



GeoSolve Ref: 180668
31 January 2019

Highlander Trusts Ltd
c/o Don MacLachlan
don@lindix.co.nz

Attention: Don MacLachlan

Coneburn Development Site, Kingston Road, Queenstown Preliminary Geotechnical Report

1.0 Introduction

This letter summarises the results of a preliminary geotechnical assessment completed by GeoSolve Limited for the Coneburn development site, Kingston Road, Queenstown.

The work described in this letter has been completed in accordance with the terms and conditions outlined in Geosolve proposal reference number 180668.

The aim of this assessment is to summarise the geotechnical work completed and provide engineering considerations associated with residential development at the site. The assessment concludes that, from a geotechnical perspective, it will be feasible to develop the site for residential purposes.

The opinions and conclusions presented in this report are based on the following sources of information:

- A walkover inspection of the site by an engineering geologist,
- A review of historic information currently held on the GeoSolve and Queenstown Lake District Council (QLDC) database;
- A test pit investigation, comprising 9 test pits to depths ranging between 2 m and 4.5 m below the existing ground surface, conducted on the 10 October 2018.
- A Cone Penetration Test (CPT) investigation, comprising 17 CPT probes to a target depth of 20 m below the existing ground surface, conducted on the 30 & 31 October 2018, and;
- A scala penetrometer investigation, conducted on the 23 November 2018.

The test locations and logs are contained in Appendices A and B respectively.

2.0 Site Description

The site is accessed from State Highway 6 and Woolshed Road and lies in the valley floor between the Remarkables and the low hills on the southern side of Peninsula Hill.

The site is currently undeveloped farmland.

A creek is located in the central lower part of the site and flows north towards the Kawarau River, small tributaries and irrigation ditches flow into this creek. The local topography gently slopes towards this creek from the eastern and western site boundaries, i.e. State Highway 6 and the lower slopes of Peninsula Hill respectively.

3.0 Proposed Development

Geosolve understands future development will comprise residential dwellings with associated access roads and services. Dwellings comprising lightweight pre-fab timber frame structures located on shallow timber pile foundations have been proposed. Parts of the site may also be developed with more standard methodologies, using concrete slabs etc.

4.0 Subsurface Conditions

Regional Geology

The site is located within the Wakatipu Basin, a feature formed predominantly by glacial advances. The Otago Schist bedrock underlying the basin has been extensively scoured by ice and lies at considerable depth below this site. Soil overlying the Otago Schist in this region includes glacial till, lake sediments and beach deposits. During post-glacial times extensive landslides developed on the steep schist mountain slopes above the Wakatipu Basin. Pleistocene glacial deposits on the edges of the basin have been topped by more recent alluvial fan deposits and deltaic fan sediments aggrading into Lake Wakatipu.

No active fault traces are known by GeoSolve to exist in the immediate vicinity of the site, an inactive fault trace is inferred to be present 100-200 m to the north east. However, a significant seismic risk exists in the region from potentially strong ground shaking associated with 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 8 will occur on the Alpine fault within the next 50 years.

Stratigraphy

The subsurface soils observed during site investigations typically comprise:

- 0.3 m of topsoil overlying;
- 0.0-4.2+ m of alluvial fan deposits
- 0.0- 20+ m (extent not proven) of lake sediment
- Schist bedrock

Topsoil was observed at the surface of all test pits to a depth of 0.3 m.

Alluvial fan deposit was observed to underlie the topsoil in TP 6 to a depth of at least 4.5 m, extent of test pit. The alluvial fan deposit comprises loose to medium dense, sandy

GRAVEL with varying components of cobbles and boulders, and firm, sandy SILT with lenses of sand and gravel.

Granular alluvial fan materials were also observed in surface exposures and shallow excavations undertaken around the streams that exit the toe of the slope on the western side of the boundary.

Lake sediments were observed at the locations of TPs 1-5 and 7-9 inclusive and were encountered below the surficial topsoil at a depth of 0.3 m. The lake sediment comprises soft, SILT with trace of sand and clay and lenses of sand and gravel. The bottom of these sediments were inferred not to be encountered.

Schist bedrock was observed outcropping on the lower slopes of Peninsular Hill adjacent to the western boundary of the site. Beach gravels were observed to overlie the schist bedrock at some locations on these lower slopes. It is inferred that schist bedrock underlies the lake sediments at depth adjacent to the western boundary of the site.

Full descriptions of the observed subsurface stratigraphy at the site is provided in the test pit logs in Appendix B.

Groundwater

Perched groundwater seepage was encountered at shallow depths within the lake sediment in Test Pits 1-5 and 7-9 at depths ranging between 0.6 and 2.8 m. Anecdotal evidence indicates shallow seepage is subject to seasonal variations in response to rainfall and snow melt. Saturation of the upper soil column is expected to vary throughout the year. Lateral variation across the site is also expected depending on the connectivity of the more permeable granular lenses.

