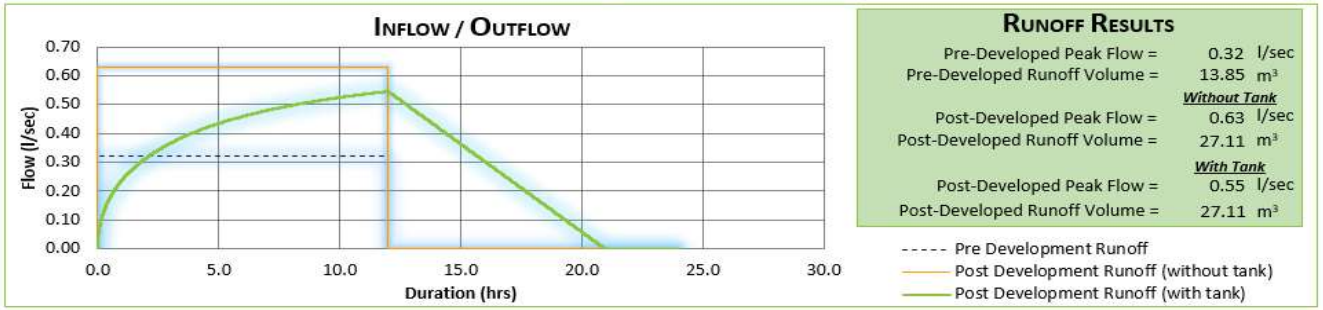
Tank Size =	10,000	litres
Orifice Size =	(Drilled Hole) 13.0	mm
Orifice Type =	Sharp-edged (C=0.61)	(-)

TANK HEAD



ORIFICE OUTPUT





Runoff Results

Pre-Developed Peak Flow =	0.32	l/sec
Pre-Developed Runoff Volume =	13.85	m³
Without Tank		
Post-Developed Peak Flow =	0.63	l/sec
Post-Developed Runoff Volume =	27.11	m³
With Tank		
Post-Developed Peak Flow =	0.55	l/sec
Post-Developed Runoff Volume =	27.11	m³

----- Pre Development Runoff
Post Development Runoff (without tank)
Post Development Runoff (with tank)

Tank Analysis

environmental CONSULTING ENGINEERS

Catchment Parameters

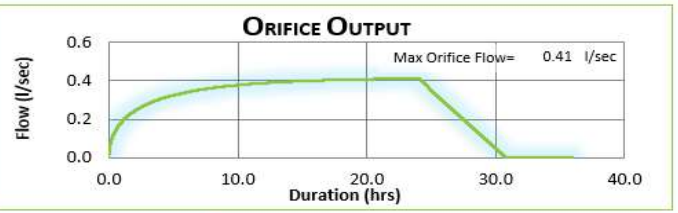
Tank Treatment Area =	220	m²
Pre-development Runoff Coefficient =	0.46	(-)
Post-development Runoff Coefficient =	0.90	(-)

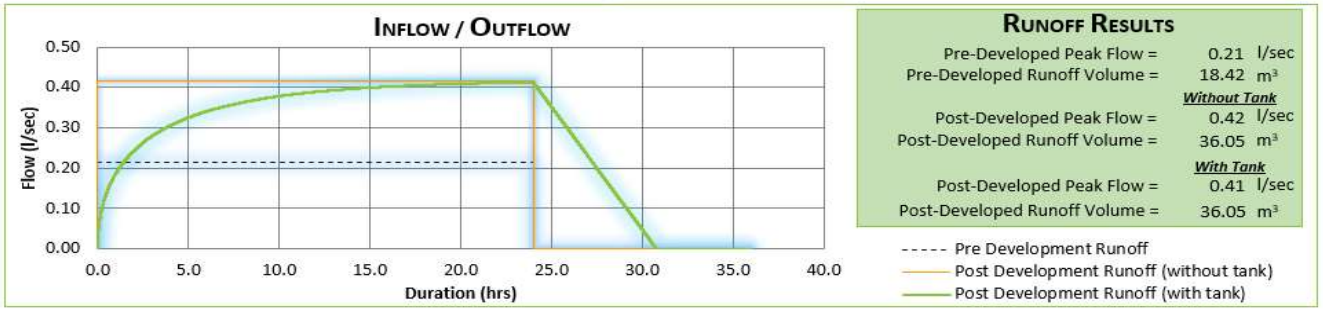
Design Conditions

Design Rainfall Zone =	Alternative Rainfall	
Design Storm Duration =	24hrs	
Design Storm Return Period =	50	yr

Tank Details

Tank Size =	10,000	litres
Orifice Size =	(Drilled Hole) 13.0	mm
Orifice Type =	Sharp-edged (C=0.61)	(-)





Runoff Results

Pre-Developed Peak Flow =	0.21	l/sec
Pre-Developed Runoff Volume =	18.42	m³
Without Tank		
Post-Developed Peak Flow =	0.42	l/sec
Post-Developed Runoff Volume =	36.05	m³
With Tank		
Post-Developed Peak Flow =	0.41	l/sec
Post-Developed Runoff Volume =	36.05	m³

----- Pre Development Runoff
Post Development Runoff (without tank)
Post Development Runoff (with tank)

Alternative scenario: 30m³ tanks with 5.5 mm orifice

Tank Analysis

environmental CONSULTING ENGINEERS

Catchment Parameters

Tank Treatment Area =	220	m²
Pre-development Runoff Coefficient =	0.46	(-)

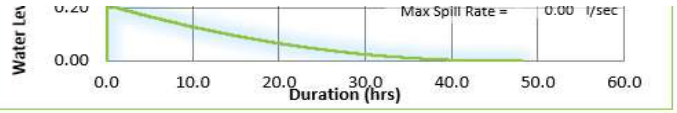
Post-development Runoff Coefficient = 0.90 (-)

