BEFORE THE HEARINGS PANEL
FOR THE PROPOSED QUEENSTOWN LAKES DISTRICT PLAN

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of the Queenstown Lakes Proposed District Plan

AND

IN THE MATTER of Hearing Submissions Seeking Amendments to the Planning Maps covering Queenstown and Queenstown Rural (Excluding Wakatipu Basin)

STATEMENT OF EVIDENCE OF NICHOLAS KARL GEDDES ON BEHALF OF

Middleton Family Trust

(Submitter 336)

Dated 2nd June 2017

1.0 QUALIFICATIONS AND EXPERIENCE

1.1 My name is Nicholas Karl Geddes. I hold a degree of Bachelor of Science majoring in Geography and Graduate Diploma in Environmental Science from Otago University.

1.2 I have fifteen years' experience as a resource management practitioner, with past positions as a Planner in local Government in Auckland, private practice in Queenstown and contract work in London, England. I have been a practicing consultant involved in a wide range of developments, district plan policy development and the preparation and presentation of expert evidence before Councils.

1.3 I was employed by a Queenstown consultancy in 1999 before moving to Auckland City Council in 2001 where I held a senior planning position with Auckland City Environments. Leaving Auckland in 2005 I worked in London as a planner for two and a half years before returning to Queenstown where I have been practicing as a planning consultant since. I currently hold a planning consultant position with Clark Fortune McDonald & Associates Limited.

1.4 I have read the Code of Conduct for Expert Witnesses in the Environment Court consolidated Practice Note (2014). I agree to comply with this Code of Conduct. This evidence is within my area of expertise, except where I state I am relying on what I have been told by another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

1.5 I have authored submissions on the plan review, prepared evidence and attended hearings in relation to the following Chapters:

a. Chapter 4 – Hearing Stream 1B in relation to Submission 414;

b. Chapter 21 & 22 – Hearing Stream 2 in relation to Submissions 228, 233, 235, 411 & 414;

c. Chapter 27 – Hearing Stream 4 in relation to Submission 414;

d. Chapter 7 – Hearing Stream 6 in relation to Submission 336;

e. Chapter 41 – Hearing Stream 9 in relation to Submissions 342 & 715;

f. Planning Maps – Hearing Stream 12 in relation to Submission 314.

2.0 SCOPE OF EVIDENCE

2.1 I have prepared evidence where I assess and explain:

a. Clarification;

b. Chapter 7 Section 32 Evaluation Report;

c. Stream 6 Section 42A Report;

d. Stream 13 Section 42A Report;

2.2 In the preparation of this evidence I have reviewed the following:

a. Section 32 Evaluation Reports; Landscape Chapter, Strategic Direction and Urban Development Chapters, Rural Residential and Rural Lifestyle Chapter and Rural Chapter.

b. The Council s.42A Reports prepared in relation to Hearing Stream 6 & 13 including the associated evidence prepared by Mr Glenn Davis, Mr Timothy Heath, Ms Wendy Banks and Mr Ulrich Glasner.

c. QLDC right-of-reply in relation to Chapters; Strategic Direction, Landscape, Urban Development and Residential.

d. The relevant submissions and further submissions of other submitters.

2.3 In addition to the above, I have reviewed the reports and statements of evidence of other experts including:

a. RM081212 & RM150520 Geotechnical Reports from Mr Paul Faulkner – Senior Engineering Geologist, Geosolve Ltd.

Abbreviations:

Queenstown Lakes District Council “QLDC”
Proposed District Plan “PDP”
Operative District Plan “ODP”
Resource Management Act 1991 “RMA 91”
Residential Chapter Section 32 Evaluation Report “s.32 report”
Section 42A “s.42A”
Low Density Residential Zone “LDRZ”
Queenstown Heights Overlay Area “QHOA”

3.0 CLARIFICATION

3.1 The Stream 13 s.42A report notes that the density of 749 lots would compromise an average of 350m2 per lot. This is not intended and I must concede that the 749 lots promoted in my previous evidence is too 'basic'.

3.3 The site is 337,100m^2 and I will assume 45% must be lost for access and services on this site which equates to a yield of 185,405m^2. My assumption is based upon the development of land on Middleton Road which has been authorised by consents RM081212 and RM150520 which has comparative geography, access ad servicing requirements.

3.3 185,405m^2 equates to 412 units (1 per 450m^2) or 123 (1 per 1500m^2).

4.0 CHAPTER 7 - SECTION 32 EVALUATION REPORT

4.1 The PDP seeks to reduce the residential density within this part of the LDRZ from "1 residential unit per 450m^2" as provided for in the ODP Standard 7.5.5.3(iii) to "1 residential unit per 1500m^2" (Rule 7.4.9 & 7.4.10) .

4.2 Page 7, part 4 of the s.32 report for the Low Density Residential Zone (LDRZ) lists seven key issues of relevance:

> The key issues of relevance to the Low Density Residential Zone are:
>
> - **Issue 1** – Growth
> - **Issue 2** – Visitor accommodation demands are increasing
> - **Issue 3** – Urban Form
> - **Issue 4** – Reducing the environmental impacts of urban development
> - **Issue 5** - Housing supply, affordability and the impacts of restrictive planning controls
> - **Issue 6** – Urban design and amenity values
> - **Issue 7** – Economic diversification

4.3 Methods to address the issues above are identified throughout the report and include:

- *"Provision for infill housing up to a density of 1 residential unit per 300m2."*
- *"Liberalisation of bulk and location rules where appropriate to better enable low intensity infill."*

- *"Objectives and policies recognise that the zone will recognise some change to enable limited infill development."*
- *"Liberalise rules to enable better realisation of intensification objectives and policies."*
- *"Greater provision for infill development in existing urban settlements, avoiding sprawling urban forms and incentivising sustainable forms of transport."*
- *"Liberalise District Plan bulk and location rules."*
- *"Objectives and policies recognise that the zone will recognise some change to enable limited infill development."*
- *"Liberalising building design controls (such as density, building height, recession planes) as appropriate to better enable limit infill development."*.
- *"Objectives, policies and rules included to enable adequate consideration to the impacts of development on residential amenity."*

4.4 It is my opinion that the methods listed above offer an accurate indication of the thrust of the s.32 report which provides a considerable body of reporting towards justifying an increase in the density of housing across the residential zones and the liberalisation of development controls to promote housing development within the boundaries of existing residential zones.

4.5 The proposed reduction in density within the QHOA is not signalled in the s.32 and is not supported by any geotechnical or hazard reporting.

4.6 In my opinion the reduction in density across the QHOA is completely "against the grain" of the s.32 report.

5.0 STREAM 6 - SECTION 42A REPORT

5.1 The s.42A report for Chapter 7 responds to submission #336 within paragraphs 9.42 to 9.47 where paragraph 9.45 reads:

"With regard to the Middleton Family Trust submission, I note that no mention has been made of the steep topography of the land, nor the site hazards that are applicable to the land within the sub-zone. I understand that these are the reasons behind the 1500m² minimum lot area as applied in the ODP and replicated within the PDP. The sub-zone covers part of the land affected by the Queenstown Hill Landslide in the mid 1900s which is attributed to a schist outcrop. As such, for any development of the sub-zone, significant geotechnical investigations will be required."

My emphasis added.

5.2 The s.42A report does not offer any justification for the proposed change in density which the PDP authorises nor does the s.32AA attached to the report.

5.3 The report is incorrect. Any development in the hazard will require detailed geotechnical investigations. The QHOA does not require the geotechnical assessment. It is noted that 42% of the site is located outside the hazard area yet the sub-zone extends over the entire area of the site as depicted by the plan contained in Attachment A to this evidence.

Steep Topography

5.4 A topographical plan of the south side of Queenstown Hill is contained in Attachment A along with cross sections.

5.5 In my opinion the topography of the land is not steep by comparison to the lower flanks of Queenstown Hill especially land below Frankton Road. This area is almost entirely occupied by a mixture of high density and low density residential development.

5.6 I believe the submitters land is steep in part but this is not unique or prohibitive to residential development.

Site Hazards

5.7 Paragraph 9.46 of the s.42A report reads:

> *"Subdivision consent (RM081212 varied by RM150520) has been granted to create 158 residential lots above Middleton Road, of which six lots are within the westernmost portion of the sub-zone. The geotechnical engineering assessments (by Tonkin & Taylor and Geosolve) that were provided as part of these applications confirm that the approximate location of the landslide boundary is within the sub-zone."*

5.8 The geotechnical reporting which imposed the landslide boundary on Council hazard maps has not informed the any QLDC reporting. Rather, geotechnical reporting provided as part of applications RM081212 and RM150520 has been referenced in the s.42A report in response to submission #336.

5.9 RM081212 and RM150520 are consent applications relating to land located on the eastern flanks of Queenstown Hill. This reporting is contained in Attachment B to this evidence.

5.10 I do not believe these reports were intended to offer advice on the geological conditions across the remainder of the landslide area nor inform a change in density across the QHOA as promoted by the PDP.

5.11 The RM081212 and RM150520 geotechnical reports are site specific reports required to satisfy section 106 of the Act as part of a subdivision consent. The tests within Section 106 are required to be met for any subdivision consent irrespective of the QHOA.

6 STREAM 13 – SECTION 42A REPORT

6.1 The s.42A report rejects submission #336 because the submission is absent on evidence with reference to natural hazards and transport. The report suggests the land is unsuited to conventional LDRZ development and the retention of the LDR zoning and the Queenstown Heights Overlay Area as notified is recommended.

Transport

7.2 I assume that the traffic assessment is undertaken on the basis that the intersection of Goldfields Heights Road and Frankton Road is adequate for 123 residential units promoted in the PDP and the additional capacity (ODP capacity) sought in the submission requires an upgrade. The additional capacity and any required upgrading of QLDC / NZTA owned infrastructure can be addressed at the time of any subdivision consent for any future development of the subject site.

7.3 Given that Goldfields Heights Road has a large residential catchment I believe this raises an important issue for QLDC as to whether this intersection can accommodate additional vehicle movements associated wit the intensification of the LDR area as sought buy the PDP.

Natural Hazards

7.4 I believe it still has not been justified how the density shift from 1 per 450m^2 to 1 per 1500m^2 relates to the natural hazard on the site or facilitates a better planning response to the natural hazard on the site.

7.3 Due to the hazard it is unlikely that development will be accommodated across the entire site but will be confined to pockets of land which are determined as suitable to build upon through detailed geotechnical investigation to be completed and submitted with any future subdivision consent to section 106 of the RMA 91.

7.4 To make efficient and effective use of stable ground within an existing residential zone would be to enable denser pockets of residential development upon ‘good’ ground while land which is determined as unbuildable remains only to be used to facilitate access to further good ground and provide landscape buffers.

7.5 I believe a planning response to this would be to remove the density and lot size in favour of no minimum lot size but limiting the total number of units on the site to the maximum established by the ODP density of 450m^2 per unit or 412 units. This response is considered as the primary relief sought by the submitter.

7.6 This primary relief requires amendments to Rule 7.4.9 and 7.4.10 of Chapter 7 and 27.4.9 as set out in Attachment C along with a section 32AA evaluation.

7.7 If the decision maker cannot contemplate the primary relief sought in the absence of further information relating to geotechnical conditions of the natural hazard secondary relief sought by the submitter is to correctly align the QHOA area to the boundary of the natural hazard as set out in Attachment A.

7.8 Again, if the secondary relief cannot be achieved for the lack of detail offered in the submission (including the evidence of Mr Faulkner) then it is my opinion that the same information must equally be required to support the change in density promoted by the PDP. In this circumstance status quo must prevail. If so, the submitter accepts this as tertiary relief.

8.0 FURTHER SUBMISSION

8.1 Paragraph 5.18 of the Stream 13 s.42A report reads:

"QAC in its further submission (FS1340) has opposed submission 336 on the basis that it will result in the intensification of ASAN within close proximity to Queenstown Airport. I note that the sub-zone is located outside of both the ANB and OCB of Queenstown Airport; consequently, and in the absence of evidence supporting QAC's concerns I do not support the reasoning in this further submission."

8.2 The submitters property is located outside the ANB and OCB and I concur with the recommendation not to accept QAC's further submission.

9.0 CONCLUSION

9.1 I do not believe there is any s.32 analysis to support the QHOA density provisions in the PDP.

9.2 The PDP reduction in density is not a well-informed planning response to a potential natural hazard or a steep site. The preferred response is no minimum allotment size and a density of no more than 412 units, amendment of the QHOA to the natural hazard boundary or no amendment from the ODP density provisions.

9.3 Section 106 of the RMA 91 has been relied upon to necessitate geotechnical investigations in relation to natural hazards not the QHOA.

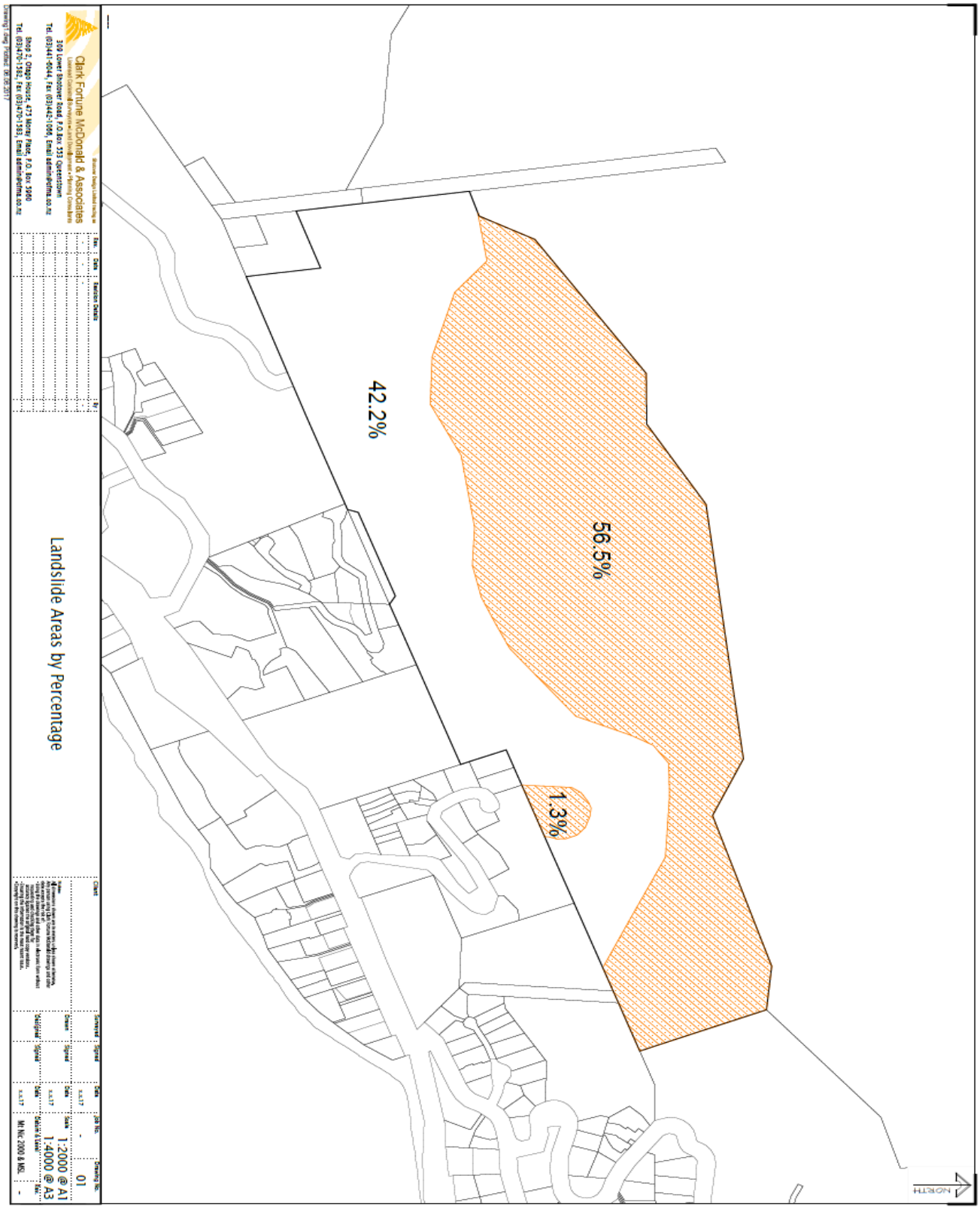
9.4 The submitters property is located outside the ANB and OCB and I concur with the recommendation not to accept QAC's further submission.

Nick Geddes

2nd June 2017

Attachment A

Site Area in Natural Hazard



Attachment B

Geotechnical Reports: RM081212 & RM150520

Tonkin & Taylor

ENVIRONMENTAL AND ENGINEERING CONSULTANTS

Tonkin & Taylor

1959 - 2009 50 YEARS

T&T Ref : 880044.3000 / LR001
26 November 2010

Beaver Contractors
c/- Clark Fortune McDonald & Associates
PO Box 553
Queenstown

Attention: Chris Hansen

Dear Chris

Remarkables View Sub-division, Queenstown
Site Layout in Relation to Queenstown Hill Landslide and Drainage Channel on the Western Boundary

1.0 Introduction

This letter has been completed by Tonkin & Taylor Ltd (T&T) and provides further information with regards to ground stability issues at the Remarkables View sub-division development, Middleton Road, Queenstown. This letter has been commissioned by Beaver Contractors and has been completed in accordance with the terms and conditions outlined in T&T proposal number 880044.00 / LoE001 dated March 2007.