The CPT probe holes were also dipped following testing. Groundwater was encountered at depths ranging between 1.1 and 4.6 m. No groundwater was encountered at the locations of CPTs 2, 3 and 12, all of which extended to depths of 20 m.

A review of available data indicates that regional groundwater levels are approximately 15-20+ m below the current site level.

5.0 Hazard Mapping

Mapped Hazards

Queenstown Lakes District Council (QLDC) hazard mapping indicates the subject site to be affected by an alluvial fan and liquefaction hazard risk (Figure 1.1).

The site is located within an area with soils identified as being 'susceptible' to liquefaction and 'Liquefaction Risk: possibly moderate (LIC 2)'. The liquefaction risk zones cover the extent of the site, apart from a small area by the western site boundary.

The liquefaction risk zones were determined by Opus (2002) and Tonkin & Taylor (2012) by analysing published geological information, data held on the T&T database and ORC well and groundwater data.

The site is also located within an area affected by alluvial fan hazards 'fan recently active', 'fan less recently active' and 'floodwater-dominated (active)'. The hazard zones encroach into the north western, southern and eastern areas of the site, as shown on Figure 1.1. The hazards zones were determined by Geological and Nuclear Sciences (GNS) in 2007 and 2008 by regional scale 1:10,000 and 1:50,000 mapping.

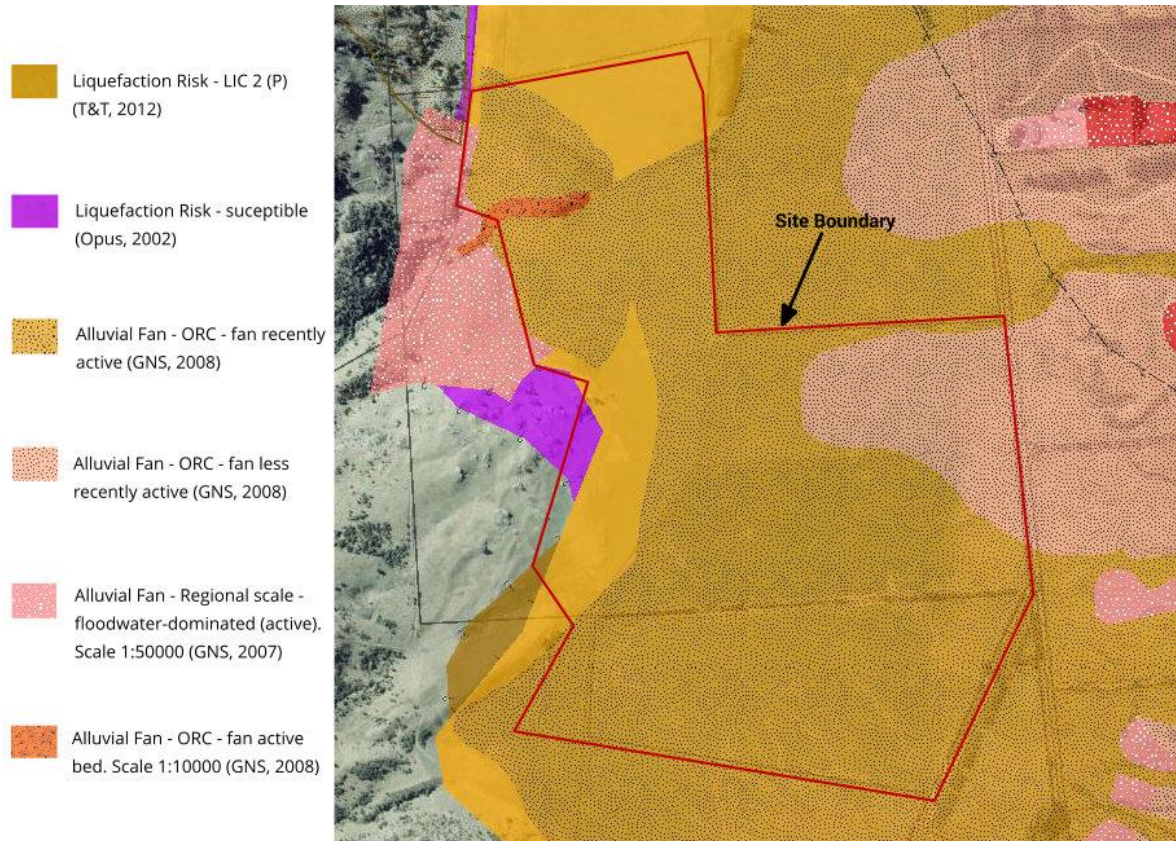


Figure 1.1: QLDC liquefaction hazard and alluvial fan hazard mapping extents relative to the site boundary

Other

A risk of rock roll is potentially present from the rock bluffs located on the lower south east slopes of Peninsula Hill, which may affect the north west corner of the site.