Design Conditions

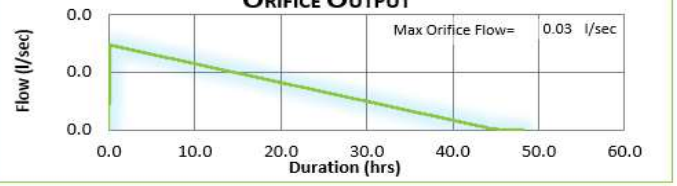
Design Rainfall Zone =	Alternative Rainfall	
Design Storm Duration =	10min	
Design Storm Return Period =	50	yr

Tank Details

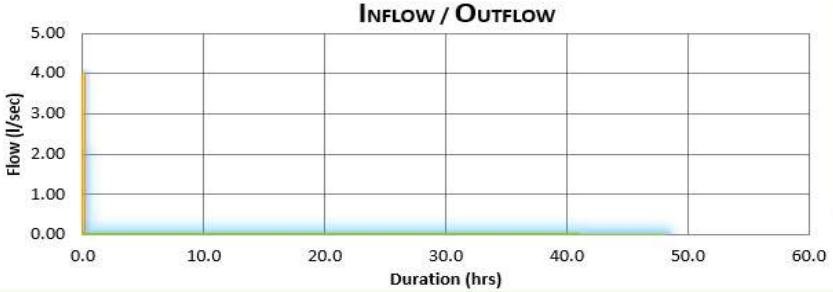
Tank Size =	30,000	litres
Orifice Size =	(Drilled Hole) 5.5	mm
Orifice Type =	Sharp-edged (C=0.61)	(-)



Orifice Output



Inflow / Outflow



Runoff Results

Pre-Developed Peak Flow =	2.05	l/sec
Pre-Developed Runoff Volume =	1.23	m³
Without Tank		
Post-Developed Peak Flow =	4.00	l/sec
Post-Developed Runoff Volume =	2.40	m³
With Tank		
Post-Developed Peak Flow =	0.03	l/sec
Post-Developed Runoff Volume =	2.40	m³

----- Pre Development Runoff
Post Development Runoff (without tank)
Post Development Runoff (with tank)

Tank Analysis

e2 environmental CONSULTING ENGINEERS

Catchment Parameters

Tank Treatment Area =	220	m²
Pre-development Runoff Coefficient =	0.46	(-)
Post-development Runoff Coefficient =	0.90	(-)

Design Conditions

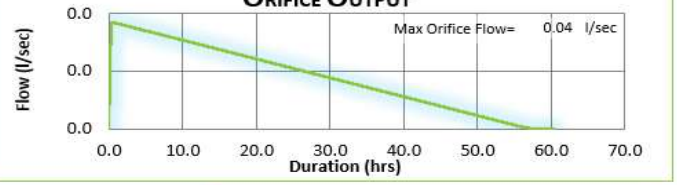
Design Rainfall Zone =	Alternative Rainfall	
Design Storm Duration =	20min	
Design Storm Return Period =	50	yr

Tank Details

Tank Size =	30,000	litres
Orifice Size =	(Drilled Hole) 5.5	mm
Orifice Type =	Sharp-edged (C=0.61)	(-)

Tank Head

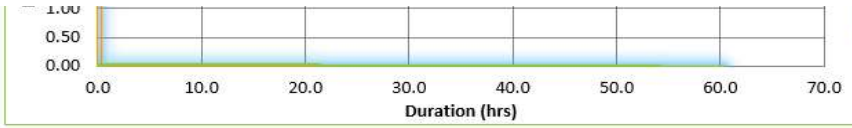
Orifice Output



Inflow / Outflow

Runoff Results

Pre-Developed Peak Flow =	1.63	l/sec
Pre-Developed Runoff Volume =	1.95	m³
Without Tank		
Post-Developed Peak Flow =	3.19	l/sec
Post-Developed Runoff Volume =	3.82	m³
With Tank		
Post-Developed Peak Flow =	0.04	l/sec



Post-Developed Runoff Volume = 3.82 m³

----- Pre Development Runoff
Post Development Runoff (without tank)
Post Development Runoff (with tank)

TANK ANALYSIS

CATCHMENT PARAMETERS

Tank Treatment Area =	220	m²
Pre-development Runoff Coefficient =	0.46	(-)
Post-development Runoff Coefficient =	0.90	(-)

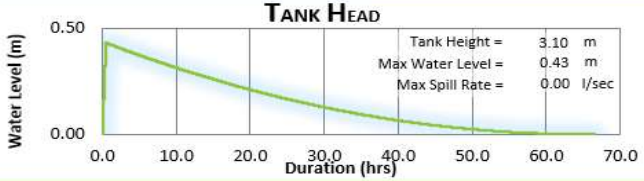
DESIGN CONDITIONS

Design Rainfall Zone =	Alternative Rainfall	
Design Storm Duration =	30min	
Design Storm Return Period =	50	yr

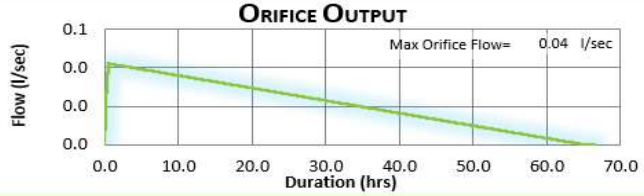
TANK DETAILS

Tank Size =	30,000	litres
Orifice Size =	(Drilled Hole) 5.5	mm
Orifice Type =	Sharp-edged (C=0.61)	(-)