This letter has been written as an addendum to and should be read in conjunction with T&T's Geotechnical Assessment Report completed for the site in April 2007 (GR001 880044.00).

The sub-division layout plan used for this assessment was provided by Clark Fortune McDonald & Associates (Job Number 10531, Drawing Number E001, dated 14 September 2010).

2.0 Observed Instability

During the site inspections completed in 2007 instability was observed in close proximity to the western boundary of the proposed subdivision. The areas of instability generally comprise the following:

- **The Queenstown Hill Landslide.**
  This feature is a large, historic and well documented landslide identifiable on the ground and from aerial photography. The main landslide body is located approximately 60m to 140m beyond the western boundary of the proposed subdivision and is not within the site boundary. Prior to site works completed for

this letter report the eastern margin of the landslide was poorly defined and the extent of active, inactive and unaffected areas required further investigation.

- **Shallow soil instability.**

  Shallow surface instability has been identified, typically comprising down slope creep of soil materials, minor scarp formation and terracing. The observed instability is shallow (typically <1.0m) and occurs as a result of high ground and surface water flow. This instability is not considered to be associated with any wider or deeper seated stability related to the adjacent Queenstown Hill landslide, and is typical of that observed in hillside environments.

3.0 Ground Investigations and Observed Geology

The following ground investigations have been completed along the western margin of the proposed subdivision for the purposes of this letter report:

- 19 test pits to depths of between 4.5 and 0.9m, and;
- Mapping of schist exposures and geomorphological features.

The locations of the test pits and mapped schist outcrops are shown on the attached Figure 1. The ground investigation was completed in October 2010.

4.0 Observed Geology

The subsurface materials encountered during the site investigation typically comprised:

- 0.1 to 0.7m of Topsoil, overlying;
- 0.0 to 0.5m of Colluvium, overlying;
- 0.0 to 4.0m of Alluvial materials, overlying;
- 0.0 to 1.3m of Glacial Till, overlying;
- Schist Bedrock at a depth of between 0.0 and 6.0 m below the existing ground surface.

The materials observed in the site investigation area consistent with those observed during T&T's 2007 geotechnical assessment. T&T's Geotechnical assessment report should be referred to for full descriptions of these materials and a general appraisal of the geological environment.

5.0 Observed Instability

The following comments are made with respect to stability along the western boundary of the proposed subdivision.

5.1 Queenstown Hill Landslide

Evidence from the test pit investigation and field mapping indicates the eastern margin of the Queenstown Hill landslide does not encroach into the western areas of the proposed sub-division. Orientations of the schist foliation along the western boundary are generally dip

direction = 240 to 280°/dip angle = 30 to 50°, and are typical of those observed in central and eastern areas of the sub-division. The foliation orientations indicate there has been no localised displacement of the schist bedrock material.

Field and aerial mapping confirms the active boundary of the landslide to be approximately 60 to 140m to the west of the proposed lots. There was no evidence for inactive landslide and associated unstable rock materials present between the active landslide and the western boundary of the proposed sub-division.

5.2 Shallow Soil Instability

Surface and groundwater flow paths were observed in close proximity to the western boundary of the proposed sub-division. The approximate locations of the flow paths are marked on attached Figure 1a. The observed flows are typically channelled into the gully present on the western margin of the site, as identified during construction of the lower part of the subdivision in 2007. Some shallow soil instability, typically comprising terracing ≤0.5m in height, was observed during the 2010 site inspection.

The observed instability is generally considered to be minor in nature and typical of that present in most Otago hillside environments. The instability is not expected to pose a significant risk to the proposed sub-division provided adequate drainage measures and appropriate earthworks are constructed in the affected areas. It should be noted that during the first phase of the subdivision construction (2007) earthworks have been completed in wet materials present in the lower area of the drainage gulley. In this area drainage measures were successfully constructed in to control surface and shallow ground seepage, and reduce the risk of instability to acceptable levels. It is expected that the same process will be undertaken as the sub-division extends upslope.

6.0 Conclusions and Recommendations

The following conclusions and recommendations are provided with respect to instability along the western margin of the proposed sub-division.

- The Queenstown Hill landslide is not considered to pose a significant risk to the proposed sub-division and no further works are required to establish the location of the eastern margin of the landslide in relation to the proposed Lot locations;
- Shallow instability associated with ground and surface water drainage was observed, however is considered to be minor in nature and typical of that present in most hillside environments in the Otago region.
- As the earthworks advance into areas of higher ground and surface water flows additional geotechnical inspections should be completed. These inspections should confirm the extent and nature of the requirements for slope re-profiling, subsoil drainage measures and other appropriate stabilisation measures as necessary (as completed during 2007 for the lower gully area);
- Where wet ground is present, temporary and permanent batter slopes should be constructed in accordance with the recommendations for wet soils in Table 5.3 and 5.4 of the previously issued T&T Geotechnical Assessment Report (Ref No .880044.00);

- Appropriate allowance should be made in the construction budget for drainage measures such as cut-off drains, horizontal and counterfort drains;
- Where appropriate, areas of vegetation should be left in place to improve stability of the near-surface soils and provide some erosion protection to the soil slopes whilst appropriate drainage construction or slope re-profiling is completed;

7.0 Report Closure

This report has been prepared by Tonkin & Taylor Ltd for the sole benefit of Beaver Contractors with respect to the particular brief given to us and it may not be relied upon in any other context or for any other purpose without our prior review and written agreement.

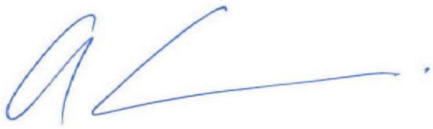
TONKIN & TAYLOR LTD
Environmental and Engineering Consultants

Report Prepared by:

……

Paul Faulkner
Engineering Geologist

Authorised for Tonkin & Taylor By:



……

Anthony Fairclough
Project Co-ordinator

Attachments: Figure 1a.

26-Nov-10
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FIGURE 1a

OUTCROPS, FOLIATION APPROXIMATELY 240-260

APPROXIMATE EDGE OF ACTIVE QUEENSTOWN HILL LANDSLIDE FROM T&T. PLANS & AERIAL MAPPING

OUTCROP A–K

TEST PIT 1–19

FOLIATION ORIENTATION (DIP DIRECTION/DIP)

OBSERVED OVERLAND & SHALLOW SOIL FLOW PATH

RANDOMLEY ORIENTATED SCHIST BLOCKS

FOLIATION MEASUREMENTS CUTS ABOVE ROAD

LOT 2 DP 351844

SEC 28 Blk XXI Shotover Survey District

SEC 1 SO 24003

SEC 64 Blk XXI Shotover Survey District

48 DP 20704

47 DP 20704

46 DP 20704

45 DP 20704

33 DP 10197

REFER PLAN 10471 E002

REFER PLAN 10226 E002

REFER PLAN 10534 E002

OVERHEAD POWER LINES

LIMIT OF CONSTRUCTION

NORTH

CLIENT REVIEW 30.09.10

Shotover Design Limited trading as
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Shop 2, Otago House, 475 Moray Place, P.O. Box 5960
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Rev	Date	Revision Details	By
-	-	-	-

Tonkin & Taylor Ltd
Geotechnical Assessment November 2010
Job Number: 880044.300

FIGURE 1a

	Surveyed	Signed	Date	Job No.	Drawing No.
	Drawn	Signed	Date	Scale	1:1000 @ A1 1:2000 @ A3
	Designed	Signed	Date	Datum & Level	Rev.
				MSL	-

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GEOSOLVE
GEOTECHNICAL ENGINEERING | ENGINEERING GEOLOGY | PAVEMENTS | HYDROGEOLOGY | HYDROLOGY

ACENZ MEMBER

GeoSolve Ref: 150639
24 September 2015

Queenstown Hill Joint Venture
C/- Clarke Fortune McDonald & Associates
PO Box 553
Queenstown

Attention: Emma Dixon

Dear Emma,

Boundary Variation
Remarkables View Sub-division

1.0 Introduction

The letter details the results of an assessment completed by Geosolve Limited of the proposed boundary variation at the Remarkables View subdivision, with respect to the Queenstown Hill Landslide.

The work described in this letter has been completed in accordance with the terms and conditions outlined in Geosolve proposal reference number 150639, dated 23rd September 2015.

2.0 Proposed Boundary Change

The extent of the proposed boundary changes addressed by this report are shown on the attached plan completed by Clark Fortune McDonald & Associates (CFMA). The plan indicates it is proposed to extend areas of the sub-division in a westerly direction. This will result in the subdivision being closer to the existing Queenstown Hill Landslide located a short distance to the west.

3.0 Assessment

Work completed for the purposes of this assessment includes:

- A review if existing reporting and mapping data completed by the Tonkin & Taylor Ltd (T&T), and the undersigned, during 2010 for the previously proposed layout (T&T ref 880044.300 dated 26th November 2010). This work included detailed geomorphological mapping of the area and a test pitting exercise to assess the nature of the underlying soil and rock materials, and;
- A site inspection to review the proposed new boundary locations.

Extensive mapping and investigation was completed by the undersigned in 2010 to determine the approximate location of the landslide feature. Mapping of existing rock outcrops was supplemented by test pitting data in order to ascertain any variation in the schist foliation orientation. The approximate location of the landslide boundary was then determined. A summary map of the work completed by T&T in 2010 is attached.

A review of the existing data and inspection of the site indicates the proposed 2015 sub-division boundaries do not encroach into the area of the landslide, which is located approximately 30m beyond the nearest part of the proposed boundary.

4.0 Conclusion and Recommendations

In conclusion the proposed new boundary is assessed to not encroach onto the Queenstown Hill Landslide and is therefore considered acceptable. Due to the proximity of the landslide an increased level of fracturing may be present in the rock mass in some areas, however standard engineering solutions are expected to be appropriate to address this eventuality.

5.0 Applicability

This report has been prepared for the benefit of Queenstown Hill Joint Venture with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

Yours faithfully,

Paul Faulkner

Senior Geotechnical Engineer

Attachments: Proposed Boundary Change Plan
T&T 2010 Site Map.

RURAL GENERAL ZONE

EDGE OF LANDSLIP AS PER T AND T REPORT DATED 2010

190

505

STAGE 5

143

142

134

182

183

184

185

186

187

188

189

LOW DENSITY RESIDENTIAL ZONE

117
921m2

118
908m2

119
662m2

120
738m2

121
838m2

122
913m2

123
696m2

124
608m2

320
678m2

321
618m2

322
1006m2

323
1180m2

STAGE 1

601
210m²

Old Boundaries

New Boundaries

501
9274m2

109
901m2

108
900m2

107
675m2

106
631m2 net
100m2 row
708m2

110
603m2

112
610m2

111
600m2
177m2 row
777m2

113
601m2
307m2 row
908m2

114
600m2

115
618m2 net
261m2 row
861m2

116
624m2

101
609m2

102
900m2

103
900m2

104
638m2

105
638m2

510
1707m2

700
2.16ha
Balance

QUEENSTOWN HEIGHTS
LOW DENSITY RESIDENTIAL
SUB-ZONE

600

600
7570m2
TO VEST IN THE QLDC
AS RECREATION RESERVE

131

132

CLIENT REVIEW 21.09.10

Shotover Design Limited trading as
Clark Fortune McDonald & Associates
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Rev.	Date	Revision Details	By
-	-	-	-

QUEENSTOWN HILL JOINT VENTURE CONCEPT PLAN
VARIATION TO STAGE 1 -
OLD V NEW BOUNDARIES

Client	Surveyed	Signed	Date	Job No.	Drawing No.
QTWN HILL JOINT VENTURE				12013	01
	Drawn ED	Signed	Date Aug 15	Scale	1:500 @ A1 1:1000 @ A3
	Designed JK/NM	Signed	Date July 15	Datum & Level Mt Nic 2000 & MSL	Rev. -

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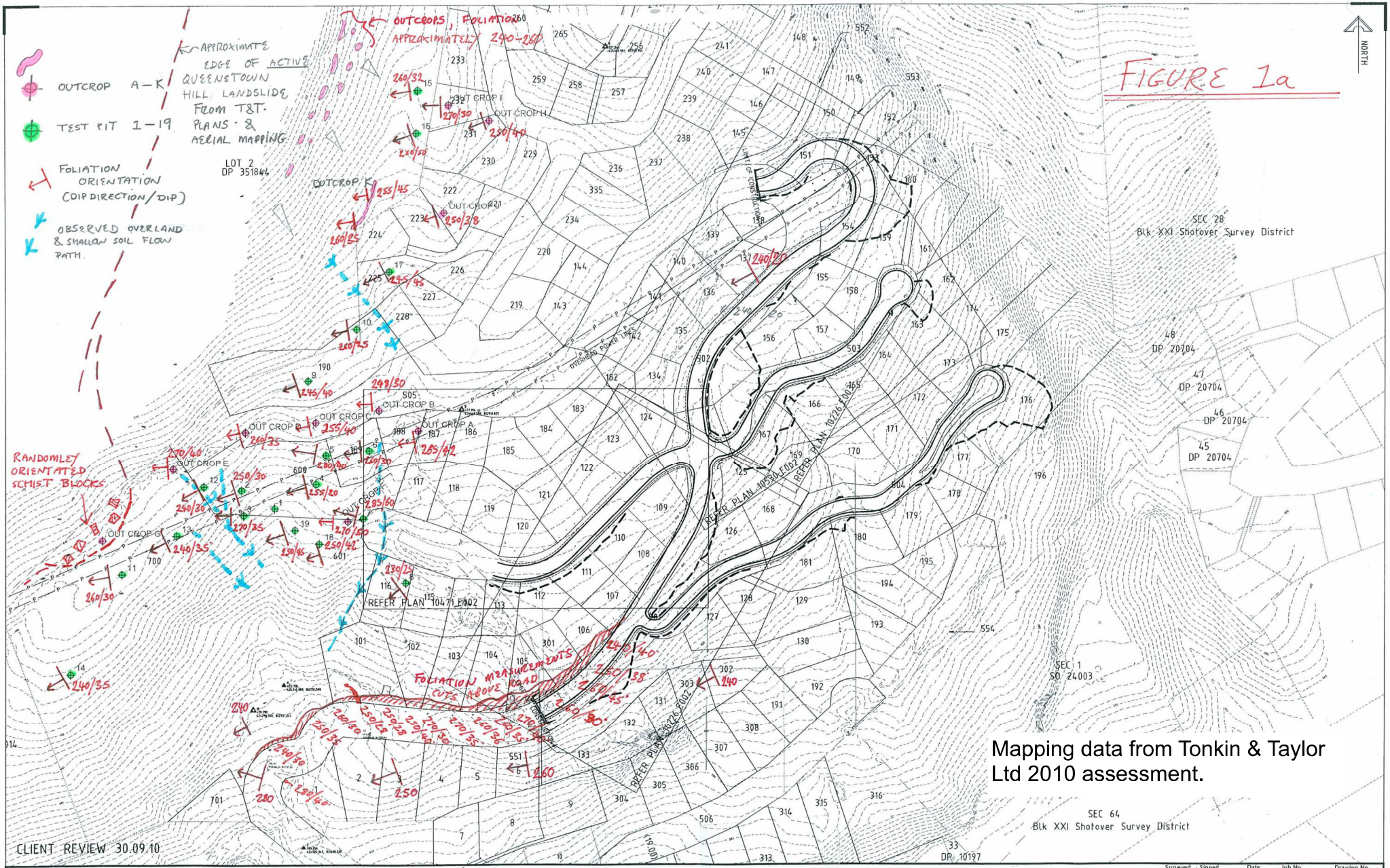

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Rev. | Date | Revision Details | By

Tonkin & Taylor Ltd
Geotechnical Assessment November 2010
Job Number: 880044.300

FIGURE 1a

Surveyed | Signed | Date | Job No. | Drawing No.
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REPORT

GRANT HENSMAN

Stage 2 Remarkables View Subdivision, Queenstown Geotechnical Assessment Report

Report prepared for:

GRANT HENSMAN

Report prepared by:

TONKIN & TAYLOR LTD

Distribution:

GRANT HENSMAN	2 copy
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April 2007

Job no: 880044

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1. Introduction

1.1. General

This report presents the results of a geotechnical assessment that has been completed by Tonkin & Taylor Ltd (T&T) to support resource consent application for Stage 2 of the Remarkables View Subdivision in Queenstown. Figure 1a, Appendix A, shows the location of the proposed development.

This geotechnical report was commissioned by Grant Hensman. T&T's proposal dated 13 March 2007, outlines the scope of works and conditions of engagement for this report.

1.2. Development

The proposed development comprises the construction of a new residential subdivision on moderate to steeply sloping ground located to the north of Frankton Road, Queenstown.