6.0 Preliminary Engineering Considerations

The recommendations and opinions contained in this report are based upon ground investigation data obtained at discrete locations and historical information held on the GeoSolve database. The nature and continuity of subsoil conditions away from the investigation locations is inferred and cannot be guaranteed.

Liquefaction Potential

The underlying lake sediments and alluvial fan deposits are assessed to be subject to liquefaction induced ground deformation and associated differential settlement of building foundations under seismic loading.

A preliminary liquefaction analysis for ULS design seismic loading conditions has been conducted for the subject site, adopting the methodology outlined in Ministry of Business, Innovation and Employment (MBIE) guidelines. The calculated preliminary vertical ground settlements under ULS seismic loading conditions are shown in Figure 1.2.

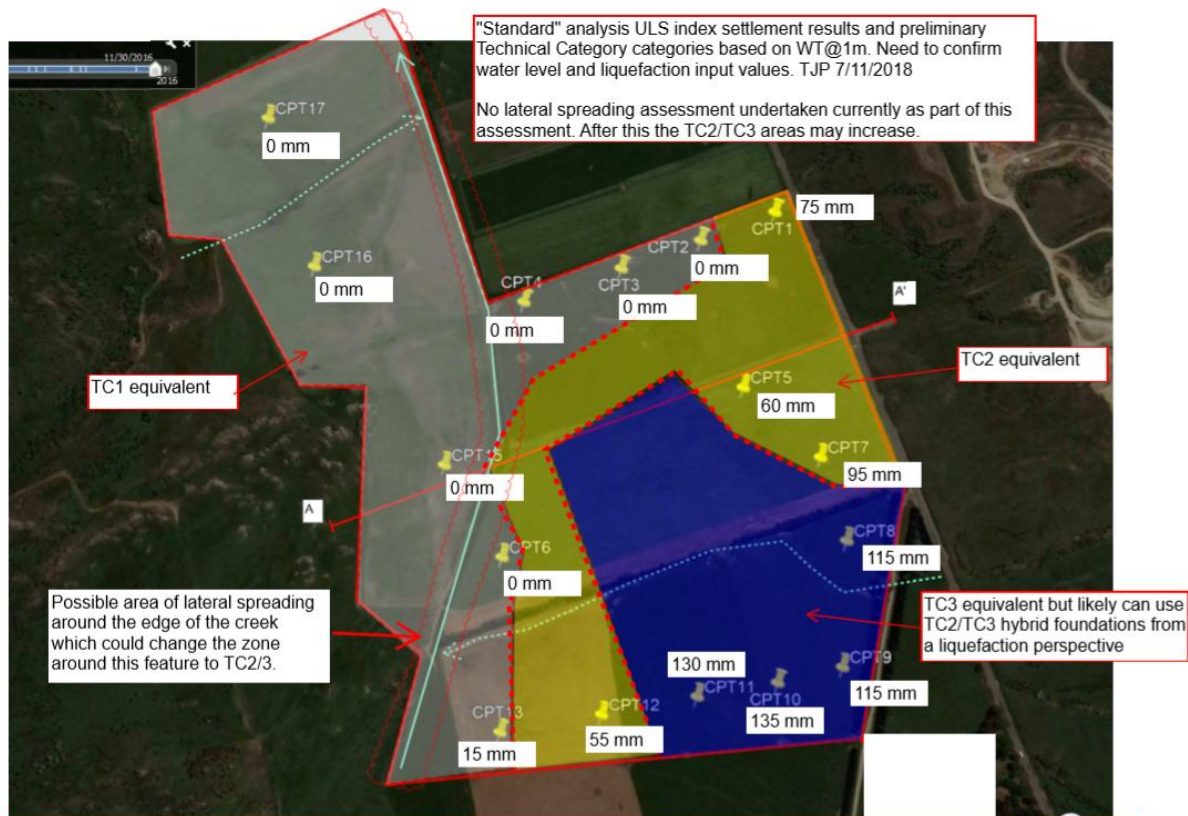


Figure 1.2: Showing the preliminary ULS index settlement results.

Figure 1.2 provides a summary of the standard MBIE liquefaction analysis procedure for each CPT test. Overall there is a clear trend of worsening risk of liquefaction induced ground deformation towards the south and east, with surface settlements of up to 135 mm shown in this area under ULS seismic loading conditions. It should be noted that a worst-case groundwater level of 1.0 m was used for the preliminary liquefaction assessment, as this was observed in many of the test pits and some of the CPT's.

As discussed in Section 4, groundwater is expected to be perched at shallow depths, with the regional groundwater being at 15-20m+ depth. The liquefaction analysis is therefore considered to be conservative. A deeper groundwater level will improve the vertical ground settlements shown in Fig 1.2 above.