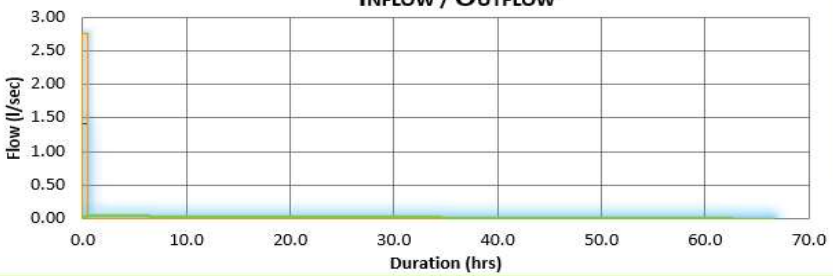
TANK HEAD



ORIFICE OUTPUT



INFLOW / OUTFLOW



RUNOFF RESULTS

Pre-Developed Peak Flow =	1.41 l/sec
Pre-Developed Runoff Volume =	2.54 m³
Without Tank	
Post-Developed Peak Flow =	2.76 l/sec
Post-Developed Runoff Volume =	4.96 m³
With Tank	
Post-Developed Peak Flow =	0.04 l/sec
Post-Developed Runoff Volume =	4.96 m³

----- Pre Development Runoff
Post Development Runoff (without tank)
Post Development Runoff (with tank)

TANK ANALYSIS

CATCHMENT PARAMETERS

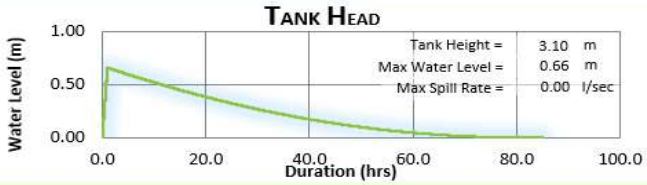
Tank Treatment Area =	220	m²
Pre-development Runoff Coefficient =	0.46	(-)
Post-development Runoff Coefficient =	0.90	(-)

DESIGN CONDITIONS

Design Rainfall Zone =	Alternative Rainfall	
Design Storm Duration =	1hr	
Design Storm Return Period =	50	yr

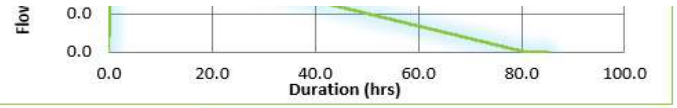
TANK DETAILS

TANK HEAD

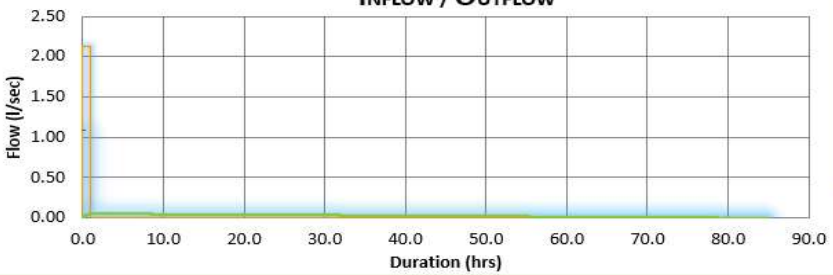


ORIFICE OUTPUT

Tank Size =	30,000	litres
Orifice Size =	(Drilled Hole) 5.5	mm
Orifice Type =	Sharp-edged (C=0.61)	(-)



Inflow / Outflow



Runoff Results

Pre-Developed Peak Flow =	1.08	l/sec
Pre-Developed Runoff Volume =	3.90	m³
Without Tank		
Post-Developed Peak Flow =	2.12	l/sec
Post-Developed Runoff Volume =	7.63	m³
With Tank		
Post-Developed Peak Flow =	0.05	l/sec
Post-Developed Runoff Volume =	7.63	m³

----- Pre Development Runoff
Post Development Runoff (without tank)
Post Development Runoff (with tank)

Tank Analysis

Catchment Parameters

Tank Treatment Area =	220	m²
Pre-development Runoff Coefficient =	0.46	(-)
Post-development Runoff Coefficient =	0.90	(-)

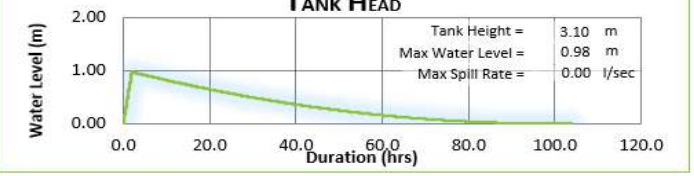
Design Conditions

Design Rainfall Zone =	Alternative Rainfall
Design Storm Duration =	2hrs
Design Storm Return Period =	50 yr

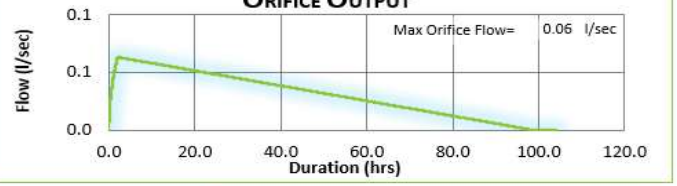
Tank Details

Tank Size =	30,000	litres
Orifice Size =	(Drilled Hole) 5.5	mm
Orifice Type =	Sharp-edged (C=0.61)	(-)

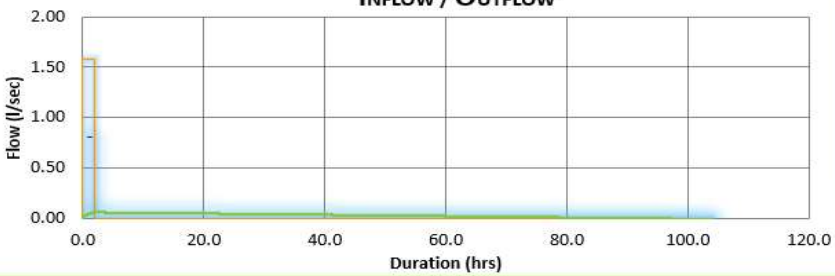
Tank Head



Orifice Output



Inflow / Outflow



Runoff Results

Pre-Developed Peak Flow =	0.81	l/sec
Pre-Developed Runoff Volume =	5.81	m³
Without Tank		
Post-Developed Peak Flow =	1.58	l/sec
Post-Developed Runoff Volume =	11.37	m³
With Tank		
Post-Developed Peak Flow =	0.06	l/sec
Post-Developed Runoff Volume =	11.37	m³