Plans of the proposed subdivision have been developed by Clark Fortune McDonald & Associates (CFMA). The drawings show the site to comprise an area of approximately 20 hectares to be divided into 134 separate building lots together with access roads and a recreation reserve. Figure 1b, Appendix A, provides a plan of the proposed subdivision

The proposed development includes a 230 m long extension of the existing Middleton Road in the south west corner of the site. This extension is shown as Road 1, Figure 1b, Appendix A. A second road named "Road 3," is also to be constructed. Road 3 is worthy of particular note from a geotechnical perspective. Road 3 branches westwards from Road 1, is approximately 60m in length and is to be constructed on a buttress of engineered fill. Details of the proposed works in the south western corner of the site are shown on Figure 1c, Appendix A. All other roads are to be formed by minor cut to fill earthworks.

2. Site Description

2.1. General

The site is located approximately 4 km east of Queenstown on the northern side of Frankton Road. The site is present on the south east facing slopes of Queenstown Hill and topographically falls in height from RL 525 m at the northern boundary to RL 400 m along the southern boundary.

Currently the site cover mainly comprises dense woodland with some open grass and shrubland in the northern areas.

2.2. Topography and Surface Drainage

The site topography comprises moderately to steeply sloping ground with steep slopes present on the southern and eastern sides of the site. Within the site boundary the ground undulates with shallow gullies, and poorly defined low ridges present throughout.

The eastern boundary of the site is marked by a deep natural gully and drainage path that runs down to Lake Wakatipu to the south. To the west the wooded slopes of Queenstown Hill continue with the Goldfield Heights residential area approximately 1 km distant. South of the site residential areas are present along Frankton Road and Perkins Road, with Lake Wakatipu located approximately 250 m from the southern boundary. In a northerly direction, areas of shrub and forest continue up to the summit of Queenstown Hill some 1.5 km distant.

Drainage across the site is from the high ground in the north towards Lake Wakatipu to the south. The most notable surface drainage feature within the site boundary is a shallow channel that runs roughly parallel to the western edge of the subdivision. Surface groundwater drainage is notable in this area with shallow soil materials becoming increasingly saturated towards the south west corner of the site and in particular where the current sealed Middleton Road terminates. The Middleton Road extension (Road 1) and Road 3 are planned in this area.

A smaller drainage channel is present on the northern boundary of the site, approximately between Lots 70 and 109. This channel is a notable depression in the northern boundary with persistent seepage and marshy surface materials. Down slope the channel gradually widens out onto the open hillside and a series of week seepages were noted over a wide area below the channel.

A summary of the general site observations are shown on Figure 1d, Appendix A.

3. Geotechnical Investigations

The following geotechnical site investigation works have been completed for the purpose of this geotechnical assessment report:

- Engineering geological/geotechnical site inspection;
- The excavation of 13 test pits to a maximum depth of 3.6 metres and logging of the sub-surface materials and;
- Scala penetrometer testing to quantify the consistency of the subsurface materials.

The locations of the test pits and the Scala penetrometer tests are shown on Figure 1b, Appendix A. The test pits and Scala penetrometer logs are provided in Appendix B.

4. Subsurface Conditions

4.1. Geological Setting

The site is located in the Wakatipu basin, a feature formed predominantly by glacial advances. Published references indicate the last glacial event occurred in the region between 10,000 and 20,000 years ago. The glaciations have left glacial till, glacial outwash and lake sediments over ice –scoured bedrock. Post glacial times have been dominated by the erosion of the bedrock and glacial sediments, with deposition of alluvial gravels by local watercourses and lacustrine sediments during periods of high lake levels.

No active fault traces were observed in the immediate vicinity of the site. However, a significant seismic risk exists in the region from potentially strong ground shaking associated with the rupture of the Alpine Fault which is located along the west coast of the South Island. There is a high probability that an earthquake with a magnitude greater than 7.5 will occur on the Alpine fault within the next 50 years.

4.2. Stratigraphy

The subsurface materials that were encountered during the site investigation works typically comprise:

- 0.0m to 0.3m of Topsoil overlying,
- 0.0m to 1.5m of Colluvium, overlying,
- 0.0m to 0.2m of Alluvial Sediments overlying,
- 0.0m to 0.65m Glacial Outwash Sediments, overlying,
- 0.0m to 3.0m Glacial Till, overlying;
- Schist bedrock.

Colluvium was present over much of the site and in the central and eastern parts directly overlay the Schist bedrock. Colluvium up to 1.5m thick was observed in the shallow cuts present across the site. Colluvium was absent in some parts of the south west corner of the site. It is inferred the colluvium in this area has been eroded by storm water run-off. The colluvium was typically described as a 'soft to firm orange brown sandy gravelly SILT.'

Alluvial sediments were observed in the drainage channel in the south west corner of the site. The alluvial sediments were described as 'soft to firm, grey sandy SILT.' The alluvial sediments were typically associated with areas of poor surface drainage and shallow groundwater.

The glacial outwash sediments typically comprised 'medium dense, orange grey silty SAND.' The glacial outwash deposits were only observed in the south west corner of the site and were found to be discontinuous.

Glacial till deposits were observed in the south west corner of the site and also in the drainage channel on the northern boundary. The composition of the till was found to be variable and comprised medium dense to dense gravels and sands and soft to firm silts. The silty till deposits were observed in the south west corner of the site and had been softened by high ground and surface water flows.

Schist bedrock was observed in all test pits, excavations and shallow cuts across the site. The rock typically comprised 'moderately weathered grey pelitic schist with psammitic and quartz bands.'

Figures 2a, 2b and 2c, provided in Appendix C, show the inferred geological stratigraphy in the south west corner of the site.

4.3. Existing Slope Instability

4.3.1. Introduction

Historic aerial photographs (about 1950) and field mapping show the Queenstown Hill Landslide immediately to the west of the proposed subdivision. The Queenstown Hill Landslide is well documented and is recorded on the QLDC Hazard Register. Historical aerial photography provides an image of the hillside prior to the growth of the dense vegetation cover which currently covers the landslide. A historical aerial photograph of the site is provided as Figure 1e in Appendix A.

The Queenstown Hill Landslide comprises a large schist landslide that is controlled by foliation shears which dip down slope. Such landsides are formed after withdrawal of glacial support, probably coupled with seismic shaking, resulting in a highly fractured, over-steepened slope. Schist landslides typically comprise material varying in size from silt to large schist blocks which can be up to several metres in diameter.

Movement of the Queenstown Hill Landslide is expected to be characterised by slow downward creep probably averaging in the order of 5 mm per year. Episodic periods of accelerated movement can also occur and are generally triggered by sustained heavy rainfall events. For the Queenstown Hill Landslide periods of accelerated movement of the entire slide are considered unlikely to exceed 50 mm/year, although large lobes within it will be capable of an order greater movement rates under extreme sustained rainfall events. The active area of the landslide has been highlighted on Figure 1e.

Figure 1e also shows the Queenstown Hill Landslide overlain with the proposed subdivision plan. From Figure 1e it can be seen several of the proposed lots on the western side of the sub-division are located in an area affected by potential landslide activity. The eastern margin of the landslide is shown to roughly follow the shallow drainage channel present on the

western margin of the site, and passes through the proposed Middleton Road extension and Road 3 fill buttress.

4.3.2. Western Area of the Proposed Subdivision

Evidence for slope instability was observed along the western margin of the subdivision. This instability typically comprised shallow terracing, minor scarp formation and a general down slope creep of the soil materials in the drainage channel area. It is expected the instability observed in the drainage channel is due to localised high ground and surface water flows and not deep seated movement associated with the adjacent Queenstown Hill landslide.

Evidence for schist landslide activity was not observed within the site boundary. Exposures of schist along the western boundary of the site are limited. Exposures are present in the south west corner, where the Middleton Road extension is proposed, and an outcrop is present on the western edge of Lot 13. Measurements of the schist foliation for these exposures show orientations are consistent with those expected for in-situ bedrock. The observed schist exposures along the western boundary are therefore considered to be outside the Queenstown Hill Landslide.

Inspections were undertaken westwards from the site along the existing track that runs roughly along the 480 m contour. Schist landslide deposits were observed along this track approximately 75 m beyond the site boundary.

It should be noted that detailed inspection of much of the western area of the site was hindered by dense vegetation cover. It is therefore recommended further inspections be completed along the western margin of the site as clearance works progress in this area.

4.3.3. Central and Eastern Areas of the Proposed Subdivision

In the central and eastern areas of the site no evidence of major instability was identified during the site walkover. Some down slope creep of soils was apparent around the drainage channel and elsewhere on the steeper slopes, however these movements are localised and considered a minor surface issue. Elsewhere a thick vegetation cover has stabilised the relatively thin veneer of colluvium that is present over the schist bedrock. The drainage channel that runs from the northern part of the site widens out into undulating moderately to steeply sloping ground. Some areas of notable steepness are present, particularly in central southern areas and a considerable depth of cut is expected to accommodate the proposed access roads.

Vertical schist bluffs are present along the eastern and southern boundaries of the site. Perkins Road is present at the foot of the southern boundary bluffs. Inspection of rock exposed by the Perkins Road cut indicates historic large scale block fall and landslide activity has occurred in this area. This area of instability is not expected to extend into the site and appears to end abruptly at the foot of the southern boundary bluffs.

The eastern boundary of the site is characterised by a series of steep slopes and schist bluffs that fall towards the adjacent gully present along the north eastern boundary of the site (refer to Figure 1d). Inspection of several rock bluffs in this area indicates the schist foliation is favourably orientated and as such deep seated slope instability is considered unlikely. However, smaller scale instability, associated with unfavourably orientated joints and fractures may occur, particularly during seismic events. From Figure 1b it can be seen the proposed building lots are set back from the steeper sections of the north eastern boundary and the risk of instability affecting building lots is considered to be low.

4.4. Groundwater

Perched groundwater was encountered in several locations during the site investigation works and was typically observed in soil materials present in the gullies and depressions that serve as storm water drainage paths or at the soil Schist rock interface.

The regional groundwater table was not encountered during the site investigation works, and is expected to lie several metres below the existing ground surface.

5. Engineering Considerations

5.1. General

The recommendations and opinions contained in this report are based upon ground investigation data obtained at discrete locations, a geotechnical site inspection and historical information held on the T&T database.

The continuity of subsoil materials and conditions between investigation locations has been inferred and cannot be guaranteed. The actual sub-surface conditions may show some variation from those described and all design recommendations contained in this report are subject to confirmation by inspection during construction.

5.2. Geotechnical Parameters

Table 5.1 provides a summary of the recommended geotechnical design parameters for the materials observed at the site.

Table 5.1 Recommended Geotechnical Design Parameters

Unit	Thickness (m)	Bulk Density γ (kN/m^3)	Effective Cohesion c' (kPa)	Effective Friction ϕ' (deg)	Elastic Modulus E (MPa)	Poisson's Ratio v
Topsoil	0.0 to 0.4	16	-	-	-	-
Colluvium	0.0 to 0.5	17	0	30	10	0.3
Alluvial Sediment	0.0 to 0.2	18	0	28	10	0.35
Glacial Outwash	0.0 to 0.7	18	0	33	10 to 20	0.35
Glacial Till	0.0 to 2.6	20	2	36	15 to 30	0.3
Schist Bedrock (See Notes 1 and 2)	Base not intercepted	27	40 to 300 (160 ave.)	28 to 55 (36 ave.)	>100	0.2
Defect within Schist (See Note 2)	-	-	0	20 to 30	5	0.35

Note 1: Rock strength and stiffness parameters estimated using the software package "RocLab1 Version 1.021"Published by Rocscience Inc., Toronto, Canada.

Note 2: The stability of the schist rock will be governed by the orientation and character of the rock defects. Additional investigation drilling and/or mapping works, and engineering assessment, will be required if cuts are required within the schist rock.

The stability of the schist rock will be governed by the orientation and character of the rock defects. Additional investigation drilling and mapping works, and engineering assessment should be undertaken if cuts are required within the schist rock.

5.3. Site Preparation

Owing to the erodible nature of the soils present across the site, robust, shallow graded sediment control measures should be instigated during construction. Slope gradients in access of 4% are considered likely as part of the works and lining of drainage channels is recommended, e.g. with geotextile and suitably graded rock, or similarly effective armouring.

Exposure to the elements should be limited for all soils. Excavations should be left proud of the finished subgrade level by 200 to 300mm if a delay prior to construction is expected. The final cut to grade should be performed immediately prior to pavement construction. Alternatively, these areas can be undercut and rebuilt to formation level with hardfill should the subgrade deteriorate due to exposure.

Covering the soils with polythene sheeting will reduce degradation due to rain and surface run-off.

Water should not be allowed to pond or collect near or under pavement or other foundation areas. Positive grading of the subgrade should be undertaken to prevent water ingress or ponding.

The soils present at the site are prone to erosion, both by wind and water, and should be protected by hardfill capping or re-topsoiled/mulched and re-vegetated as soon as the finished batter or subgrade levels are achieved.

5.4. Earthworks

All fill should be placed and compacted in accordance with NZS 4431:1989 and certified in accordance with Queenstown Lakes District Council standards.

Prior to the placement of fill all unsuitable material should be removed from the affected areas in accordance with the recommendations provided in NZS 4431: 1989. Particular note of this requirement should be made with respect to the alluvial sediments identified in the south western corner of the site close to the Road 3 fill area. The subgrade should be inspected by a

suitable qualified geotechnical practitioner to ensure all unsuitable materials are removed.

Most of the soil materials observed on site are considered to be marginal in their suitability as fill due to their high silt content. The alluvial sediments are unlikely to be suitable as subgrade material unless specific design and controls are in place.

If the glacial soils are to be used as fill consideration should be given appropriate interlayering or blending with coarser materials. Excavated rock should be broken into fragments less than 100 mm in diameter if it is to be used as fill.

5.5. Excavations

5.5.1. General

The proposed cut slopes for the Middleton Road extension will be up to 8 m deep and are dealt with separately in Section 5.5.5.

Elsewhere on site it is expected cut excavations up to 5 metres deep will be required for the permanent access roads

Recommendations for temporary and permanent batter angles are described in the following sections. Slopes that are required to be steeper than those described should be structurally retained or subject to specific engineering design.

All slopes should be periodically monitored during construction for instability and excessive erosion, and, where necessary, corrective measures should be implemented to the approval of a geotechnical practitioner.

Drainage works, such as horizontal drains, should be provided to control groundwater seeps. The final design and location of all sub-soil drainage works should be confirmed after stripping of overburden, by a geotechnical practitioner.

5.5.2. Temporary Cut Slopes in Soil

Table 5.2 details the recommended batter angles for temporary slopes in the soil materials present at the site.

Table 5.2 Recommended Batters for Temporary Slopes in Soil Materials.

Material Type	Maximum Slope Height (m)	Maximum Temporary Batter Slopes (horizontal to vertical)	
		Dry Ground	Wet Ground
Colluvium	5.0	1.75 : 1	3 : 1
Alluvial Sediment	5.0	1.75 : 1	3 : 1
Glacial Outwash	5.0	1.5 : 1	2: 1
Glacial Till	5.0	1 : 1	2.5:1

5.5.3. Permanent Cut Slopes in Soil

Table 5.3 details the recommended batters for permanent slopes in the soil materials identified at the site.

Table 5.3 Recommended Batters for Permanent Cut Slopes

Material Type	Recommended Maximum Batter Angle in Permanent Cut Slopes Less than 5.0m High (horizontal to vertical)	Recommended Maximum Batter Angle in Permanent Cut Slopes greater than 5.0m High(horizontal to vertical)
Colluvium	2 : 1	Specific design to be completed
Alluvial Sediments	2 : 1	Specific design to be completed
Glacial Outwash	2 : 1	Specific design to be completed
Glacial Till	1.5 : 1	Specific design to be completed

5.5.4. Cut Slopes in Schist Rock

The recommended maximum batter for cuts formed in schist rock is 0.5:1 (horizontal to vertical). However, the stability of cuts within the schist rock is dependent on the orientation of defects in the rock mass and the potential for unstable blocks and/or wedges to form. The installation of rock bolts and/or shotcrete may be necessary to ensure the satisfactory stability of slopes cut in schist rock. Alternatively, if room is available at the crest, rock

slopes can be battered back to a stable angle. This angle will depend on the orientation and nature of the defects within the rock mass.

5.5.5. Cuts for the Middleton Road Extension

Figure 1c presents a plan of the proposed Middleton Road (Road 1) extension. Cuts up to 8 m deep are proposed. Information from the ground investigation indicates the cuts will be in both soil and rock materials. Figures 2a, 2b and 2c provide geotechnical cross-sections through the proposed cut slopes associated with the Middleton Road extension.

The deepest cuts are expected to occur at Chainage 410m, however, the maximum thicknesses of soil materials are expected to be at Chainage 380m. Test Pit 3 was completed on the northern side of the proposed cut at Chainage 380m. This test pit indicates the depth to rock is approximately 3.6m below surface level. Elsewhere the depth to rock was shown to vary from 3.6m to surface level. It is expected, therefore, that most of the proposed cut to form the Middleton Road extension will be made in rock.

Table 5.2 provides recommendations for permanent batters in soil materials. It is recommended the batter angles for wet slopes be adopted for the Middleton Road extension cut slopes due to the high groundwater flows in this area.

For permanent cuts in rock, instability may be an issue if unfavourable defects are present. It is therefore recommended that pilot cuts be completed in advance of the main excavations to allow detailed inspection and examination of the rock defects to be completed. The results of these inspections will enable any additional support requirements to be assessed.