No lateral spreading assessment for the ground adjacent to the creek has been undertaken as part of this preliminary assessment. Based on the results of this assessment it is possible that the land around the creek may meet TC2/TC3 performance criteria.

To refine the liquefaction analysis additional investigations, including the installation and monitoring of piezometers, would be required to model the groundwater regime with more accuracy. In the absence of such data, conservative assumptions have been applied and it is possible that the extent of liquefaction prone land may be reduced when assessed with more accuracy. Similarly, this analysis has not accounted for the prospect of modifications resulting from civil works that may be targeted to reduced liquefaction risk.

Alluvial Fan

A specific alluvial fan assessment has not been completed by Geosolve for the purposes of this assessment however will need to be considered for future development. Based on residential developments in similar locations, particularly the Hanley's Farm sub-division 500 m to the south, appropriate management of the risk associated with alluvial fan activity is expected to be achievable.

Foundation Bearing Capacity

The surface soils at the site will generally provide a reduced bearing capacity and do not meet 'good ground' requirements as outlined in NZS3604 (i.e. 300kPa allowable bearing capacity). Scala testing to 2 m depth was undertaken adjacent to test pits 1, 4, 7 and 9. The soil conditions in these areas comprised low strength lake sediments. Blow counts indicate a significant variation in bearing capacity. In the upper 1 m ultimate bearing capacities of 60-180 kPa are inferred, at depths greater than 1 m, ultimate bearing capacities of 120-300 kPa are shown.

Standard shallow foundations, e.g. strip footings or waffle slab systems, are unlikely to be practical in many areas without ground improvement which would probably comprise undercutting weak materials and replacement with engineered fill.

If 'good ground' (excluding bearing capacity criteria) with 200kPa is encountered as per the MBIE Guidance document (i.e. approx. 2 blows per 100 mm of a Scala) then a MBIE Type 1 Surface Structure could be used for all MBIE TC1, TC2 and possibly TC3 areas with minor to moderate lateral spreading risk.

The results of the Scala investigation indicate weak surficial soils are present within the outlined TC1 and TC2 areas (Figure 1.2) and a deeper embedment depth of the timber pole foundation system is likely to be required for an MBIE Type 1 Surface Structure.

Based on the results of a preliminary scala investigation (4 four test locations) a minimum embedment depth of 1.2 m is required. For cost estimates a range of more conservative embedment depths is recommended, e.g. 1.2 to 2.5 m.

Further investigation will be required to provide foundation options for the subject site, and once building platforms are known could be done on a building by building basis to provide the most cost-effective approach. the discussed options are preliminary. It should be noted that if a higher lateral spreading risk, liquefaction hazard potential and/or lower bearing capacity is identified for a particular site then shallow ground improvement may be required as part of the foundation system.

Pavement Design

Pavement subgrade materials are expected to predominately comprise lake sediments.

Groundwater seepage was encountered within the lake sediments at shallow depths of between 0.6 and 2.8 m. Due to the presence of surficial groundwater seepage it is likely that subdrains will be required under kerbs to maintain a dry pavement subgrade.

Preliminary assessment for costing purposes indicates CBR values (10th percentile) for the pavement subgrade of approximately 2% are likely to be appropriate for this material. Additionally, local improvement of the subgrade may be required if weaker ground is identified. Increased or decreased CBR values may be applicable after inspection once stripping is carried out.

All soft and/or unsuitable materials which are exposed during the preparation of the pavement subgrade should be excavated and replaced with engineered fill to meet design CBR requirements.

Construction

Lake sediments underlie much of the site. These materials can weaken significantly from their natural state if subject to rainfall, water ponding (saturation), frost and disturbance from vehicle trafficking. These processes can negatively influence pavement subgrades and building foundation areas. Shallow groundwater seepages were commonly observed across the site and will be encountered if excavations are completed, e.g. for service trenches. Pipe trenches are also likely to encounter weak ground and appropriate bedding and backfill will need to be considered.

Construction methodologies to minimise surface disturbance, and undertaking construction at a dryer time of year, should be considered to minimise the issues outlined above. Construction of site wide drainage to maintain groundwater levels below construction depths may be desirable to make for more efficient construction. This may be feasible provided suitable fall to the creek in the lower area of the site can be achieved.

7.0 Further Work

Further geotechnical testing and assessment should be undertaken to better define the geological zones, groundwater regime, areas of low bearing, liquefaction and lateral spreading hazards across the site.