----- Pre Development Runoff
Post Development Runoff (without tank)
Post Development Runoff (with tank)

Tank Analysis

Catchment Parameters

Tank Treatment Area =	220	m^2
Pre-development Runoff Coefficient =	0.46	(-)
Post-development Runoff Coefficient =	0.90	(-)

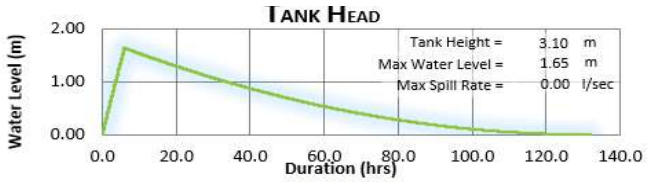
Design Conditions

Design Rainfall Zone =	Alternative Rainfall	
Design Storm Duration =	6hrs	
Design Storm Return Period =	50	yr

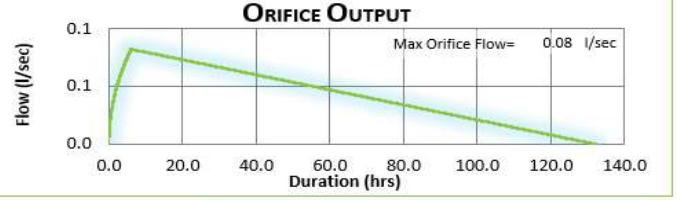
Tank Details

Tank Size =	30,000	litres
Orifice Size =	(Drilled Hole) 5.5	mm
Orifice Type =	Sharp-edged (C=0.61)	(-)

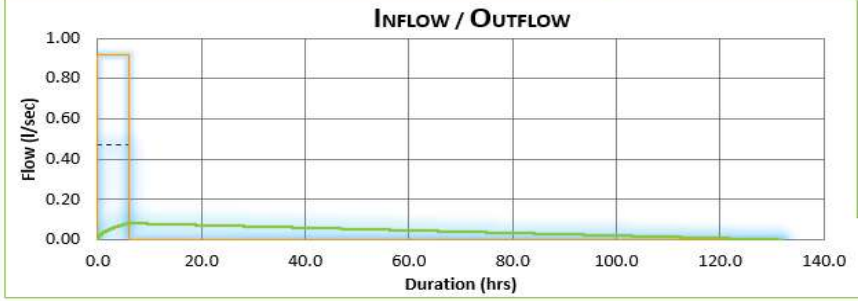
Tank Head



Orifice Output



Inflow / Outflow



Runoff Results

Pre-Developed Peak Flow =	0.47	l/sec
Pre-Developed Runoff Volume =	10.15	m^3
Without Tank		
Post-Developed Peak Flow =	0.92	l/sec
Post-Developed Runoff Volume =	19.85	m^3
With Tank		
Post-Developed Peak Flow =	0.08	l/sec
Post-Developed Runoff Volume =	19.85	m^3

----- Pre Development Runoff
Post Development Runoff (without tank)
Post Development Runoff (with tank)

Tank Analysis

environmental CONSULTING ENGINEERS

Catchment Parameters

Tank Treatment Area =	220	m^2
Pre-development Runoff Coefficient =	0.46	(-)
Post-development Runoff Coefficient =	0.90	(-)

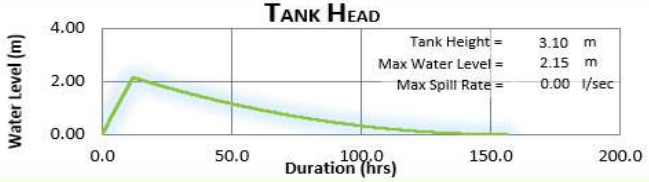
Design Conditions

Design Rainfall Zone =	Alternative Rainfall	
Design Storm Duration =	12hrs	
Design Storm Return Period =	50	yr

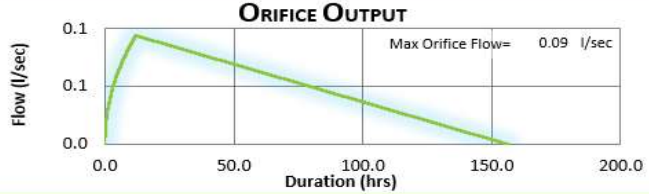
Tank Details

Tank Size =	30,000	litres
Orifice Size =	(Drilled Hole) 5.5	mm
Orifice Type =	Sharp-edged (C=0.61)	(-)

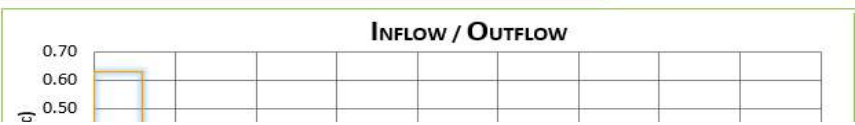
Tank Head



Orifice Output

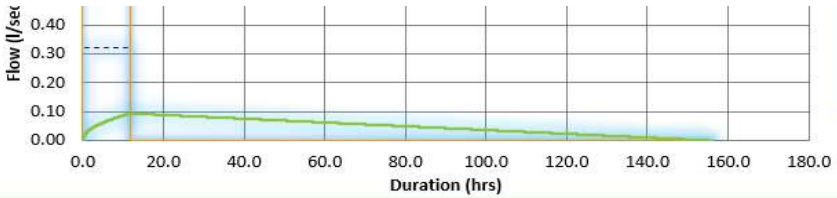


Inflow / Outflow



Runoff Results

Pre-Developed Peak Flow =	0.32	l/sec
Pre-Developed Runoff Volume =	13.85	m^3
Without Tank		