Formation of the proposed Middleton Road cuts using traditional excavator and rock breaking techniques is expected to be time consuming. The use of blasting may provide an economic alternative. A specialist contractor should be consulted for a detailed assessment of the blasting works.

5.6. Engineered Fill Slopes

5.6.1. General

All fill should be placed and compacted in accordance with NZS 4431:1989 and certified in accordance with the Queenstown Lakes District standards.

Table 5.4 provides recommendations for batters formed in engineered fill.

Table 5.4 Recommended Batters for Slopes in Engineered Fill

Material Source	Recommended Maximum Batter for Engineered Fill Slopes Less than 3.0 Metres High (horizontal to vertical)	Recommended Maximum Batter for Engineered Fill Slopes greater than 3.0 Metres High (horizontal to vertical)
Colluvium	2.5 : 1 (landscaping only)	Not Recommended
Alluvial Sediments	2.5:1 (landscaping only)	Specific Design Required
Glacial Till and Glacial Outwash Material	2:1	Specific Design Required
Schist Rock	1.75 : 1	Specific Design Required
Blended Glacial and Schist Rock materials	1.75:1 to 2 : 1	Specific Design Required

5.6.2. Fill Beneath Road 3

5.6.2.1. General

The engineered fill slope that is proposed beneath Road 3 is greater than 3.0m in height and specific design has been completed to ensure the stability of this structure. This stability assessment has been completed using the computer software programme Slope/W. The slope gradient of the fill adopted for the analysis has been taken from drawings completed by CFMA. These drawings indicate a proposed slope gradient of 3:1 (horizontal to vertical). Figure 2d, Appendix A, shows a typical cross-section through the proposed Road 3 fill slope.

The stability assessment has been completed on the assumption the fill material will comprise a blend of glacial till and granular rock material excavated from the adjacent Middleton Road extension cuts. The analysis also assumes drainage will be installed on the up-slope side of Road 3 to prevent groundwater entering the fill material.

Slope displacements associated with seismic events have been estimated using the methods proposed by Ambraseys and Menu (M.N Ambraseys and J.M. Menu, Earthquake Engineering and Structural Dynamics, Vol 16, no7, pp985-1006. 1988).

5.6.2.2. Fill Material Properties

The design parameters that have been adopted for the blended glacial till and schist rock fill material are summarised in Table 5.5 below.

Table 5.5 Design Parameters for Blended Glacial Till Material and Rock Fill

Material	Bulk Density γ (kN/m³)	Effective Cohesion c' (kPa)	Effective Friction ϕ' (degrees)	Elastic Modulus E (MPa)	Poisson's Ratio v
Blended Glacial and Rock Material	19	0	35	20 to 35	0.25

5.6.2.3. Seismic Acceleration

Seismic acceleration has been estimated in accordance with the recommendations of AS/NZS1170.0:2002 assuming Class C subsoil conditions. An importance Level 2 and a 100 year design life have been adopted for design of the engineered fill slope.

Table 5.6 summarises the peak ground acceleration, $C_{(0)}$, that has been adopted during the stability assessment of the Road 3 engineered fill slope.

TABLE 5.6 Summary of Design Peak Ground Acceleration

Design Case	Annual Probability of Exceedance	Estimated Peak Ground Acceleration ($C_{(0)}$)
Serviceability Limit State 1 (SLS1)	1/25 years	0.11g
Ultimate Limit State (ULS)	1/1000 years	0.55g

5.6.3. Design Criteria

Table 5.7 summarises the design criteria for the proposed fill slope.

TABLE 5.7 Summary of the Geotechnical Design Criteria for Unreinforced Earthfill Slopes

Description	Geotechnical Design Criteria
In Service Conditions (Static)	Factor of Safety against Slope Instability >1.50
Serviceability Limit State (SLS1)	Factor of Safety against Slope Instability >1.20
Ultimate Limit State (ULS)	Ground Displacement ≤ 50mm

5.6.4. Analysis Results

Table 5.8 provides the analysis results for the stability of the proposed fill slope beneath Road 3.

Table 5.8 Summary of the Analysis Results

Design Case	Calculated Factor Of Safety	Expected Slope Displacement
In Service Conditions (Static)	2.0	Nil
Serviceability Limit State (SLS1)	1.6	Nil
Ultimate Limit State (ULS)	0.65	20 mm

The analysis results indicate the stability of the proposed engineered fill slope will be satisfactory provided the slope is constructed in accordance with the recommendations in Section 5.4 of this report.

5.7. Groundwater Issues

5.7.1. General

The regional groundwater is expected lie at a level well below the proposed works and is not expected to be encountered during construction.

Perched groundwater levels are expected to be encountered at several locations across the site and drainage measures, such as horizontal, counterfort or cut-off drains, should be installed to the approval of a geotechnical practitioner. Site inspections indicate wet soils will be encountered along the western boundary and in the northern central areas of the site.

5.7.2. Drainage for the Middleton Road Extension

The Middleton Road extension and associated earthworks are to be located within the drainage that runs along the western boundary of the site. High ground and surface water flows are present in this area. To ensure stability of the proposed cut slopes the installation of drainage measures to control water flow is recommended. Plans provided indicate the construction of a subsoil cut-off drain is proposed between Chainages 320m and 390m on the up hill side of the cut. The cut-off drains are shown to connect to the

existing storm water drain system that has been constructed along Middleton Road.

The following recommendations are provided regarding the construction of the proposed cut-off drains:

- The minimum depth of the cut-off drain should be 1.0 m;
- The minimum width of the cut-off drain should be 0.3 m;
- The minimum fall of the cut-off drain should be 1:50 (horizontal to vertical);
- The pipe should comprise a 100 mm diameter class 500 heavy duty drainage pipe that meets the requirements of Transit New Zealand Specification F/2;
- The trench should be lined with a non woven geotextile filter cloth, such as 'Bidim A14' or similar to prevent blockage by silt infilling;
- The trench should be backfilled with a clean free draining material such as washed 20/40 drainage gravel.

In addition to the cut-off drain the construction of horizontal drains to target deeper seepages may be required. It is recommended that the construction of up to10 horizontal drains be budgeted for. The actual number of drains will need to be confirmed on site based on seepages observations on the cut face.

The shallow soil materials in this area are wet and unstable and excavation of the cut-off drain should proceed with caution. It is recommended that short lengths (5-10m) of the trench are excavated and backfilled prior to excavation of the next section. It is also recommended that the slopes of the trench are battered back in line with Section 5.4.2. of this report.

5.8. Stability of Existing Slopes

Field inspection and aerial photographs indicate the proposed sub-division does not encroach onto the more active segment of the Queenstown Hill Landslide, but a small proportion does encompass potentially active, peripheral segments of the slide. Areas of shallow surface instability have been identified within the site boundary, however it is expected these areas can be remediated during the subdivision earthworks or isolated from the proposed building lots by a reserve area. The remainder of this section provides a detailed description of all the areas of instability that have been identified to date.

5.8.1. Western Area

The western side of the site is close to the eastern margin of the Queenstown Hill Landslide. Field mapping indicates that active landsliding is present approximately 75 m from the site boundary at the 480 m contour. Elsewhere

dense vegetation prevented a detailed inspection of the western area of the site from being completed, however, evidence of high groundwater flows, surface creep, shallow scarps and terracing was observed.

It is considered likely that some stabilisation measures will be required during the formation of building platforms and access roads in the western area. Temporary and permanent batter gradients should be made in accordance with the recommendations for wet soils in Tables 5.3 and 5.4 of this report. Measures to control the ground and surface water should be constructed in conjunction with site clearance works in this area. Allowance for the construction of cut-off drains, horizontal drains and counterfort drains should be made in this area.

Dense vegetation currently covers much of the western area. This provides protection and stability to the surface materials. It is recommended that widespread removal of the vegetation is avoided and slope re-profiling and drainage installation is completed without delay where vegetation removal is necessary.

It is recommended that further geotechnical inspections be completed along the western margin of the site as clearance and earthworks progress to confirm the extent and design of slope re-profiling, drainage and other stability requirements in this area.

5.8.2. Central and Eastern Areas

In the central and eastern areas of the site little evidence for slope instability was observed within the proposed building lots and the requirement for comprehensive stabilisation measures are considered unlikely.

Some minor instability may be ongoing within the reserve area.

5.9. Subsoil Class for Seismic Design

For detailed design purposes it is recommended the magnitude of seismic acceleration be estimated in accordance with the recommendations of NZS 1170.5:2004.

It is expected for much of the site schist rock will be at depths of less than 3 m and Class B subsoil conditions will be appropriate. In some areas, notably in the drainage channels present along the western margin and in the northern central area, soils are expected to exceed 3m in thickness and Class C subsoil conditions will be present.

5.10. Pavements

The proposed sub-division development requires the construction of several access roads. The expected in-situ design (10-precentile) CBR values for the

materials present on site are provided in Table 5.10. These are preliminary values subject to site inspection.

Table 5.9 Recommended Sub-grade 10 Percentile CBR values for Pavement Design

Sub-grade Material	Preliminary 10 Percentile CBR Value
Alluvial Sediment	Unsuitable as subgrade material – Excavate and replace as appropriate
Colluvium	2%
Glacial outwash and glacial till	4-6%
Schist bedrock	15%

Groundwater is expected to adversely affect pavements in some areas and suitable sub-soil drainage measures should be incorporated into the pavement design.

All unsuitable materials, such as vegetation, topsoil and soft sediments should be excavated from beneath road footprints and replaced with granular subbase or engineered fill prior to commencing pavement construction.

Inspections of the pavement sub-grade should be completed during construction by a geotechnical practitioner to carry out penetration testing and confirm the subsurface conditions are in accordance with this report.

5.11. Existing Structures and Neighbouring Properties

There are no existing structures within or immediately adjacent to the site. Neighbouring properties are not expected to be adversely affected by the proposed works provided the recommendations of this report are completed.

5.12. Natural Hazards

A risk of seismic activity has been identified for the region as a whole and appropriate allowance should be made for seismic loading during detailed design of structures or earthworks.

The western margin of the proposed subdivision is close to the edge of a prominent landslide on Queenstown Hill. Detailed mapping of this area was restricted due to the dense vegetation coverage. It is recommended additional geotechnical inspection and mapping works be completed in this area during the site clearance works.

No other significant natural hazards have been identified within the site boundaries.

It is understood that future development to the west of the site is being considered. Such development will encroach into the area of the Queenstown Hill Landslide, and towards the active area identified approximately 75 m from the site boundary. Due to the potential for ongoing movement this area is not considered appropriate for residential development.

5.13. Aquifers

No aquifer resource is expected to be adversely affected by the proposed development.

5.14. Environmental Issues During Construction

5.14.1. Erosion and Sediment Control

Due to the sloping nature of the site, groundwater and surface water run-off and soil erosion will require controls. Options to control sediment run-off include earth bunds, silt fences, hay bales, vegetation buffer strips and sediment ponds.

Details for the implementation of erosion and sediment control measures can be accessed at the following internet link:

http://www.aucklandcity.govt.nz/council/documents/district/Ann14.pdf

Further detail related to construction sites can be found at:

http://www.itd.idaho.gov/manuals/Online_Manuals/BMP/

5.14.2. Noise

It is expected that conventional earthmoving equipment, such as excavators with rock breaking equipment will be required during construction of the access roads.

The site is not located close to adjacent properties however the construction contractor should ensure the appropriate measures are taken to control the construction noise, in accordance with QLDC requirements.

5.14.3. Dust

The soils present at the site have a relatively low potential to generate dust. However the Contractor should take appropriate measures to control dust in

accordance with QLDC requirements. Regular damping with sprinklers is expected to be an effective measure to control airborne dust during construction.

6. Conclusions

Proposed Development

- From a geotechnical perspective the proposed development is considered technically feasible provided it is properly designed and controlled. A moderate geotechnical risk has been identified with the ground and storm water drainage and potential shallow instability along the western boundary of the subdivision. See 5.8/1
- Both of the risks can be addressed with proper engineering design and construction

Existing Geotechnical Conditions

- The stratigraphy of the site typically comprises the following sequence and thickness of materials:

  0.0 to 0.3m of Topsoil, overlying;

  0.0 to 1.5m of Colluvium, overlying;

  0.0 to 0.2m of Alluvial sediments, overlying;

  0.0 to 0.65m of Glacial Outwash Sediments, overlying;

  0.0 to 3.0m of Glacial Till, overlying;

  Schist bedrock at a depth of 0 to 3.6m below the existing ground surface.

- Shallow instability within the soil materials has been identified along the western boundary of the site.
- The Queenstown Hill Landslide exhibits activity approximately 75 m to the west of the site.
- Shallow ground and surface water flows have been identified along the western boundary of the site and to a lesser extent on the northern boundary.
- The regional groundwater table was not encountered during the site investigation works and is expected to lie well below the proposed finished ground surface.

Geotechnical Design Parameters

- Recommended parameters for the soil materials are presented in Table 5.1 of this report.
- Recommended parameters for the schist rock are provided in Section 5.2 of this report.

Recommended Cut Batters

- Permanent slopes in soil and rock materials will be formed as part of the development. Section 5.5 of this report provides recommendations for temporary and permanent batters in soil materials and slopes excavated in schist rock.

Recommended Fill Batters

- Recommendations for fill batters are provided in Table 5.6 of this report
- Stability analysis indicates proposed fill slopes beneath Road 3 have a satisfactory factor or safety against geotechnical instability providing the slope is formed at 3:1 (horizontal: vertical), or flatter and proper drainage to control ground and surface water flows is constructed.
- Colluvium and alluvial sediment soil materials should not be used in construction of engineered fill unless subject to specific design.

Earthworks

- All earthworks should be certified and constructed in accordance with NZS 4431:1989 and Queenstown Lakes District Standards.
- Earthwork construction should be inspected by a geotechnical practitioner

Groundwater Issues

- The regional groundwater table is expected to lie at depth below the finished ground surface and is not expected to be encountered during construction of the proposed earthworks.
- Perched groundwater is present within the soils and on the surface of the schist rock in several locations.
- If wet soils are encountered during earthworks construction then appropriate drainage measures should be installed.
- Completion of subsoil and surface drainage measures will be required to ensure stability of the soil materials present in the area of the proposed Middleton Road extension. Recommendations for drainage measures are discussed in Section 5.7.2 of this report.

Stability of existing slopes

- The Queenstown Hill Landslide which has experience historic activity has been identified approximately 75 m to the west of the site.
- Shallow instability has been identified in the soils that are present along the western boundary of the site. This instability is inferred to be related to high ground and surface water flows.

- It is recommended that slope re-profiling works and drainage be installed in conjunction with site clearance and earthworks in the western area.
- The existing vegetation cover provides considerable support to the surface materials in the western area and the removal of vegetation in this area should be avoided where possible.
- Further geotechnical inspections should be completed in the western area to confirm the extent of slope re-profiling and drainage works as site clearance and earthworks advance.
- No significant stability issues have been identified in the central and eastern areas of the site.

Seismic Design

- The magnitude of seismic acceleration for structural design should be estimated in accordance with NZ 1170.5:2004. It is expected that Class B subsoil conditions will be present across most of the site where schist rock lies at a depth less than 3 m below the finished ground surface. Class C conditions will be present in the drainage channels where the depth to bedrock is greater than 3 m. The drainage channels are located in the western and northern areas of the site.

Recommendations for Additional Geotechnical Work

- Detailed design of drainage under the fill embankment.
- Inspections during earthwork construction to confirm extent and design of drainage and slope re-profiling along the western boundary.
- Pilot excavations in advance of the main cut to allow mapping of the schist and confirmation of the requirements for support.
- Testing and certification of engineered fill in accordance with the requirements of NZS 4431:1989 and Queenstown Lakes District Standards.

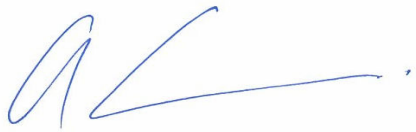
7. Applicability

This report has been prepared for the benefit of Grant Hensman with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

TONKIN & TAYLOR LTD

Environmental and Engineering Consultants

Report prepared by: Reviewed for Tonkin & Taylor by:



....

Paul Faulkner Anthony Fairclough

Engineering Geologist Senior Geotechnical Engineer

Authorised by:

.....