The following works are considered appropriate:

- Investigations (Test pit, Borehole, DPH or similar) to confirm the ground water conditions more accurately in key zones, foundation and pavement issues;
- Further CPT testing around the identified boundaries shown on Figure 1.2 to better define them;
- A lateral spreading assessment around the creek;
- Alluvial fan and rock roll assessments;
- Additionally, if desired, it is possible to adjust the standard MBIE procedure with specialist engineering assessment. This type of assessment has recently been

undertaken in Queenstown with good results however these procedures do not always provide a significant improvement.

8.0 Conclusions and Future Development

Our assessment indicates residential development of the site is feasible from a geotechnical perspective. Further geotechnical assessment is recommended to support final development plans and resource consent applications.

9.0 Report Closure

This report has been prepared for the benefit of Highlander Trusts Ltd 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. Please don't hesitate to contact the undersigned if you have any questions on the content of this letter.

Yours faithfully,



Paul Faulkner
Senior Engineering Geologist



Attachments:

Site Plan
Test Pit and Scala Logs
CPT Data



Scale 1:6000
 0 50 100 150 200 250 (m)

Key

-  = Test Pit
-  = Cone Penetrometer Test

CADFILE:	Sketch 1.xar	DRAWN	MBS	01/2019
SCALE (AT A3 SIZE):	AS SHOWN	DRAFTING CHECKED	MBS	01/2019
PROJECT No:	180668	APPROVED	PGF	01/2019

 **GEOSOLVE**
 ENGINEERING CONSULTANTS

 GEOTECHNICAL
 WATER RESOURCES
 PAVEMENTS

Highlander Trust Ltd
 Special Housing Area Approval
 Coneburn Valley SHA
 Site Investigation Plan





FIG No:
 FIGURE 1

REV.
 1

EXCAVATION LOG

EXCAVATION NUMBER:
TP 1

PROJECT:	Coneburn Valley SHA			JOB NUMBER:	180668	
LOCATION:	See Site Plan	INCLINATION: Vertical				
EASTING:		mE	EQUIPMENT:	15T Excavator	OPERATOR:	Patterson
NORTHING:		mN	INFOMAP NO.		COMPANY:	N/A
ELEVATION:		m	DIMENSIONS:		HOLE STARTED:	10-Oct-18
METHOD:			EXCAV. DATUM:		HOLE FINISHED:	10-Oct-18

DEPTH (m)	SOIL / ROCK TYPE	GRAPHIC LOG	DESCRIPTION	USCS GROUP	GROUNDWATER / SEEPAGE	SCALA PENETROMETER Blows per 100mm 0 5 10 15
0.3	TOPSOIL		Dark brown, organic sandy SILT. Soft. Moist.		Seepage @ 1 m 	
2.0	LAKE SEDIMENT		Dark grey, SILT with trace of sand and clay, lenses of sand and gravel. Sand is fine. Gravel is fine. Some dilatancy. Soft. Sub-horizontal bedding and laminations. Moist to wet.			



Total Depth = 2 m

COMMENT: Strong inflow 10+ l/s @ 1.0 m. Test pit collapsing.	Logged By: PGF
	Checked Date: 16.01.19
	Sheet: 1 of 1

EXCAVATION LOG

EXCAVATION NUMBER:
TP 2

PROJECT: Coneburn Valley SHA		JOB NUMBER: 180668	
LOCATION: See Site Plan		INCLINATION: Vertical	
EASTING:	mE	EQUIPMENT: 15T Excavator	OPERATOR: Patterson
NORTHING:	mN	INFOMAP NO.	COMPANY: N/A
ELEVATION:	m	DIMENSIONS:	HOLE STARTED: 10-Oct-18
METHOD:		EXCAV. DATUM:	HOLE FINISHED: 10-Oct-18

DEPTH (m)	SOIL / ROCK TYPE	GRAPHIC LOG	DESCRIPTION	USCS GROUP	GROUNDWATER / SEEPAGE	SCALA PENETROMETER
0.3	TOPSOIL		Dark brown, organic sandy SILT. Soft. Moist.		Seepage @ 0.9 m →	
2.0	LAKE SEDIMENT		Dark grey, SILT with trace of sand and clay, lenses of sand and gravel. Sand is fine. Gravel is fine. Some dilatancy. Soft. Sub-horizontal bedding and laminations. Moist to wet.			