Post-Developed Peak Flow = 0.63 l/sec
Post-Developed Runoff Volume = 27.11 m³

With Tank

Post-Developed Peak Flow = 0.09 l/sec
Post-Developed Runoff Volume = 27.11 m³

----- Pre Development Runoff
Post Development Runoff (without tank)
Post Development Runoff (with tank)

TANK ANALYSIS

CATCHMENT PARAMETERS

Tank Treatment Area =	220	m²
Pre-development Runoff Coefficient =	0.46	(-)
Post-development Runoff Coefficient =	0.90	(-)

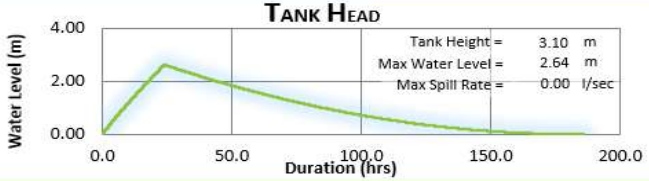
DESIGN CONDITIONS

Design Rainfall Zone =	Alternative Rainfall	
Design Storm Duration =	24hrs	
Design Storm Return Period =	50	yr

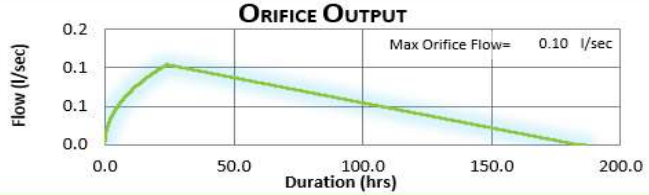
TANK DETAILS

Tank Size =	30,000	litres
Orifice Size =	(Drilled Hole) 5.5	mm
Orifice Type =	Sharp-edged (C=0.61)	(-)

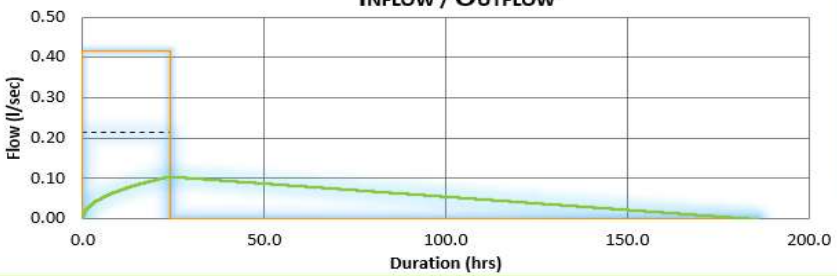
TANK HEAD



ORIFICE OUTPUT



INFLOW / OUTFLOW



RUNOFF RESULTS

Pre-Developed Peak Flow = 0.21 l/sec
Pre-Developed Runoff Volume = 18.42 m³

Without Tank

Post-Developed Peak Flow = 0.42 l/sec
Post-Developed Runoff Volume = 36.05 m³

With Tank

Post-Developed Peak Flow = 0.10 l/sec
Post-Developed Runoff Volume = 36.05 m³

----- Pre Development Runoff
Post Development Runoff (without tank)
Post Development Runoff (with tank)

TANK ANALYSIS

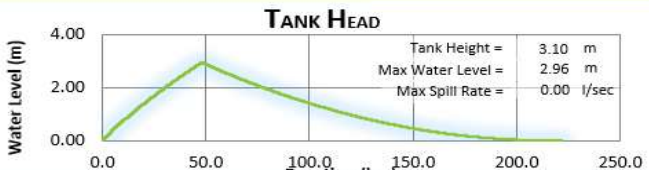
CATCHMENT PARAMETERS

Tank Treatment Area =	220	m²
Pre-development Runoff Coefficient =	0.46	(-)
Post-development Runoff Coefficient =	0.90	(-)

DESIGN CONDITIONS

Design Rainfall Zone =	Alternative Rainfall	
Design Storm Duration =	48hrs	

TANK HEAD

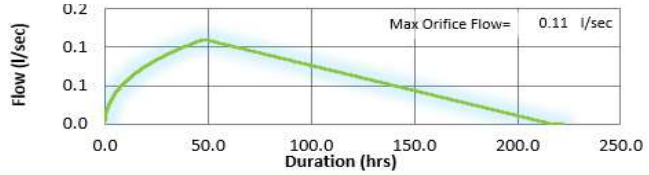


ORIFICE OUTPUT

Design Storm Return Period =	50	yr

Tank Details

Tank Size =	30,000	litres
Orifice Size =	(Drilled Hole) 5.5	mm
Orifice Type =	Sharp-edged (C=0.61)	(-)



Inflow / Outflow

Runoff Results

Pre-Developed Peak Flow =	0.14	l/sec
Pre-Developed Runoff Volume =	23.92	m³
Without Tank		
Post-Developed Peak Flow =	0.27	l/sec
Post-Developed Runoff Volume =	46.79	m³
With Tank		
Post-Developed Peak Flow =	0.11	l/sec
Post-Developed Runoff Volume =	46.79	m³

----- Pre Development Runoff
Post Development Runoff (without tank)
Post Development Runoff (with tank)

ORIFICE CALCULATOR

PROJECT DETAILS

Description:	Management of overland flow paths	**Project Number:**	23045
Client:	Bowenvale Park Estates Ltd	**Ref. Number:**	1
Site:	169 Bowenvale Avenue, Christchurch	**Assessed by:**	DHM
Coordinates:		**Date:**	14/12/2023