Graham Salt

Project Co-ordinator

pgf

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Appendix A: Site Plans and Geological Cross Sections

DRAWN	MABN	1/5/07
DRAFTING CHECKED		
APPROVED		
CADFILE :		
SCALES (AT A4 SIZE)		

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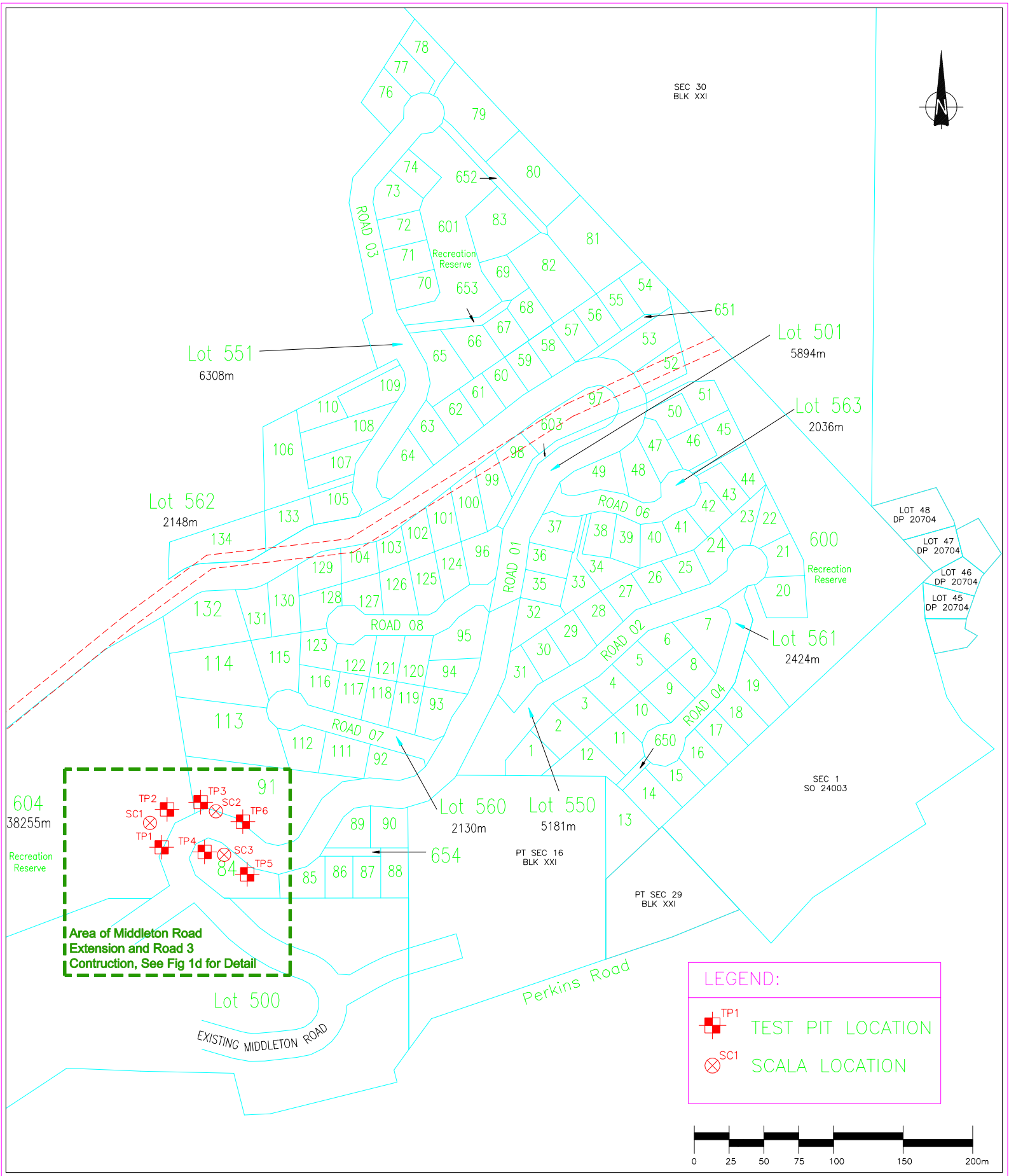
Grant Hensman
Geotechnical Investigations
Middleton Road, Queenstown
Site Location

PROJECT No. 880044

FIG. No. Fig. 1a

REV. 0



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APPROVED		
CADFILE :		
SCALES (AT A4 SIZE)		
PROJECT No. 880044		

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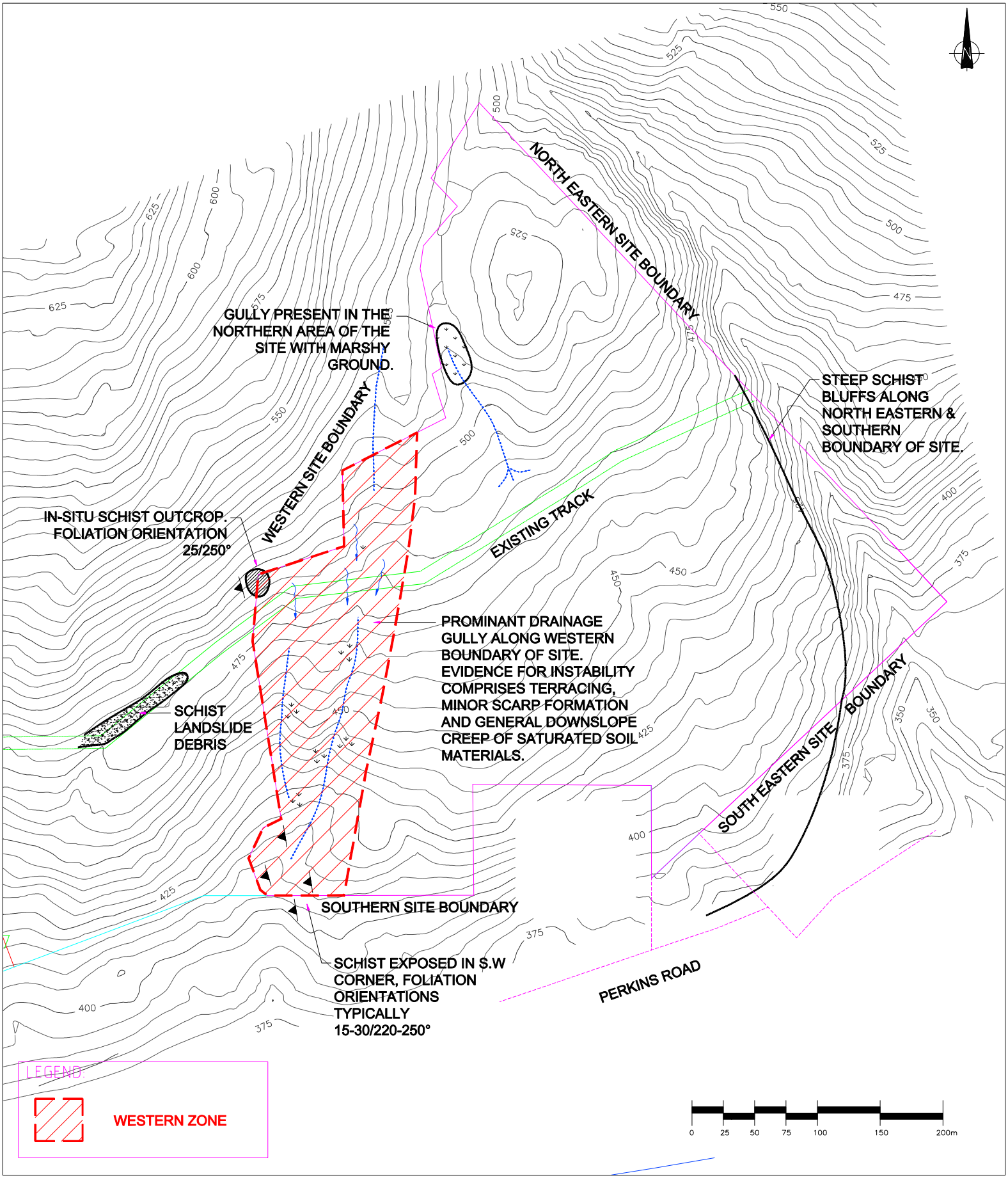
Geotechnical Investigations
Middleton Road, Queenstown
Development & Test Location Plan

FIG. No. Fig. 1b

REV. 0



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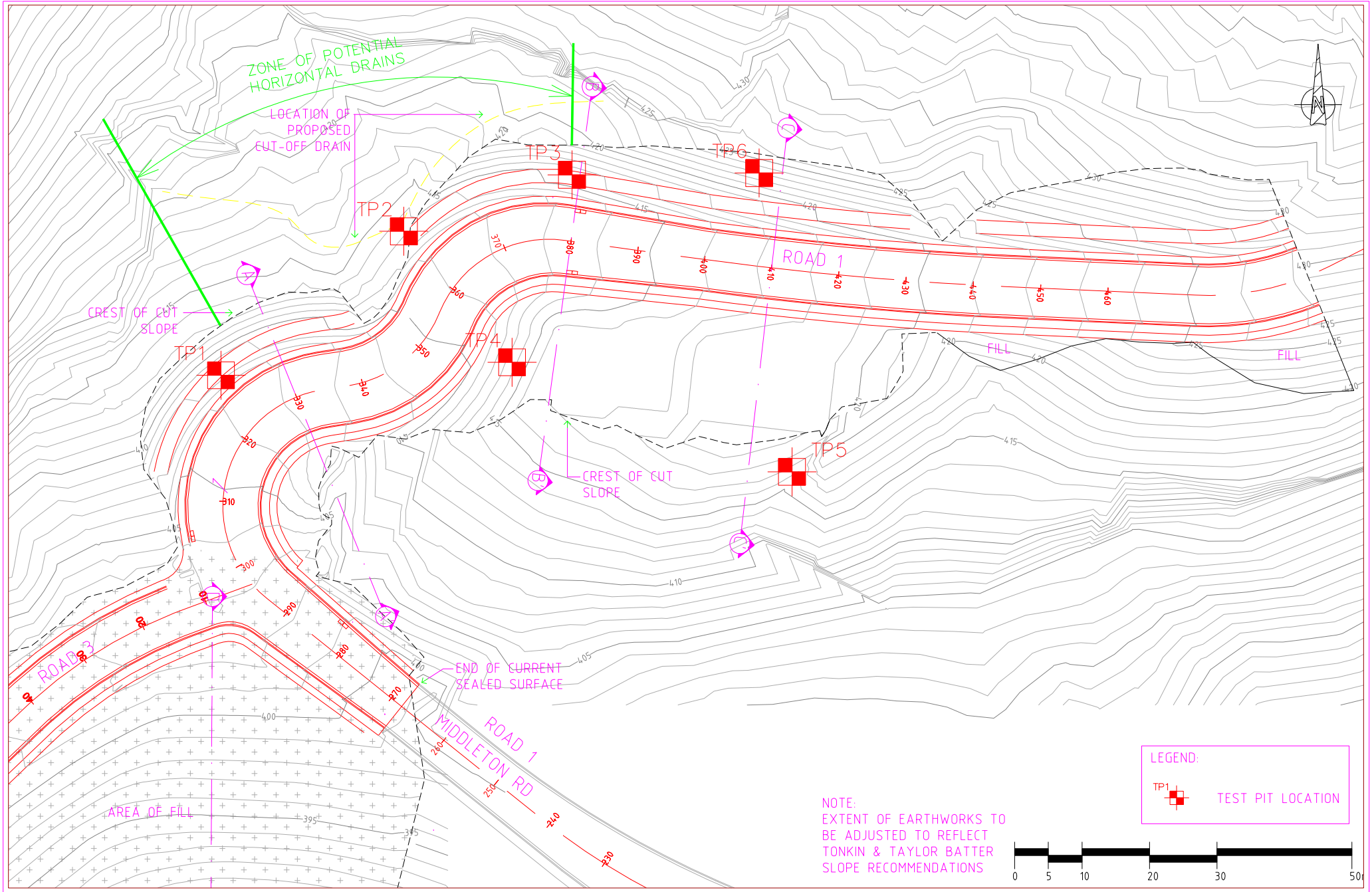
DRAWN	EJD	4/07
DRAFTING CHECKED		
APPROVED		
CADFILE :		
SCALES (AT A4 SIZE)		
PROJECT No. 880044	FIG. No. Fig. 1c	REV. 0

Grant Hensman
Geotechnical Investigations
Middleton Road, Queenstown
Geotechnical Observation Plan



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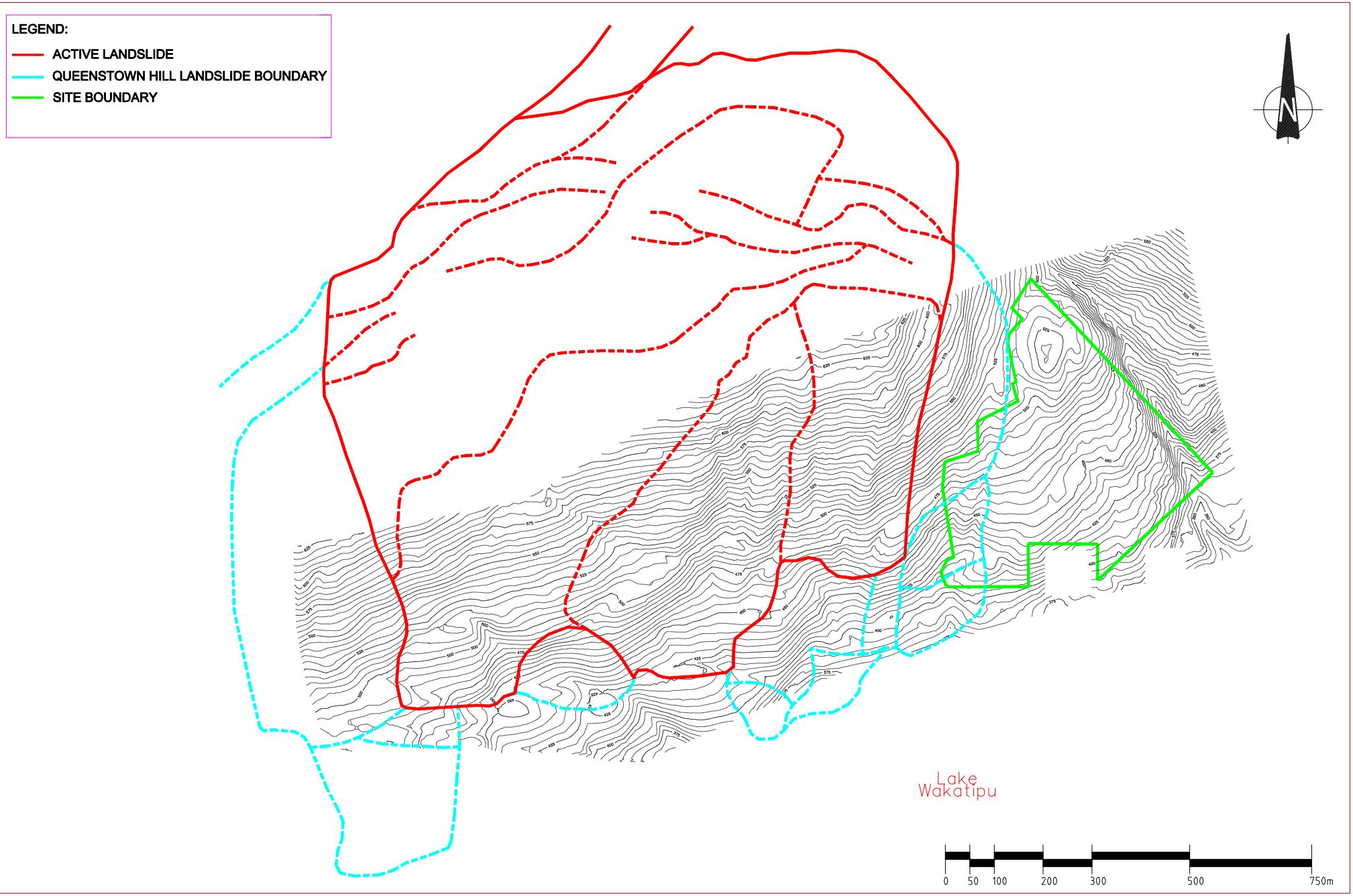
DRAFTING CHECKED		
APPROVED		
CADFILE :		
SCALES (AT A4 SIZE)		
PROJECT No. 880044		

Grant Hensman
Geotechnical Investigations
Middleton Road, Queenstown
Site Plan (South West Corner of Site)

FIG. No. Fig. 1d

REV. 0



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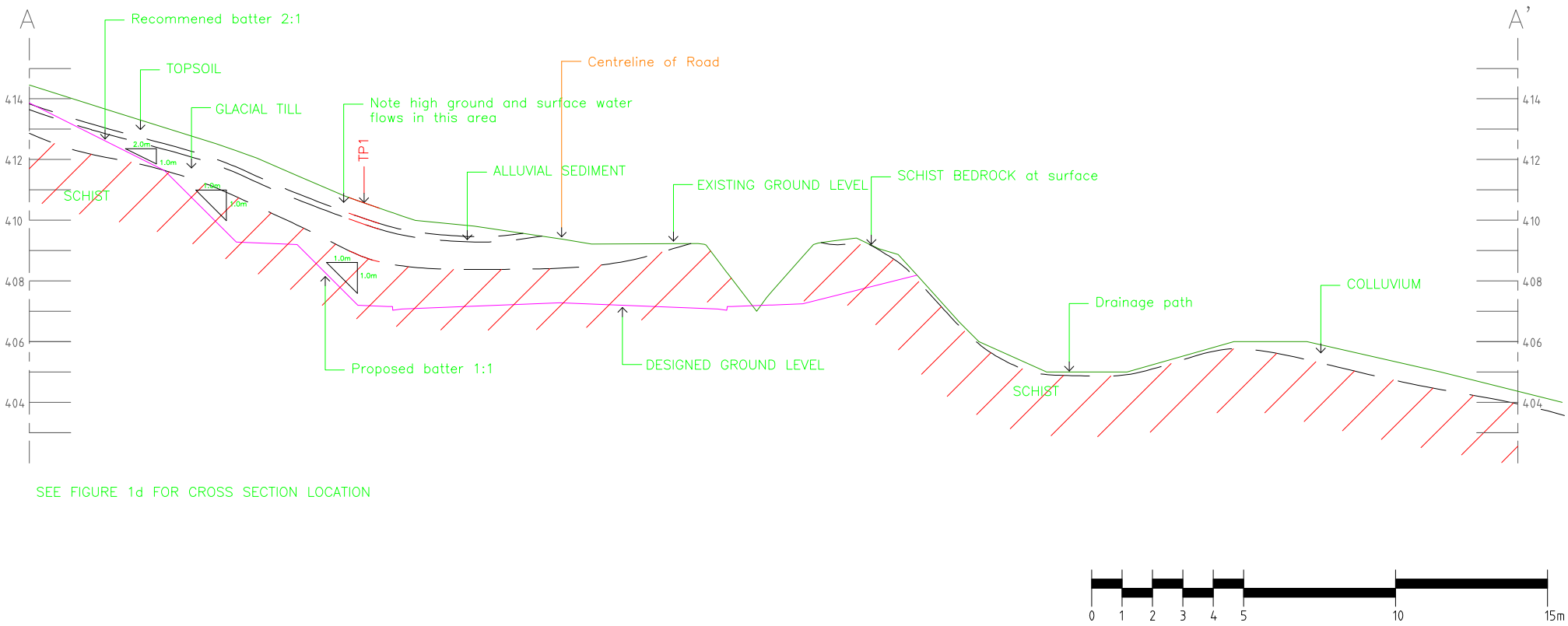
APPROVED		
CADFILE :		
SCALES (AT A4 SIZE)		
PROJECT No. 880044		