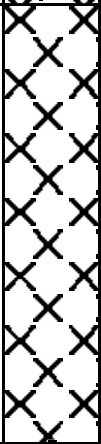

Total Depth = 2 m

COMMENT: Strong water inflow 10+ l/s @ 0.9 m. Test pit collapsing.	Logged By: PGF
	Checked Date: 16.01.19
	Sheet: 1 of 1

EXCAVATION LOG

EXCAVATION NUMBER:
TP 3

PROJECT: Coneburn Valley SHA		JOB NUMBER: 180668	
LOCATION: See Site Plan		INCLINATION: Vertical	
EASTING:	mE	EQUIPMENT: 15T Excavator	OPERATOR: Patterson
NORTHING:	mN	INFOMAP NO.	COMPANY: N/A
ELEVATION:	m	DIMENSIONS:	HOLE STARTED: 10-Oct-18
METHOD:		EXCAV. DATUM:	HOLE FINISHED: 10-Oct-18

DEPTH (m)	SOIL / ROCK TYPE	GRAPHIC LOG	DESCRIPTION	USCS GROUP	GROUNDWATER / SEEPAGE	SCALA PENETROMETER
0.3	TOPSOIL		Dark brown, organic sandy SILT. Soft. Moist.			
2.0	LAKE SEDIMENT		Dark grey, SILT with trace of sand and clay, lenses of sand and gravel. Sand is fine. Gravel is fine. Some dilatancy. Soft. Sub-horizontal bedding and laminations. Moist to wet.		Seepage @ 1 m 	


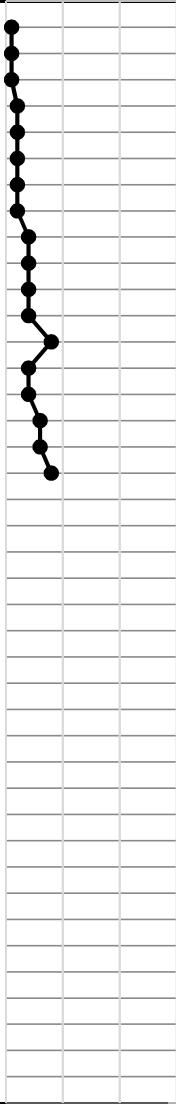



Total Depth = 2 m

COMMENT: Strong water inflow 10+ l/s @ 1.0 m. Test pit collapsing.	Logged By: PGF
	Checked Date: 16.01.19
	Sheet: 1 of 1

EXCAVATION LOG

EXCAVATION NUMBER:
TP 4

PROJECT:	Coneburn Valley SHA			JOB NUMBER:	180668	
LOCATION:	See Site Plan		INCLINATION: Vertical			
EASTING:		mE	EQUIPMENT:	15T Excavator	OPERATOR:	Patterson
NORTHING:		mN	INFOMAP NO.:		COMPANY:	N/A
ELEVATION:		m	DIMENSIONS:		HOLE STARTED:	10-Oct-18
METHOD:			EXCAV. DATUM:		HOLE FINISHED:	10-Oct-18

DEPTH (m)	SOIL / ROCK TYPE	GRAPHIC LOG	DESCRIPTION	USCS GROUP	GROUNDWATER / SEEPAGE	SCALA PENETROMETER Blows per 100mm 0 5 10 15
0.3	TOPSOIL		Dark brown, organic sandy SILT. Soft. Moist.		Seepage @ 2.8 m	
2.8	LAKE SEDIMENT		Dark grey, SILT with trace of sand and clay, lenses of sand and gravel. Sand is fine. Gravel is fine. Some dilatancy. Soft. Sub-horizontal bedding and laminations. Moist, increasing moisture content with depth.			
2.9	LAKE SEDIMENT		Grey brown, sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, subrounded to subangular. Loose, Bedded, Wet.			
4.2	LAKE SEDIMENT		Dark grey, SILT with trace of sand and clay, lenses of sand and gravel. Sand is fine. Gravel is fine. Some dilatancy. Soft. Sub-horizontal bedding and laminations. Moist.			

Total Depth = 4.2 m


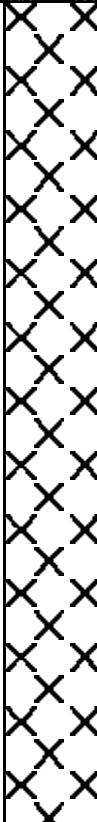


COMMENT: Strong water inflow 10+ l/s @ 2.8 m. Test pit collapsing.	Logged By: PGF
	Checked Date: 16.01.19
	Sheet: 1 of 1

EXCAVATION LOG

EXCAVATION NUMBER:

TP 5

PROJECT:	Coneburn Valley SHA			JOB NUMBER:	180668	
LOCATION:	See Site Plan		INCLINATION: Vertical			
EASTING:		mE	EQUIPMENT:	15T Excavator	OPERATOR:	Patterson
NORTHING:		mN	INFOMAP NO.		COMPANY:	N/A
ELEVATION:		m	DIMENSIONS:		HOLE STARTED:	10-Oct-18
METHOD:			EXCAV. DATUM:		HOLE FINISHED:	10-Oct-18

DEPTH (m)	SOIL / ROCK TYPE	GRAPHIC LOG	DESCRIPTION	USCS GROUP	GROUNDWATER / SEEPAGE	SCALA PENETROMETER
0.3	TOPSOIL		Dark brown, organic sandy SILT. Soft. Moist.			
3.5	LAKE SEDIMENT		Dark grey, SILT with trace of sand and clay, lenses of sand and gravel. Sand is fine. Gravel is fine. Some dilatancy. Soft. Sub-horizontal bedding and laminations. Moist to wet.		Seepage @ 1.2 m  Seepage @ 2.8 m 	

Total Depth = 2 m

COMMENT: Strong water inflow 10+ l/s @ 1.2 m and 2.8 m. Test pit collapsing.