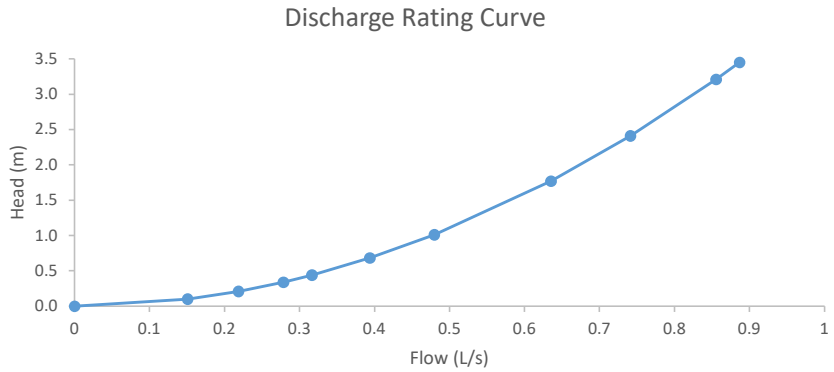
Orifice Description: Roof tank orifice calculator for 15mm orifice

CIRCULAR ORIFICE

Orifice Diameter, D:	0.015	m
Coefficient of Discharge, C_d:	0.61	
Flow Area, A:	0.000	m^2

Typical values for the coefficient of discharge are:
Sharp orifice: 0.62
Tube: 0.80

Head	Flow		
0	-	L/s	
0.1	0.151	L/s	
0.21	0.219	L/s	
0.34	0.278	L/s	
0.44	0.317	L/s	
0.68	0.394	L/s	
1.01	0.480	L/s	
1.77	0.635	L/s	
2.41	0.741	L/s	
3.21	0.855	L/s	*Full tank / spilling*
3.45	0.887	L/s	*Full tank / spilling*



ORIFICE CALCULATOR

PROJECT DETAILS

Description:	Management of overland flow paths	**Project Number:**	23045
Client:	Bowenvale Park Estates Ltd	**Ref. Number:**	1
Site:	169 Bowenvale Avenue, Christchurch	**Assessed by:**	DHM
Coordinates:		**Date:**	14/12/2023

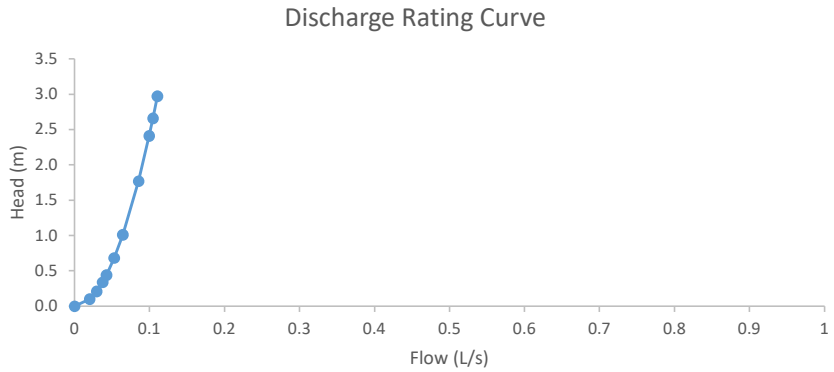
Orifice Description: Roof tank orifice calculator for 5.5mm orifice

CIRCULAR ORIFICE

Orifice Diameter, D:	0.0055 m
Coefficient of Discharge, C_d:	0.61
Flow Area, A:	0.000 m^2

Typical values for the coefficient of discharge are:
Sharp orifice: 0.62
Tube: 0.80

Head	Flow	
0	-	L/s
0.1	0.020	L/s
0.21	0.029	L/s
0.34	0.037	L/s
0.44	0.043	L/s
0.68	0.053	L/s
1.01	0.065	L/s
1.77	0.085	L/s
2.41	0.100	L/s
2.66	0.105	L/s
2.97	0.111	L/s



APPENDIX C – COMMUNICATIONS

Peter Harte

From: Peter Harte
Sent: Tuesday, 3 October 2023 11:47 am
To: 'Paul.Currie'
Subject: FW: Water & Wastewater Comments - 169 Bowenvale Ave, Cashmere

---

From: Tang, Alison <Alison.Tang@ccc.govt.nz>
Sent: Thursday, 28 September 2023 9:55 am
To: peter.harte@e2environmental.com
Cc: Johnson, Ian <Ian.Johnson@ccc.govt.nz>; Wastewater Capacity <WastewaterCapacity@ccc.govt.nz>; WaterCapacity <WaterCapacity@ccc.govt.nz>
Subject: Water & Wastewater Comments - 169 Bowenvale Ave, Cashmere

Hi Peter

Thanks for the enquiry. It looks like you're not proposing to extend the legal road boundary, is that correct? Water/Wastewater comments below.

Wastewater: This property is currently located in a wastewater capacity constraint area, however Bowenvale Avenue flows do not directly contribute to the parts of the catchment where network overflows are predicted, so we anticipate that the proposed 11 lots will not be required to attenuate its discharge. Regarding connection point, there is an application for 130 Bowenvale Ave that includes extension of the DN150 gravity main up Bowenvale Ave to their site entrance, so the 169 Bowenvale project would be expected to extend the main from there.

Water supply: The 130 Bowenvale project also proposes to extend the DN150 water supply main up to their site entrance, so 169 Bowenvale further extending up to the edge of the legal road is expected to be able to supply the current high pressure water supply zone. Future zoning for this area may result in reduced pressure.

General: Engineering design must be in accordance with the Infrastructure Design Standard and Construction Standard Specification; consultation with Fire Emergency New Zealand for any fire flow requirements. Council's preference is for the ownership of services in private land to remain private.

Kind regards
Alison
Water & Wastewater Asset Planning

From: Johnson, Ian <Ian.Johnson@ccc.govt.nz>
Sent: Monday, September 25, 2023 11:19 AM
To: WaterCapacity <WaterCapacity@ccc.govt.nz>; Wastewater Capacity <WastewaterCapacity@ccc.govt.nz>
Subject: FW: Sub Servicing query - 169 Bowenvale Ave, Cashmere

FYI – can you please provide Peter with replies to his capacity queries listed below.