Grant Hensman
Geotechnical Investigations
Middleton Road, Queenstown
Queenstown Hill Landslide Location Plan

FIG. No. Fig. 1e

REV. 0



SEE FIGURE 1d FOR CROSS SECTION LOCATION

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APPROVED		
CADFILE :		
SCALES (AT A4 SIZE)		
PROJECT No. 880044		

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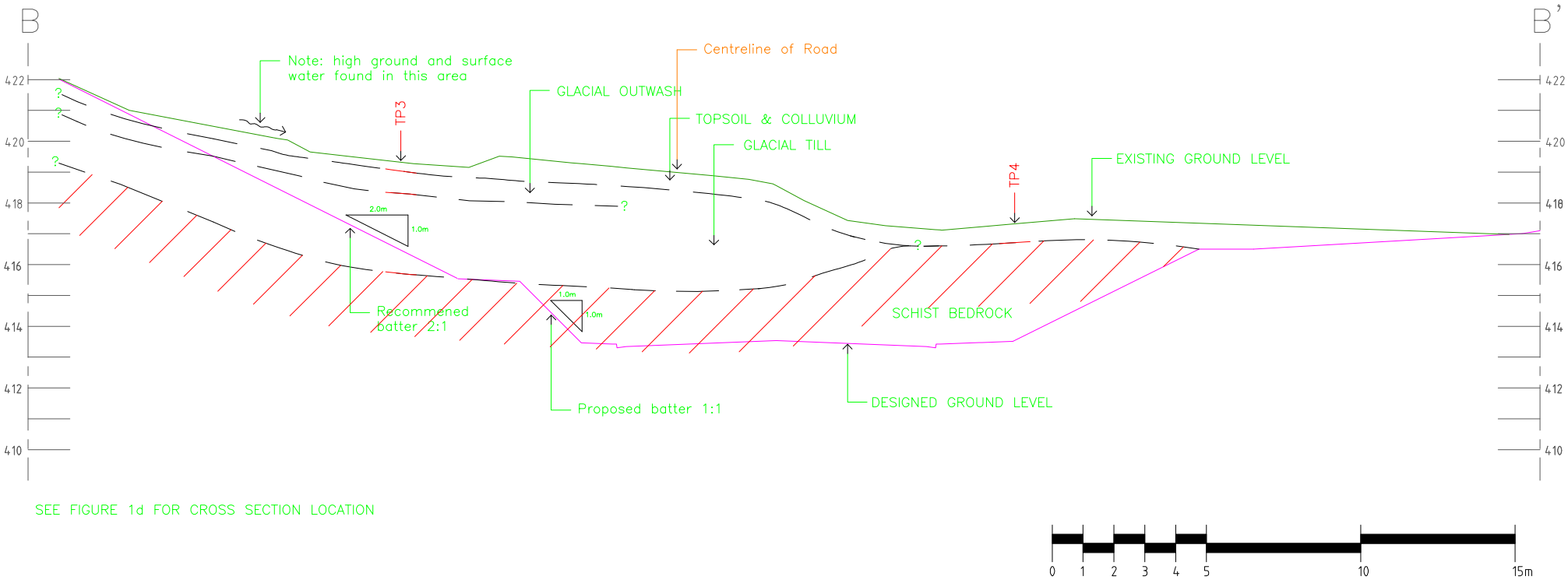
Geotechnical Investigations
Middleton Road, Queenstown
Section A – A' (Chainage 330m)

FIG. No. Fig. 2a

REV. 0



SEE FIGURE 1d FOR CROSS SECTION LOCATION

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APPROVED		
CADFILE :		
SCALES (AT A4 SIZE)		
PROJECT No. 880044		

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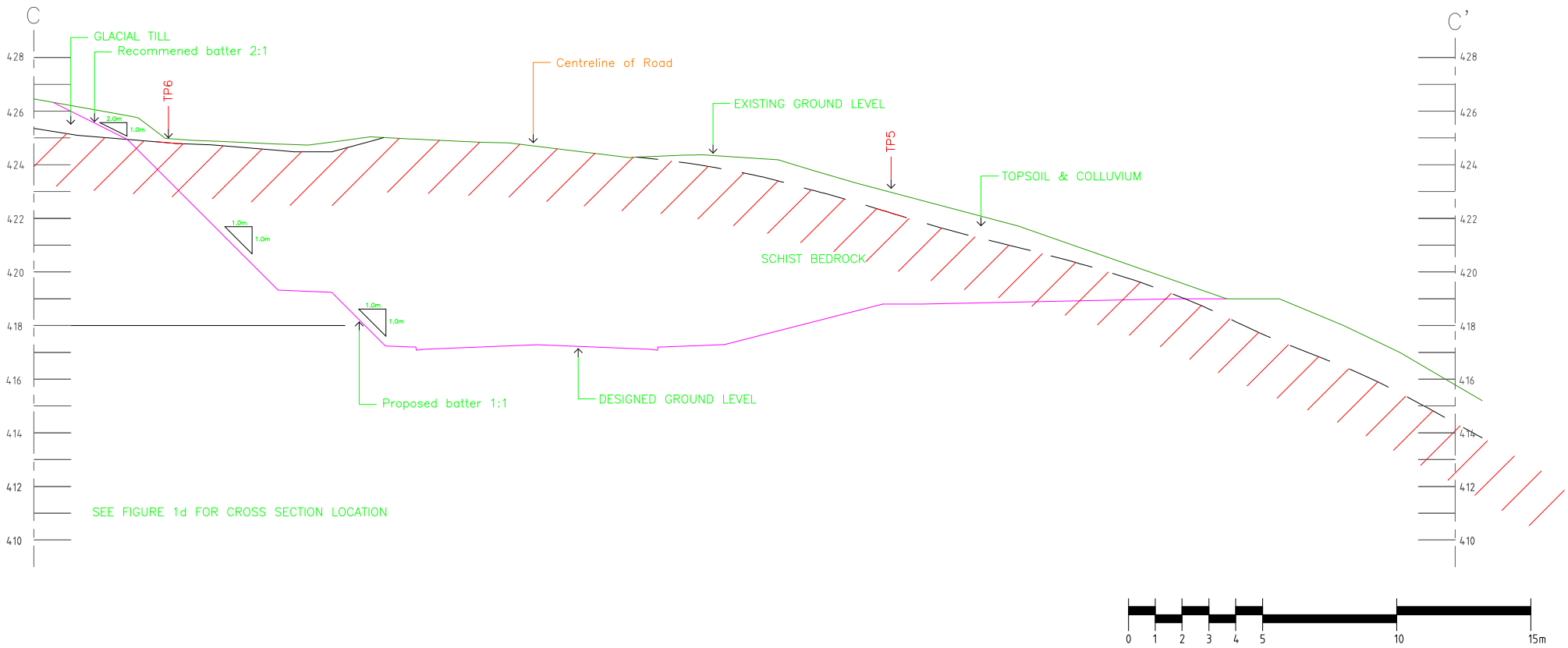
Middleton Road, Queenstown
Section B – B' (Chainage 380m)

FIG. No. Fig. 2b

REV. 0



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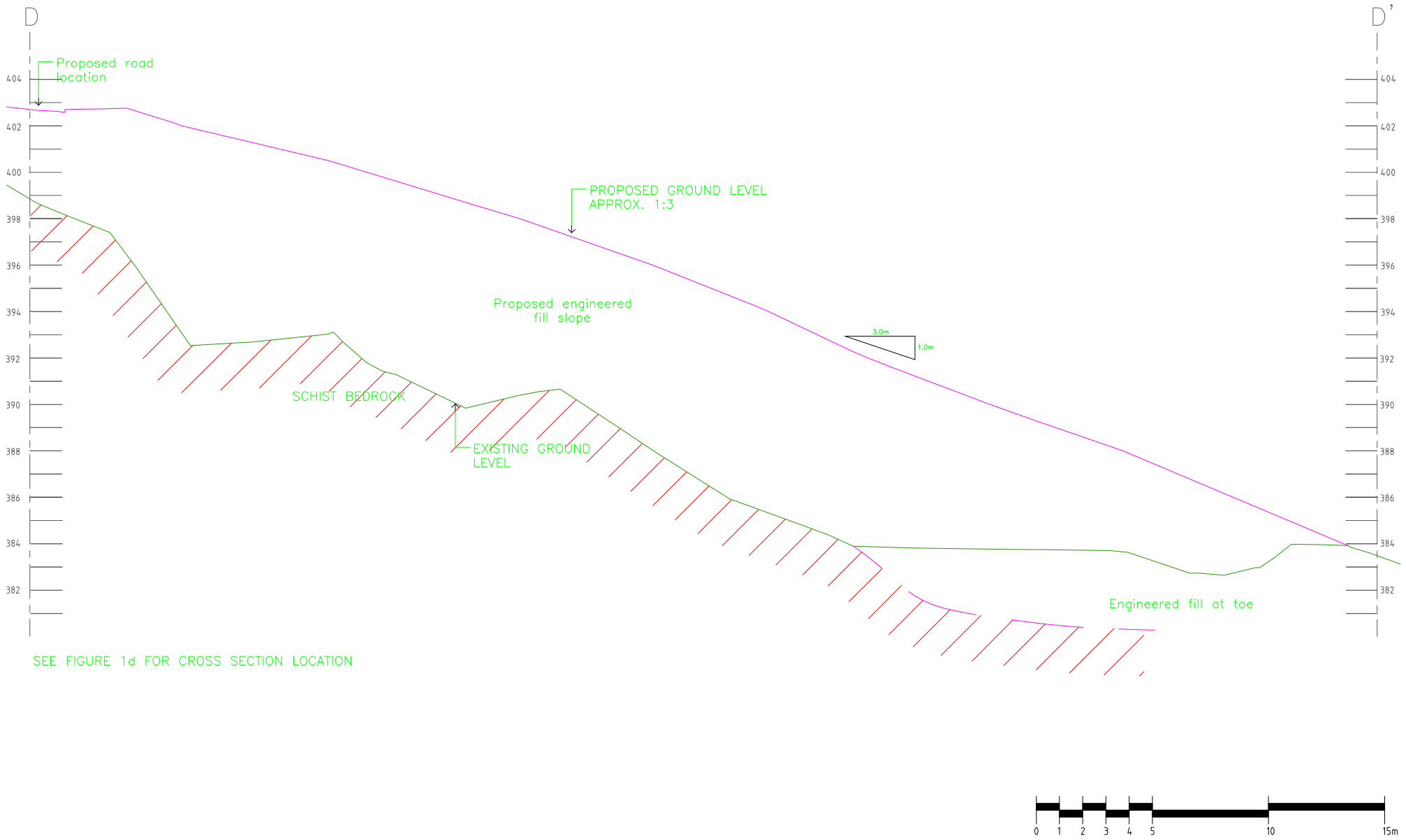
DRAFTING CHECKED		
APPROVED		
CADFILE :		
SCALES (AT A4 SIZE)		
PROJECT No. 880044		

Grant Hensman
Geotechnical Investigations
Middleton Road, Queenstown
Section C – C' (Chainage 410m)

FIG. No. Fig. 2c

REV. 0



SEE FIGURE 1d FOR CROSS SECTION LOCATION

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DRAFTING CHECKED		
APPROVED		
CADFILE :		
SCALES (AT A4 SIZE)		
PROJECT No. 880044		

Grant Hensman
Geotechnical Investigations
Middleton Road, Queenstown
Section D – D' (Proposed Fill beneath Road 3)

FIG. No. Fig. 2d

REV. 0

Appendix B: Test Pit and Scala Penetrometer Logs

TONKIN & TAYLOR

SCALA PENETROMETER LOG

Job No: *880044*
Project: *Middleton Road Qtn*

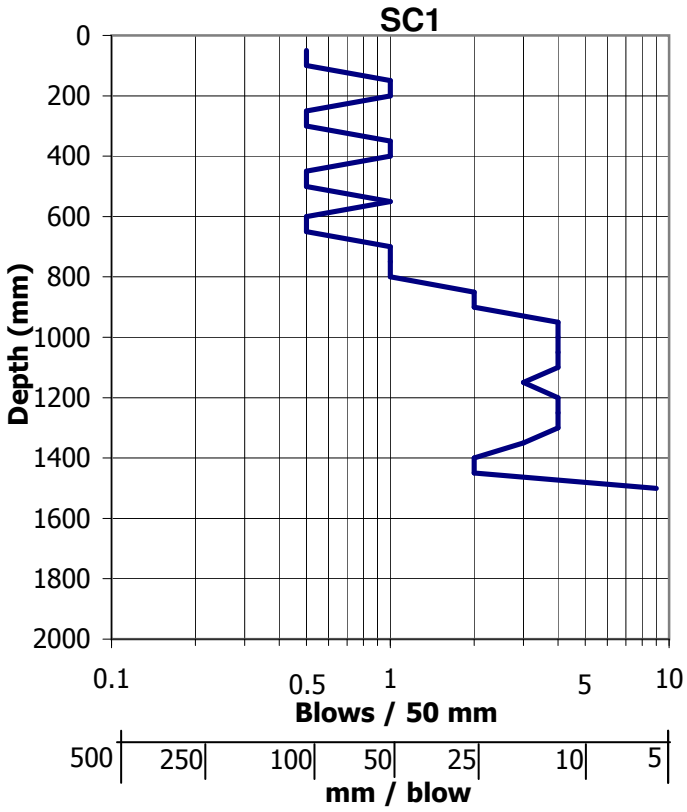
Date: *3/05/2007*
Operated by: *PGF*
Logged by: *MABN*

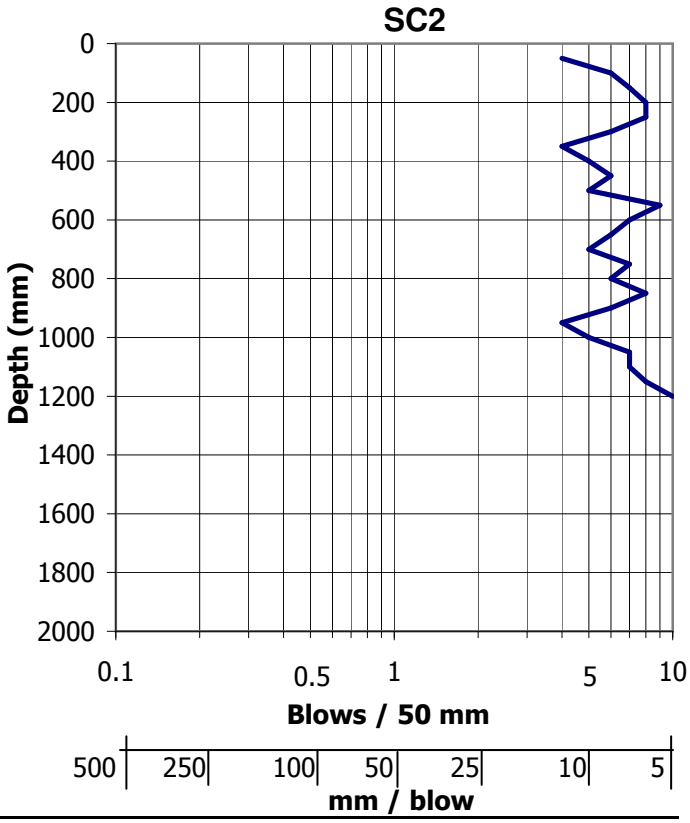
Test Number ***SC1 & SC2***

Sheet ***1***
of ***1***

SC1 Location: RL: 0 m	
mm Driven	No. of Blows
50	*0.5*
100	*0.5*
150	*1*
200	*1*
250	*0.5*
300	*0.5*
350	*1*
400	*1*
450	*0.5*
500	*0.5*
550	*1*
600	*0.5*
650	*0.5*
700	*1*
750	*1*
800	*1*
850	*2*
900	*2*
950	*4*
1000	*4*
1050	*4*
1100	*4*
1150	*3*
1200	*4*
1250	*4*
1300	*4*
1350	*3*
1400	*2*
1450	*2*
1500	*9*
1550	
1600	
1650	
1700	
1750	
1800	
1850	
1900	
1950	
2000	
Inferred Soil Type	
Watertable Depth	