Logged By: PGF

Checked Date: 16.01.19





Sheet: 1 of 1

EXCAVATION LOG

EXCAVATION NUMBER:

TP 6

PROJECT:	Coneburn Valley SHA			JOB NUMBER:	180668	
LOCATION:	See Site Plan		INCLINATION: Vertical			
EASTING:		mE	EQUIPMENT:	15T Excavator	OPERATOR:	Patterson
NORTHING:		mN	INFOMAP NO.		COMPANY:	N/A
ELEVATION:		m	DIMENSIONS:		HOLE STARTED:	10-Oct-18
METHOD:			EXCAV. DATUM:		HOLE FINISHED:	10-Oct-18

DEPTH (m)	SOIL / ROCK TYPE	GRAPHIC LOG	DESCRIPTION	USCS GROUP	GROUNDWATER / SEEPAGE	SCALA PENETROMETER
0.3	TOPSOIL		Dark brown, organic sandy SILT. Soft. Moist.		NO SEEPAGE	
1.2	ALLUVIAL FAN DEPOSIT		Yellow grey, sandy GRAVEL. Gravel is fine to coarse, subangular to subrounded. Loose to medium dense. Sub-horizontal bedding and laminations. Moist.			
2.6	ALLUVIAL FAN DEPOSIT		Grey brown, sandy SILT with lenses of sand and gravel. Non-dilatant. Firm. Sub-horizontal bedding and laminations. Moist.			
4.5	ALLUVIAL FAN DEPOSIT		Grey brown, sandy GRAVEL with cobbles and some boulders. Gravel is fine to coarse, subangular to subrounded, Boulders up to 250 mm dia. Loose to medium dense. Sub-horizontal bedding and laminations. Moist.			

Total Depth = 4.5 m


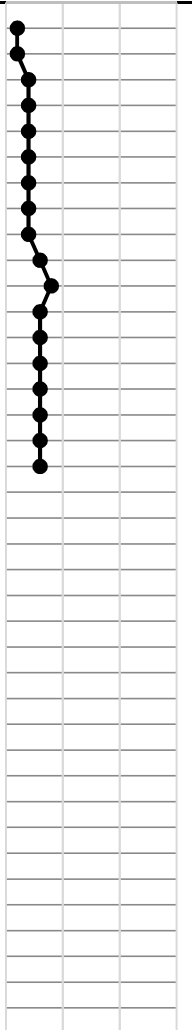


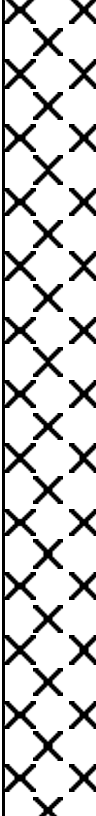
COMMENT: Test pit dry. Minor collapse of loose areas.	Logged By: PGF
	Checked Date: 16.01.19
	Sheet: 1 of 1

EXCAVATION LOG

EXCAVATION NUMBER:

TP 7

PROJECT:	Coneburn Valley SHA			JOB NUMBER:	180668	
LOCATION:	See Site Plan		INCLINATION:		Vertical	
EASTING:		mE	EQUIPMENT:	15T Excavator	OPERATOR:	Patterson
NORTHING:		mN	INFOMAP NO.:		COMPANY:	N/A
ELEVATION:		m	DIMENSIONS:		HOLE STARTED:	10-Oct-18
METHOD:			EXCAV. DATUM:		HOLE FINISHED:	10-Oct-18

DEPTH (m)	SOIL / ROCK TYPE	GRAPHIC LOG	DESCRIPTION	USCS GROUP	GROUNDWATER / SEEPAGE	SCALA PENETROMETER Blows per 100mm 0 5 10 15
0.3	TOPSOIL		Dark brown, organic sandy SILT. Soft. Moist.		Seepage @ 0.6 m	
0.6	LAKE SEDIMENT		Brown grey, sandy SILT. Non-dilatant. Soft. Bedded. Moist.			
0.8	LAKE SEDIMENT		Grey brown, sandy GRAVEL. Gravel is fine to coarse, subangular to subrounded. Loose to medium dense. Bedded. Wet.			
4.0	LAKE SEDIMENT		Dark grey, SILT with trace of sand and clay, lenses of sand and gravel. Sand is fine. Gravel is fine. Some dilatancy. Soft. Sub-horizontal bedding and laminations. Moist to wet.			