Thanks

Kind regards

Ian Johnson
Planning Engineer Subdivisions
Asset Planning -Water & Wastewater

03 941 8399

Ian.Johnson@ccc.govt.nz

Te Hononga Civic Offices, 53 Hereford Street, Christchurch

PO Box 73014, Christchurch 8154

ccc.govt.nz

Christchurch City Council

From: Peter Harte <peter.harte@e2environmental.com>
Sent: Friday, September 22, 2023 4:56 PM
To: Johnson, Ian <Ian.Johnson@ccc.govt.nz>
Cc: Hozias, Doru <Doru.Hozias@ccc.govt.nz>
Subject: Sub Servicing query - 169 Bowenvale Ave, Cashmere

Hi Ian,

I am working on a servicing report for a residential subdivision at 169 Bowenvale Avenue, Cashmere. A draft of the scheme plan is attached. I was wondering if you could advise if there were any capacity issues/points to know about WW & WS.

Wastewater

- Can the system receive an additional 11x lots of WW discharge which totals 0.38 L/s or 0.08 L/s per lot?
- I'm assuming a new DN150 line will have to be trenched down Bowenvale Avenue

Water Supply

- Can you advise if there were any capacity issues with the network and can the system service an additional 11x lots? There is an existing DN100 located along the western boundary.

Thanks,

Peter

Peter Harte

From: Norton, Brian <Brian.Norton@ccc.govt.nz> on behalf of Norton, Brian
Sent: Monday, 25 September 2023 4:44 pm
To: Peter Harte
Cc: Naji Abhari, Mandana; Hozias, Doru
Subject: RE: 169 Bowenvale Avenue Subdivision -Stormwater

Hi Peter, Full Flood Attenuation (capture of the full storm with slow release over 96 hours) is typically the requirement for greenfields in the Heathcote catchment, (and is a simpler design) but this is a relatively small site so reduction of all peak flows below pre-developed will be OK.

Brian Norton
Senior Stormwater Planning Engineer
Asset Planning – Stormwater & Waterways
Three Waters

03 941 8394
Brian.Norton@ccc.govt.nz
Te Hononga Civic Offices, 53 Hereford Street, Christchurch
PO Box 73014, Christchurch 8154
ccc.govt.nz

Christchurch City Council

From: Peter Harte <peter.harte@e2environmental.com>
Sent: Monday, September 25, 2023 4:36 PM
To: Norton, Brian <Brian.Norton@ccc.govt.nz>
Cc: Naji Abhari, Mandana <Mandana.Abhari@ccc.govt.nz>; Hozias, Doru <Doru.Hozias@ccc.govt.nz>
Subject: Re: 169 Bowenvale Avenue Subdivision -Stormwater

Thanks Brian, just to clarify, all storm events up to the 50year (27 hour?) to be attentuated for the extra over runoff generated as a result of the development, correct?

On Mon, 25 Sep 2023, 3:23 PM Norton, Brian, <Brian.Norton@ccc.govt.nz> wrote:

> Hi Peter,
>
> Full flood attenuation for storms up to 50-year, 27-hour duration. First flush treatment of hardstand runoff. Probably using Filterra, Up-Flo or Stormfilter given the location.

Kind Regards

Brian Norton

Senior Stormwater Planning Engineer
Asset Planning – Stormwater & Waterways

Three Waters

03 941 8394

From: Peter Harte <peter.harte@e2environmental.com>
Sent: Friday, September 22, 2023 5:11 PM
To: Norton, Brian <Brian.Norton@ccc.govt.nz>
Cc: Naji Abhari, Mandana <Mandana.Abhari@ccc.govt.nz>; Hozias, Doru <Doru.Hozias@ccc.govt.nz>; Johnson, Ian <Ian.Johnson@ccc.govt.nz>
Subject: 169 Bowenvale Avenue Subdivision -Stormwater

Hi Brian,

Please see attached scheme plan for the proposed Subdivision development at 169 Bowenvale Ave. There is a stormwater waterway is located along the western side of Bowenvale Avenue.

I assume Stormwater runoff will be authorised under the CCC global SW consent? The terminal discharge point for the waterways around the area/site is the Heathcote River. Can you please advise of CCC requirements?

Kind regards,

Peter Harte. Civil Engineer

m 022 679 9001
e2 Environmental Ltd
Unit 1/46 Acheron Drive

Riccarton

PO Box 31159
Christchurch 8444
www.e2environmental.com

NOTES

1. Legal Description
   Lot 3 DP 78608
   Comprised in RT CB45A/976
   Total Area 9686m²
2. This plan has been prepared for Resource Consent purposes only. No detailed design should be undertaken utilising this data.
3. Boundary dimensions and areas shown are subject to a full legal survey and approval by Land Information NZ.
4. A full assessment of easements will be undertaken after construction of services. This may result in additional easements.