SC2 Location: RL: 0m	
mm Driven	No. of Blows
50	*4*
100	*6*
150	*7*
200	*8*
250	*8*
300	*6*
350	*4*
400	*5*
450	*6*
500	*5*
550	*9*
600	*7*
650	*6*
700	*5*
750	*7*
800	*6*
850	*8*
900	*6*
950	*4*
1000	*5*
1050	*7*
1100	*7*
1150	*8*
1200	*10*
1250	
1300	
1350	
1400	
1450	
1500	
1550	
1600	
1650	
1700	
1750	
1800	
1850	
1900	
1950	
2000	
Inferred Soil Type	
Watertable Depth	





TONKIN & TAYLOR LTD
EXCAVATION LOG

EXCAVATION NUMBER: **TP 1**

PROJECT: Remarkables View Stage 2		Job Number: 880044
LOCATION: see site plan	Inclination: N/A	Direction: N/A

EASTING:	N/A mE	EQUIPMENT: 20T excavator	OPERATOR: Warren
NORTHING:	N/A mN	INFOMAP NO.	COMPANY: Beaver Construction
ELEVATION:	N/A m	DIMENSIONS:	HOLE STARTED: 16-Mar-07
METHOD:	N/A	EXCAV. DATUM: Ground Level	HOLE FINISHED: 16-Mar-07

PENETRATION (SPT)	GROUNDWATER / SEEPAGE	DEPTH (m)	GRAPHIC LOG	ENGINEERING DESCRIPTION: SOIL / ROCK CLASSIFICATION, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	WATER CONTENT	GEOLOGICAL: SOIL / ROCK TYPE, ORIGIN, MINERAL COMPOSITION, DEFECTS, STRUCTURE, FORMATION
		0.2		Orange/grey, sandy gravelly SILT with rootlets. Gravel is fine to medium, sub-angular to sub-rounded. Soft to firm.	very moist	TOPSOIL
		0.4		Grey, sandy SILT with rare gravel. Gravel is fine to medium, sub-angular to sub-rounded. Soft to firm. Very moist		ALLUVIAL SEDIMENT
		0.6		Orange/grey, sandy gravelly SILT with boulders. Gravel is fine to coarse, sub-angular to sub-rounded, boulders are rounded to max 200mm. Soft to firm.	wet	GLACIAL TILL
		0.8				
		1.0				
		1.2				
	→	1.4				
		1.6		Brownish grey, pelitic SCHIST. Moderately to highly weathered. Moderately strong. Foliation 30/220.		BEDROCK
		1.8				
		2.0		Total Depth = 1.8 m		
		2.2				
		2.4				
		2.6				
		2.8				
		3.0				
		3.2				

COMMENT: Pit sides recollapsing, tension cracks on surface (upslope), moderate seepage at 1.4m depth	Logged By: PGF
	Checked Date:
PHOTO REF.: N/A	Sheet: 1 of 1

TONKIN & TAYLOR LTD
EXCAVATION LOG

EXCAVATION NUMBER: **TP 2**

PROJECT: Remarkables View Stage 2		Job Number: 880044
LOCATION: see site plan	Inclination: N/A	Direction: N/A

EASTING:	N/A mE	EQUIPMENT: 20T excavator	OPERATOR: Warren
NORTHING:	N/A mN	INFOMAP NO.	COMPANY: Beaver Construction
ELEVATION:	N/A m	DIMENSIONS:	HOLE STARTED: 16-Mar-07
METHOD:	N/A	EXCAV. DATUM: Ground Level	HOLE FINISHED: 16-Mar-07

PENETRATION (SPT)	GROUNDWATER / SEEPAGE	DEPTH (m)	GRAPHIC LOG	ENGINEERING DESCRIPTION: SOIL / ROCK CLASSIFICATION, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	WATER CONTENT	GEOLOGICAL: SOIL / ROCK TYPE, ORIGIN, MINERAL COMPOSITION, DEFECTS, STRUCTURE, FORMATION
	NO SEEPAGE	0.1		Brownish grey, sandy gravelly SILT with cobbles and rootlets. Gravel is sub-angular to sub-rounded, fine to coarse, cobbles are angular to rounded. Soft to firm.	moist	COLLUVIUM
		0.2				
		0.3				
		0.4				
		0.5				
		0.6		Orange grey, silty SAND with rare gravel and boulders. Gravel is fine to medium, sub-rounded to rounded, boulders are rounded, max size 500mm. Medium dense.	moist	GLACIAL OUTWASH
		0.7		Brownish grey, silty sandy GRAVEL with cobbles and rare boulders. Gravel is angular to rounded, fine to coarse, cobbles are angular to sub-angular, boulders are rounded, max size 250mm. Medium dense to dense.	moist	GLACIAL TILL
		0.8				
		0.9				
		1.0				
		1.1				
		1.2		Brownish grey, pelitic SCHIST. Moderately to highly weathered. Weak to moderately strong. Foliation 32/218.		BEDROCK
		1.3				
		1.4		Total Depth = 1.3 m		
		1.5				
		1.6				

COMMENT: Unstable Pit sides, topsoil removed by others prior to ground investigation	Logged By: PGF
	Checked Date:
PHOTO REF.: N/A	Sheet: 1 of 1

TONKIN & TAYLOR LTD
EXCAVATION LOG

EXCAVATION NUMBER: **TP 3**

PROJECT: Remarkables View Stage 2		Job Number: 880044
LOCATION: see site plan	Inclination: N/A	Direction: N/A

EASTING:	N/A mE	EQUIPMENT: 20T excavator		OPERATOR: Warren	
NORTHING:	N/A mN	INFOMAP NO.		COMPANY: Beaver Construction	
ELEVATION:	N/A m	DIMENSIONS:		HOLE STARTED: 16-Mar-07	
METHOD:	N/A	EXCAV. DATUM: Ground Level		HOLE FINISHED: 16-Mar-07	

PENETRATION (SPT)	GROUNDWATER / SEEPAGE	DEPTH (m)	GRAPHIC LOG	ENGINEERING DESCRIPTION: SOIL / ROCK CLASSIFICATION, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	WATER CONTENT	GEOLOGICAL: SOIL / ROCK TYPE, ORIGIN, MINERAL COMPOSITION, DEFECTS, STRUCTURE, FORMATION
		0.0		Dark brown, silty SAND with rootlets.		TOPSOIL
		0.4		Greyish brown, sandy gravelly SILT with rare cobbles. Gravel is fine to medium, sub-angular to sub-rounded, cobbles are angular to sub-angular. Soft to firm.		COLLUVIUM
		0.8		Orangy grey, silty sandy GRAVEL with rare cobbles. Gravel is sub-angular to sub-rounded, cobbles are sub-angular. Loose to medium dense.		GLACIAL OUTWASH
		1.2		Brownish grey, sandy SILT with some gravel, cobbles, boulders and lenses of silty sand. Gravel is sub-angular to sub-rounded, cobbles are sub-rounded to rounded, boulders are sub-rounded to rounded, max size is 250mm. Firm to stiff.	moist	TILL
		1.6				
		2.0		Orangy grey, silty sandy GRAVEL with rare cobbles. Gravel is sub-angular to sub-rounded, cobbles are sub-angular. Medium dense to dense. Moist		TILL
		2.4		Brownish grey, sandy SILT with some gravel, cobbles, boulders and lenses of silty sand. Gravel is sub-angular to sub-rounded, cobbles are sub-rounded to rounded, boulders are sub-rounded to rounded, max size is 250mm. Stiff.	moist	TILL
		2.8				
	→	3.2		Brown, sandy SILT with some gravel, cobbles and lenses of silty sand. Gravel is sub-angular to sub-rounded, cobbles are sub-rounded to rounded, boulders are sub-rounded to rounded, max size is 250mm. Stiff.	moist	TILL
		3.6				
		4.0		Pelitic SCHIST. Moderately weathered. Moderately strong. Foliation 35/229.		BEDROCK
				Total Depth = 3.9 m		
		4.4				
		4.8				
		5.2				
		5.6				
		6.0				
		6.4				

COMMENT:	Logged By: PGF
	Checked Date:
PHOTO REF.: N/A	Sheet: 1 of 1

TONKIN & TAYLOR LTD
EXCAVATION LOG

EXCAVATION NUMBER: **TP 4**

PROJECT: Remarkables View Stage 2		Job Number: 880044
LOCATION: see site plan	Inclination: N/A	Direction: N/A

EASTING:	N/A mE	EQUIPMENT: 20T excavator	OPERATOR: Warren
NORTHING:	N/A mN	INFOMAP NO.	COMPANY: Beaver Construction
ELEVATION:	N/A m	DIMENSIONS:	HOLE STARTED: 16-Mar-07
METHOD:	N/A	EXCAV. DATUM: Ground Level	HOLE FINISHED: 16-Mar-07

PENETRATION (SPT)	GROUNDWATER / SEEPAGE	DEPTH (m)	GRAPHIC LOG	ENGINEERING DESCRIPTION: SOIL / ROCK CLASSIFICATION, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	WATER CONTENT	GEOLOGICAL: SOIL / ROCK TYPE, ORIGIN, MINERAL COMPOSITION, DEFECTS, STRUCTURE, FORMATION
	NO SEEPAGE	0.1		Orange brown, silty gravelly SAND with rootlets. Gravel is fine to coarse, sub-angular to sub-rounded. Loose to medium dense.	moist	COLLUVIUM
		0.2				
		0.3				
		0.4				
		0.5		Grey brown, silty gravelly SAND with rare cobbles. Gravel is fine to coarse, sub-rounded to rounded, cobbles are sub-rounded to rounded. Moderately dense.	moist	TILL
		0.6				
		0.7				
		0.8				
		0.9				
		1.0				
		1.1				
		1.2		Grey, pelitic SCHIST. Moderately weathered. Moderately strong. Foliation 28/230.		BEDROCK
		1.3				
		1.4		Total Depth = 1.3 m		
		1.5				
		1.6				

COMMENT:	Logged By: PGF
	Checked Date:
PHOTO REF.: N/A	Sheet: 1 of 1

TONKIN & TAYLOR LTD
EXCAVATION LOG

EXCAVATION NUMBER: **TP 5**

PROJECT: Remarkables View Stage 2		Job Number: 880044
LOCATION: see site plan	Inclination: N/A	Direction: N/A

EASTING:	N/A mE	EQUIPMENT: 20T excavator	OPERATOR: Warren
NORTHING:	N/A mN	INFOMAP NO.	COMPANY: Beaver Construction
ELEVATION:	N/A m	DIMENSIONS:	HOLE STARTED: 16-Mar-07
METHOD:	N/A	EXCAV. DATUM: Ground Level	HOLE FINISHED: 16-Mar-07

PENETRATION (SPT)	GROUNDWATER / SEEPAGE	DEPTH (m)	GRAPHIC LOG	ENGINEERING DESCRIPTION: SOIL / ROCK CLASSIFICATION, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	WATER CONTENT	GEOLOGICAL: SOIL / ROCK TYPE, ORIGIN, MINERAL COMPOSITION, DEFECTS, STRUCTURE, FORMATION
	NO SEEPAGE	0.1		Dark brown, TOPSOIL.		
		0.2		Orange brown, sandy gravelly SILT with rare cobbles. Gravel is sub-angular to sub-rounded, fine to coarse, cobbles are sub-angular to sub-rounded. Firm.	moist	COLLUVIUM
		0.3				
		0.4		Grey, pelitic SCHIST. Moderately weathered. Moderately strong.		BEDROCK
				Total Depth = 0.4 m		
		0.5				
		0.6				
		0.7				
		0.8				

COMMENT:	Logged By: PGF
	Checked Date:
PHOTO REF.: N/A	Sheet: 1 of 1

TONKIN & TAYLOR LTD
EXCAVATION LOG

EXCAVATION NUMBER: **TP 6**

PROJECT: Remarkables View Stage 2		Job Number: 880044
LOCATION: see site plan	Inclination: N/A	Direction: N/A

EASTING:	N/A mE	EQUIPMENT: 20T excavator	OPERATOR: Warren
NORTHING:	N/A mN	INFOMAP NO.	COMPANY: Beaver Construction
ELEVATION:	N/A m	DIMENSIONS:	HOLE STARTED: 16-Mar-07
METHOD:	N/A	EXCAV. DATUM: Ground Level	HOLE FINISHED: 16-Mar-07

PENETRATION (SPT)	GROUNDWATER / SEEPAGE	DEPTH (m)	GRAPHIC LOG	ENGINEERING DESCRIPTION: SOIL / ROCK CLASSIFICATION, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	WATER CONTENT	GEOLOGICAL: SOIL / ROCK TYPE, ORIGIN, MINERAL COMPOSITION, DEFECTS, STRUCTURE, FORMATION
	NO SEEPAGE	0.1		Orangy grey, silty gravelly SAND with cobbles. Gravel is sub-angular to rounded, fine to coarse, cobbles are sub-angular to rounded. Dense.		TILL
		0.2				
		0.3				
		0.4				
		0.5				
		0.6				
		0.7		Grey, pelitic SCHIST. Moderately weathered. Moderately strong. Foliation 25/222.		BEDROCK
		0.8				
		0.9		Total Depth = 0.8 m		
		1.0				
		1.1				
		1.2				
		1.3				
		1.4				
		1.5				
		1.6				

COMMENT: Topsoil removed from area by others prior to ground investigation	Logged By: PGF
	Checked Date:
PHOTO REF.: N/A	Sheet: 1 of 1

TONKIN & TAYLOR LTD
EXCAVATION LOG

EXCAVATION NUMBER: **TP 7**

PROJECT: Remarkables View Stage 2		Job Number: 880044
LOCATION: see site plan	Inclination: N/A	Direction: N/A

EASTING:	N/A mE	EQUIPMENT: 20T excavator	OPERATOR: Warren
NORTHING:	N/A mN	INFOMAP NO.	COMPANY: Beaver Construction
ELEVATION:	N/A m	DIMENSIONS:	HOLE STARTED: 16-Mar-07
METHOD:	N/A	EXCAV. DATUM: Ground Level	HOLE FINISHED: 16-Mar-07

PENETRATION (SPT)	GROUNDWATER / SEEPAGE	DEPTH (m)	GRAPHIC LOG	ENGINEERING DESCRIPTION: SOIL / ROCK CLASSIFICATION, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	WATER CONTENT	GEOLOGICAL: SOIL / ROCK TYPE, ORIGIN, MINERAL COMPOSITION, DEFECTS, STRUCTURE, FORMATION
	NO SEEPAGE	0.1		Dark brown, clayey SILT with rare gravel and rootlets. Gravel is fine to medium, sub-angular to sub-rounded. Soft.		TOPSOIL
		0.4		Orange brown, sandy gravelly SILT with rare cobbles. Gravel is fine to coarse, sub-angular to sub-rounded, cobbles are sub-angular to sub-rounded. Firm.	moist	COLLUVIUM
		0.5		Grey, pelitic SCHIST. Moderately weathered. Moderately strong. Foliation 31/226.		BEDROCK
				Total Depth = 0.5 m		
		0.6				
		0.7				
		0.8				

COMMENT:	Logged By: PGF
	Checked Date:
PHOTO REF.: N/A	Sheet: 1 of 1

TONKIN & TAYLOR LTD
EXCAVATION LOG

EXCAVATION NUMBER: **TP 8**

PROJECT: Remarkables View Stage 2		Job Number: 880044
LOCATION: see site plan	Inclination: N/A	Direction: N/A

EASTING:	N/A mE	EQUIPMENT: 20T excavator	OPERATOR: Warren
NORTHING:	N/A mN	INFOMAP NO.	COMPANY: Beaver Construction
ELEVATION:	N/A m	DIMENSIONS:	HOLE STARTED: 16-Mar-07
METHOD:	N/A	EXCAV. DATUM: Ground Level	HOLE FINISHED: 16-Mar-07

PENETRATION (SPT)	GROUNDWATER / SEEPAGE	DEPTH (m)	GRAPHIC LOG	ENGINEERING DESCRIPTION: SOIL / ROCK CLASSIFICATION, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	WATER CONTENT	GEOLOGICAL: SOIL / ROCK TYPE, ORIGIN, MINERAL COMPOSITION, DEFECTS, STRUCTURE, FORMATION
	NO SEEPAGE	0.1		Dark brown, clayey SILT with rootlets. Soft.		TOPSOIL
		0.2				
		0.3		Orangy brown, sandy gravelly SILT. Gravel is fine to coarse, sub-angular to sub-rounded. Soft to firm.	moist	COLLUVIUM
		0.4				
		0.5				
		0.6				
		0.7				
		0.8		Pelitic SCHIST. Moderately weathered. Moderately strong. Foliation 18/216.		BEDROCK
		0.9		Total Depth = 0.8 m		
		1.0				
		1.1				
		1.2				
		1.3				
		1.4				
		1.5				
		1.6				