Total Depth = 4 m


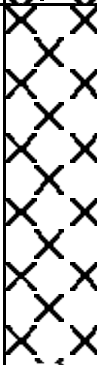

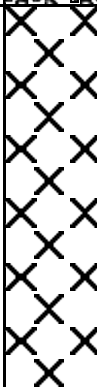
COMMENT: Water inflow ~1-2 l/s @ 0.6 m. Test pit collapsing	Logged By: PGF
	Checked Date: 16.01.19
	Sheet: 1 of 1

EXCAVATION LOG

EXCAVATION NUMBER:

TP 8

PROJECT:	Coneburn Valley SHA			JOB NUMBER:	180668	
LOCATION:	See Site Plan		INCLINATION: Vertical			
EASTING:		mE	EQUIPMENT:	15T Excavator	OPERATOR:	Patterson
NORTHING:		mN	INFOMAP NO.		COMPANY:	N/A
ELEVATION:		m	DIMENSIONS:		HOLE STARTED:	10-Oct-18
METHOD:			EXCAV. DATUM:		HOLE FINISHED:	10-Oct-18

DEPTH (m)	SOIL / ROCK TYPE	GRAPHIC LOG	DESCRIPTION	USCS GROUP	GROUNDWATER / SEEPAGE	SCALA PENETROMETER
0.3	TOPSOIL		Dark brown, organic sandy SILT. Soft. Moist.		Seepage @ 1.7 m	
1.7	LAKE SEDIMENT		Dark grey, SILT with trace of sand and clay, lenses of sand and gravel. Sand is fine. Gravel is fine. Some dilatancy. Soft. Sub-horizontal bedding and laminations. Moist to wet.			
2.0	LAKE SEDIMENT		Grey, sandy GRAVEL. Gravel is fine to coarse, subangular to subrounded. Loose. Bedded. Wet.			
3.5	LAKE SEDIMENT		Dark grey, SILT with trace of sand and clay, lenses of sand and gravel. Sand is fine. Gravel is fine. Some dilatancy. Soft. Sub-horizontal bedding and laminations. Moist to wet.			

Total Depth = 3.5 m


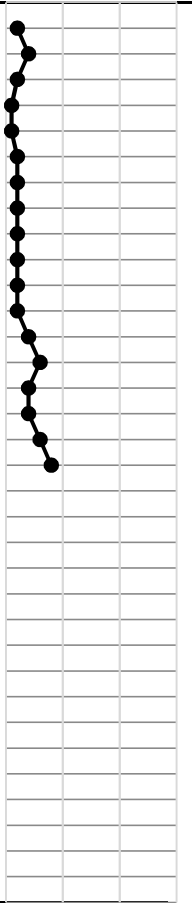



COMMENT: Strong water inflow 10 l/s @ 1.7 m and 3.5 m. Test pit collapsing	Logged By: PGF
	Checked Date: 16.01.19
	Sheet: 1 of 1

EXCAVATION LOG

EXCAVATION NUMBER:

TP 9

PROJECT:	Coneburn Valley SHA			JOB NUMBER:	180668	
LOCATION:	See Site Plan		INCLINATION:		Vertical	
EASTING:		mE	EQUIPMENT:	15T Excavator	OPERATOR:	Patterson
NORTHING:		mN	INFOMAP NO.:		COMPANY:	N/A
ELEVATION:		m	DIMENSIONS:		HOLE STARTED:	10-Oct-18
METHOD:			EXCAV. DATUM:		HOLE FINISHED:	10-Oct-18

DEPTH (m)	SOIL / ROCK TYPE	GRAPHIC LOG	DESCRIPTION	USCS GROUP	GROUNDWATER / SEEPAGE	SCALA PENETROMETER Blows per 100mm 0 5 10 15
0.3	TOPSOIL		Dark brown, organic sandy SILT. Soft. Moist.		Seepage @ 2.8 m	
2.8	LAKE SEDIMENT		Dark grey, SILT with trace of sand and clay, lenses of sand and gravel. Sand is fine. Gravel is fine. Some dilatancy. Soft. Sub-horizontal bedding and laminations. Moist to wet.			
3.0	LAKE SEDIMENT		Grey, sandy GRAVEL. Gravel is fine to coarse, subangular to subrounded. Loose Bedded. Wet.			
3.5	LAKE SEDIMENT		Dark grey, SILT with trace of sand and clay, lenses of sand and gravel. Sand is fine. Gravel is fine. Some dilatancy. Soft. Sub-horizontal bedding and laminations. Moist to wet.			

Total Depth = 3.5 m

COMMENT: Strong water inflow 10 l/s @ 2.8 m. Test pit collapsing	Logged By: PGF
	Checked Date: 16.01.19
	Sheet: 1 of 1