LOT 2
DP 65981

LOT 1
DP 78608

BOWENVALE AVENUE

LOT 3
DP 30431

LOT 2
DP 78608

LOT 2
780m²
NET 700m²

LOT 1
710m²

LOT 3
775m²
NET 700m²

PART LOT 3
DP 28705

LOT 4
700m²

LOT 6
770m²
NET 700m²

LOT 5
700m²

LOT 7
765m²
NET 700m²

LOT 8
700m²

LOT 10
760m²
NET 700m²

LOT 9
700m²

LOT 11
755m²
NET 700m²

LOT 12
710m²

J.O.A.L LOT 13 850m²

PART LOT 2
DP 33462

EXISTING HOUSE AND GARAGE TO BE REMOVED

6.2m, 11.8m, 5.55m, 33.0m, 12.7m, 28.0m, 10.4m, 19.8m, 32.8m, 3.1m, 4.0m, 2.8m, 18.9m, 22.7m, 5.0m, 26.9m, 35.0m, Ⓑ, Ⓒ, 4.3m, 4.2m, 4.9m, 2.0m, 31.9m, 17.5m, 29.8m, 20.5m, 1.1m, 24.1m, 32.8m, 19.9m, Ⓗ, 27.8m, Ⓘ, 137.4m, Ⓐ, 18.9m, 2.8m, 4.0m, 26.8m, 31.7m, Ⓓ, Ⓔ, 4.3m, 1.3m, 25.9m, 5.0m, 2.0m, 28.2m, 21.7m, 23.7m, 25.8m, 1.2m, 27.9m, 28.1m, 23.8m, 23.1m, 2.8m, 4.0m, Ⓙ, 23.3m, 21.8m, 26.7m, 2.0m, 4.2m, Ⓕ, Ⓖ, 5.5m, 5.0m, 2.0m, 21.1m, 25.6m, 6.2m, 25.5m, Ⓞ DP 78608, 28.1m, 25.6m, 19.9m, 6.2m

Rev.	Date	Description	Drwn	Chk	Appd
B	19/12/2023	EASEMENTS ADDED	SG	RG	RG
A	13/09/2023	DRAWING ISSUED	SG	RG	RG

GRAHAM SURVEYING

Drawn	Date 13/09/2023
Checked RG	Date 13/09/2023
Surveyed	Date
Approved RG	Date 13/09/2023

Project
169 BOWENVALE AVENUE
CASHMERE
CHRISTCHURCH

Title
LOTS 1 - 13 BEING A PROPOSED SUBDIVISION OF LOT 3 DP 78608

Status
FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION PURPOSES

Scale	Size
1:500m	A3
Horizontal Datum: MT PLEASANT 2000	Vertical Datum: NZVD 2016

Client
BOWENVALE PARK ESTATES LTD

Drawing Number	Revision
GSL23152-RC-1400	B

DIAGRAM A

Ⓜ DP 78608
Ⓝ
Ⓚ
Ⓛ DP 78608
Ⓡ DP 78608
Ⓢ DP 78608
Ⓞ DP 78608

SCALE 1:150m

SCHEDULE OF PROPOSED EASEMENTS

PURPOSE	SHOWN	BURDENED LAND	BENEFITTED LAND
RIGHT OF WAY	A	LOT 13	LOTS 1 - 12
	B	LOT 2	LOTS 1, 3 & 4
	C	LOT 3	LOTS 1, 2 & 4
	D	LOT 6	LOTS 5, 7 & 8
	E	LOT 7	LOTS 5, 6 & 8
	F	LOT 10	LOTS 9, 11 & 12
	G	LOT 11	LOTS 9, 10 & 12
RIGHT TO DRAIN SEWAGE RIGHT TO CONVEY WATER RIGHT TO CONVEY ELECTRICITY RIGHT TO CONVEY TELECOMMUNICATIONS	A	LOT 13	LOTS 1 - 12
	B	LOT 2	LOT 3
	C	LOT 3	LOT 2
	D	LOT 6	LOT 7
	E	LOT 7	LOT 6
	F	LOT 10	LOT 11
	G	LOT 11	LOT 10
RIGHT TO DRAIN WATER	A	LOT 13	LOTS 1 - 12 & PART LOT 3 DP 28705
	B	LOT 2	LOTS 1, 3 & 4
	C	LOT 3	LOTS 1, 2 & 4
	D	LOT 6	LOTS 5, 7, 8 & PART LOT 3 DP 28705
	E	LOT 7	LOTS 5, 6, 8 & PART LOT 3 DP 28705
	F	LOT 10	LOTS 9, 11, 12 & PART LOT 3 DP 28705
	G	LOT 11	LOTS 9, 10, 12 & PART LOT 3 DP 28705
	H	LOT 6	PART LOT 3 DP 28705
	I	LOT 7	
	J	LOT 10	

SCHEDULE OF EXISTING EASEMENTS

PURPOSE	SHOWN	BURDENED LAND	DOCUMENT
RIGHT OF WAY RIGHT TO DRAIN WATER RIGHT TO DRAIN SEWAGE RIGHT TO CONVEY WATER RIGHT TO CONVEY ELECTRIC POWER RIGHT TO CONVEY TELEPHONIC COMMUNICATIONS	K, L, M, N, O, R & S DP 78608	LOT 3 DP 78608	EC 400757.2
RIGHT OF WAY	K, L, M, N, O, R & S DP 78608	LOT 3 DP 78608	T 920309
RIGHT TO CONVEY WATER	K, L & S DP 78608	LOT 3 DP 78608	A364090.4
RIGHT TO CONVEY ELECTRIC POWER RIGHT TO CONVEY TELEPHONIC COMMUNICATIONS	K & N DP 78608	LOT 3 DP 78608	A364090.4

AMALGAMATION CONDITIONS

THAT LOT 13 HEREON (LEGAL ACCESS) BE HELD AS TO 12 UNDIVIDED ONE-TWELFTH SHARES BY THE OWNERS OF LOTS 1 TO 12 HEREON AS TENANTS IN COMMON IN THE SAID SHARES AND THAT INDIVIDUAL RECORDS OF TITLE ISSUE

Rev.	Date	Description	Drwn	Chk	Appd
B	19/12/2023	SHEET RC-1401 ADDED	SG	RG	RG

GRAHAM SURVEYING

Drawn SG	Date 19/12/2023	
Checked RG	Date 19/12/2023	
Surveyed	Date	
Approved RG	Date 19/12/2023	

Project
169 BOWENVALE AVENUE
CASHMERE
CHRISTCHURCH

Title
LOTS 1 - 13 BEING A PROPOSED SUBDIVISION OF LOT 3 DP 78608 EASEMENT SCHEDULE

Status FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION PURPOSES

Scale	Size A3
Horizontal Datum	Vertical Datum

Client
BOWENVALE PARK ESTATES LTD

Drawing Number	Revision
GSL23152-RC-1401	B