COMMENT:	Logged By: PGF
	Checked Date:
PHOTO REF.: N/A	Sheet: 1 of 1

TONKIN & TAYLOR LTD
EXCAVATION LOG

EXCAVATION NUMBER: **TP 9**

PROJECT: Remarkables View Stage 2		Job Number: 880044
LOCATION: see site plan	Inclination: N/A	Direction: N/A

EASTING:	N/A mE	EQUIPMENT: 20T excavator	OPERATOR: Warren
NORTHING:	N/A mN	INFOMAP NO.	COMPANY: Beaver Construction
ELEVATION:	N/A m	DIMENSIONS:	HOLE STARTED: 16-Mar-07
METHOD:	N/A	EXCAV. DATUM: Ground Level	HOLE FINISHED: 16-Mar-07

PENETRATION (SPT)	GROUNDWATER / SEEPAGE	DEPTH (m)	GRAPHIC LOG	ENGINEERING DESCRIPTION: SOIL / ROCK CLASSIFICATION, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	WATER CONTENT	GEOLOGICAL: SOIL / ROCK TYPE, ORIGIN, MINERAL COMPOSITION, DEFECTS, STRUCTURE, FORMATION
	NO SEEPAGE	0.1		Dark brown, clayey SILT with rootlets. Soft.		TOPSOIL
		0.2				
		0.3		Orangy brown, sandy gravelly SILT. Gravel is fine to coarse, sub-angular to sub-rounded. Soft to firm.	moist	COLLUVIUM
		0.4				
		0.5				
		0.6				
		0.7				
		0.8		Pelitic SCHIST. Moderately weathered. Moderately strong. Foliation 18/216.		BEDROCK
		0.9		Total Depth = 0.8 m		
		1.0				
		1.1				
		1.2				
		1.3				
		1.4				
		1.5				
		1.6				

COMMENT:	Logged By: PGF
	Checked Date:
PHOTO REF.: N/A	Sheet: 1 of 1

TONKIN & TAYLOR LTD
EXCAVATION LOG

EXCAVATION NUMBER: **TP 10**

PROJECT: Remarkables View Stage 2		Job Number: 880044
LOCATION: see site plan	Inclination: N/A	Direction: N/A

EASTING:	N/A mE	EQUIPMENT: 20T excavator	OPERATOR: Warren
NORTHING:	N/A mN	INFOMAP NO.	COMPANY: Beaver Construction
ELEVATION:	N/A m	DIMENSIONS:	HOLE STARTED: 16-Mar-07
METHOD:	N/A	EXCAV. DATUM: Ground Level	HOLE FINISHED: 16-Mar-07

PENETRATION (SPT)	GROUNDWATER / SEEPAGE	DEPTH (m)	GRAPHIC LOG	ENGINEERING DESCRIPTION: SOIL / ROCK CLASSIFICATION, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	WATER CONTENT	GEOLOGICAL: SOIL / ROCK TYPE, ORIGIN, MINERAL COMPOSITION, DEFECTS, STRUCTURE, FORMATION
	NO SEEPAGE	0.1		Dark brown, clayey SILT with rootlets. Soft.		TOPSOIL
		0.2				
		0.3		Orangy brown, sandy gravelly SILT. Gravel is fine to coarse, sub-angular to sub-rounded. Soft to firm.	moist	COLLUVIUM
		0.4				
		0.5				
		0.6				
		0.7				
		0.8		Pelitic SCHIST. Moderately weathered. Moderately strong. Foliation 18/216.		BEDROCK
		0.9		Total Depth = 0.8 m		
		1.0				
		1.1				
		1.2				
		1.3				
		1.4				
		1.5				
		1.6				

COMMENT:	Logged By: PGF
	Checked Date:
PHOTO REF.: N/A	Sheet: 1 of 1

TONKIN & TAYLOR LTD
EXCAVATION LOG

EXCAVATION NUMBER: **TP 11**

PROJECT: Remarkables View Stage 2			Job Number: 880044
LOCATION: see site plan	Inclination:	N/A	Direction: N/A

EASTING:	N/A mE	EQUIPMENT: 20T excavator		OPERATOR: Warren	
NORTHING:	N/A mN	INFOMAP NO.		COMPANY: Beaver Construction	
ELEVATION:	N/A m	DIMENSIONS:		HOLE STARTED: 16-Mar-07	
METHOD:	N/A	EXCAV. DATUM: Ground Level		HOLE FINISHED: 16-Mar-07	

PENETRATION (SPT)	GROUNDWATER / SEEPAGE	DEPTH (m)	GRAPHIC LOG	ENGINEERING DESCRIPTION: SOIL / ROCK CLASSIFICATION, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	WATER CONTENT	GEOLOGICAL: SOIL / ROCK TYPE, ORIGIN, MINERAL COMPOSITION, DEFECTS, STRUCTURE, FORMATION
		0.0		Dark brown, sandy SILT with rootlets. Soft.		TOPSOIL
		0.4		Orange brown, sandy gravelly SILT with rare cobbles. Gravel is sub-angular to sub-rounded, fine to coarse, cobbles are sub-angular to sub-rounded. Firm. Moist.		COLLUVIIUM
		0.8		Dark grey, silty SAND with some gravel and cobbles. Gravel is sub-rounded to rounded, fine to coarse, cobbles are sub-rounded to rounded. Dense.	moist	GLACIAL TILL
		1.2				
		1.6		Orange grey, silty SAND with some gravel and cobbles and rare boulders. Gravel is sub-rounded to rounded, fine to coarse, cobbles are sub-rounded to rounded, boulders are sub-rounded, max size 200mm. Dense.	moist	GLACIAL TILL
		2.0				
		2.4				
	▶	2.8				
		3.2				
		3.6		Grey, pelitic SCHIST. Moderately weathered. Moderately strong.		BEDROCK
				Total Depth = 3.5 m		
		4.0				
		4.4				
		4.8				
		5.2				
		5.6				
		6.0				
		6.4				

COMMENT: Light seepage at 2.8m	Logged By: PGF
	Checked Date:
PHOTO REF.: N/A	Sheet: 1 of 1

TONKIN & TAYLOR LTD
EXCAVATION LOG

EXCAVATION NUMBER: **TP 12**

PROJECT: Remarkables View Stage 2		Job Number: 880044
LOCATION: see site plan	Inclination: N/A	Direction: N/A

EASTING:	N/A mE	EQUIPMENT: 20T excavator	OPERATOR: Warren
NORTHING:	N/A mN	INFOMAP NO.	COMPANY: Beaver Construction
ELEVATION:	N/A m	DIMENSIONS:	HOLE STARTED: 16-Mar-07
METHOD:	N/A	EXCAV. DATUM: Ground Level	HOLE FINISHED: 16-Mar-07

PENETRATION (SPT)	GROUNDWATER / SEEPAGE	DEPTH (m)	GRAPHIC LOG	ENGINEERING DESCRIPTION: SOIL / ROCK CLASSIFICATION, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	WATER CONTENT	GEOLOGICAL: SOIL / ROCK TYPE, ORIGIN, MINERAL COMPOSITION, DEFECTS, STRUCTURE, FORMATION
	NO SEEPAGE	0.0		Dark brown, sandy SILT with rootlets. Soft.		TOPSOIL
		0.2		Orange brown, sandy gravelly SILT. Gravel is fine to coarse, angular to sub-rounded. Soft to firm.	moist	COLLUVIUM
		0.4				
		0.6		Yellowish grey, silty gravelly SAND with cobbles and boulders up to 200mm. Gravel is fine to coarse, sub-angular to rounded. Medium dense to dense.	moist	TILL
		0.8				
		1.0				
		1.2				
		1.4		Greenish brown, sandy silty GRAVEL. Gravel is fine to coarse, sub-angular to rounded. Dense.	moist	TILL
		1.6				
		1.8		Grey, pelitic SCHIST. Moderately weathered. Moderately strong.		BEDROCK
				Total Depth = 1.7 m		
		2.0				
		2.2				
		2.4				
		2.6				
		2.8				
		3.0				
		3.2				

COMMENT:	Logged By: PGF
	Checked Date:
PHOTO REF.: N/A	Sheet: 1 of 1

TONKIN & TAYLOR LTD
EXCAVATION LOG

EXCAVATION NUMBER:
TP 13

PROJECT: Remarkables View Stage 2		Job Number: 880044
LOCATION: see site plan	Inclination: N/A	Direction: N/A

EASTING:	N/A mE	EQUIPMENT: 20T excavator	OPERATOR: Warren
NORTHING:	N/A mN	INFOMAP NO.	COMPANY: Beaver Construction
ELEVATION:	N/A m	DIMENSIONS:	HOLE STARTED: 16-Mar-07
METHOD:	N/A	EXCAV. DATUM: Ground Level	HOLE FINISHED: 16-Mar-07

PENETRATION (SPT)	GROUNDWATER / SEEPAGE	DEPTH (m)	GRAPHIC LOG	ENGINEERING DESCRIPTION: SOIL / ROCK CLASSIFICATION, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	WATER CONTENT	GEOLOGICAL: SOIL / ROCK TYPE, ORIGIN, MINERAL COMPOSITION, DEFECTS, STRUCTURE, FORMATION
	NO SEEPAGE	0.1		Dark brown, clayey SILT with rootlets. Soft.		TOPSOIL
		0.2		Orangy brown, sandy gravelly SILT. Gravel is fine to coarse, sub-angular to sub-rounded. Soft to firm.	moist	COLLUVIUM
		0.3				
		0.4		Pelitic SCHIST. Moderately weathered. Moderately strong. Foliation 18/216.		BEDROCK
				Total Depth = 0.4 m		
		0.5				
		0.6				
		0.7				
		0.8				

COMMENT:	Logged By: PGF
	Checked Date:
PHOTO REF.: N/A	Sheet: 1 of 1

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Attachment C

Amended Policies

Rule 7.4.9

~~Dwelling,~~ Residential Unit, ~~Residential Flat~~

~~7.4.9.1 One (1) per site in Arrowtown.~~

~~7.4.9.2 For all other locations, two (2) or less per site.~~

7.4.9.1 Development of no greater than one residential unit per 450m² net site area, except within the following areas:

(a) The Queenstown Heights Overlay Area where the maximum site density shall be one residential unit per 1500m² net site area with the exception of Lot 2 DP 409336 where there shall be no more than 412 residential units.

Note – Additional rates and development contributions may apply for multiple units located on one site.

Rule 7.4.10

~~Dwelling,~~ Residential Unit, ~~Residential Flat~~

~~7.4.10.1 Two (2) or more per site in Arrowtown.~~

~~7.4.10.2 For all other locations, three (3) or more per site.~~

7.4.10.1 Development of no greater than one residential unit per 300m² net site area, except within the following areas:

(a) Site located within the Queenstown Heights Overlay Area with the exception of Lot 2 DP 409336 where there shall be no more than 412 residential units.

(b) Sites located within the Air Noise Boundary or located between the Air Noise Boundary and Outer Control Boundary of Queenstown Airport.

Control ~~Discretion~~ is ~~restricted~~ reserved to all of the following:

- ~~The location, external appearance, site layout and design of buildings and fences~~
- ~~The extent to which~~ How the design advances housing diversity and promotes sustainability either through construction methods, design or function
- Privacy for the subject site and neighbouring residential units
- In Arrowtown, ~~the extent to which the development responds positively to~~ consistency with Arrowtown's character, utilising the Arrowtown Design Guidelines ~~2006~~ 2016 as a guide
- ~~The extent to which the development positively addresses the s~~Street activation

- Building dominance ~~The extent to which building mass is broken down and articulated in order to reduce impacts~~ on neighbouring properties and the public realm
- Parking and access: safety, and efficiency and impacts to on-street parking and neighbours
- Design and integration of landscaping. ~~The extent to which landscaped areas are well integrated into the design of the development and contribute meaningfully to visual amenity and streetscape, including the use of small trees, shrubs or hedges that will reach at least 1.8m in height upon maturity.~~
- Natural Hazards. ~~Where a site is subject to any natural hazard and the proposal results in an increase in gross floor area: an assessment by a suitably qualified person is provided that addresses the nature and degree of risk the hazard(s) pose to people and property, whether the proposal will alter the risk to any site, and the extent to which such risk can be avoided or sufficiently mitigated.~~

Note – Additional rates and development contributions may apply for multiple units located on one site.

Rule 27.4.9 (Standards for Subdivision Activities) of Chapter 27 is amended as follows:

Rule 27.6

27.6.1 No lots to be created by subdivision, including balance lots, shall have a net site area or where specified, average, less than the minimum specified.

Residential	Queenstown Heights Sub Zone	~~1500m²~~ No minimum

Section 32AA

The costs, benefits, efficiency, and effectiveness of the recommended rules are set out below, showing additions to the notified text in underlining and deletions in ~~strike through text~~:

Rule 7.4.9

~~Dwelling,~~ Residential Unit, ~~Residential Flat~~

~~7.4.9.1 One (1) per site in Arrowtown.~~

~~7.4.9.2 For all other locations, two (2) or less per site.~~

7.4.9.1 Development of no greater than one residential unit per 450m² net site area, except within the following areas:

(a) The Queenstown Heights Overlay Area where the maximum site density shall be one residential unit per 1500m² net site area with the exception of Lot 2 DP 409336 where there shall be no more than 749 residential units.

Note – Additional rates and development contributions may apply for multiple units located on one site.

Costs	Benefits
• The 450m² net site area represents a decrease in the permitted density for the zone.	• The redrafted wording of the rule takes into account the size of the site and responds to potential geotechnical constraints on Lot 2 DP 409336. • The notified policy was not supported by s32 analysis.
Efficiency	**Effectiveness**
• This change is efficient as it correlates with the minimum site area specified in Chapter 27: Subdivision and Development for the zone and the Queenstown Heights Overlay Area.	• These changes are effective as they remove ambiguity as to what density is permitted within the zone regardless of the number of dwellings proposed on a site and provide a definitive maximum for Lot 2 DP 409336.

Rule 7.4.10

~~Dwelling,~~ Residential Unit, ~~Residential Flat~~

~~7.4.10.1 Two (2) or more per site in Arrowtown.~~

~~7.4.10.2 For all other locations, three (3) or more per site.~~

7.4.10.1 Development of no greater than one residential unit per 300m² net site area, except within the following areas:

(a) Site located within the Queenstown Heights Overlay Area with the exception of Lot 2 DP 409336 where there shall be no more than 749 residential units.

(b) Sites located within the Air Noise Boundary or located between the Air Noise Boundary and Outer Control Boundary of Queenstown Airport.

Control ~~Discretion~~ is ~~restricted~~ reserved to all of the following:

- ~~The location, external appearance, site layout and design of buildings and fences~~
- ~~The extent to which~~ How the design advances housing diversity and promotes sustainability either through construction methods, design or function
- Privacy for the subject site and neighbouring residential units
- In Arrowtown, ~~the extent to which the development responds positively to~~ consistency with Arrowtown's character, utilising the Arrowtown Design Guidelines ~~2006~~ 2016 as a guide
- ~~The extent to which the development positively addresses the s~~Street activation

- Building dominance ~~The extent to which building mass is broken down and articulated in order to reduce impacts~~ on neighbouring properties and the public realm
- Parking and access: safety, and efficiency and impacts to on-street parking and neighbours
- Design and integration of landscaping. ~~The extent to which landscaped areas are well integrated into the design of the development and contribute meaningfully to visual amenity and streetscape, including the use of small trees, shrubs or hedges that will reach at least 1.8m in height upon maturity.~~
- Natural Hazards. ~~Where a site is subject to any natural hazard and the proposal results in an increase in gross floor area: an assessment by a suitably qualified person is provided that addresses the nature and degree of risk the hazard(s) pose to people and property, whether the proposal will alter the risk to any site, and the extent to which such risk can be avoided or sufficiently mitigated.~~

Note – Additional rates and development contributions may apply for multiple units located on one site.

Costs	**Benefits**
• Applying a restricted discretionary activity status for residential units between 300m² and 449m² net site area will trigger consent regardless of the number of dwellings. This results in additional costs for developers.	• The redrafted wording of the rule takes into account the size of the site. • This rule allows control over the design of residential units on smaller lots to ensure that adverse effects are avoided, remedied or mitigated. • The notified policy was not supported by s32 analysis.
Efficiency	**Effectiveness**
• These changes are effective as they remove ambiguity as to what density is permitted within the zone regardless of the number of dwellings. proposed on a site. • The change collaborates with minimum allotment size in the Queenstown Height Overlay Area.	• These changes are effective as they remove ambiguity as to what density is permitted within the zone regardless of the number of dwellings proposed on a site.

Rule 27.6.1

Recommended Amendments to Rules 27.6.1 – Minimum Lot Area Table

27.6.2 No lots to be created by subdivision, including balance lots, shall have a net site area or where specified, average, less than the minimum specified.

Residential	Queenstown Heights Sub Zone	~~1500m²~~ No minimum

Costs	Benefits
• No minimum lot size may affect living amenity, however given Low Density Residential development controls this will be effectively managed.	• The notified Rule was not supported by s32 analysis and lead to an inefficient use of land zoned residential. • The amended Rule will enable compact urban form and increase density for the residential zone.
Efficiency	**Effectiveness**
• The change collaborates with Low Density Residential density provisions.	• These changes are effective as they allow greater flexibility in subdivision design.