

# Mark T Mitchell Ltd

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## Consulting Geotechnical Engineers

Ref: W – 16581.7  
23 December, 2020

Frontier Developments Ltd  
PO Box 5254  
Frankton, Hamilton 3242

Attention: Lyall Green

### **Site Investigation, Geotechnical Assessment and Foundation Recommendations Lot No. 2 Pirongia Road (Frontier Estate), Te Awamutu**

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This report presents the results of a Soils Investigation and Geotechnical Assessment at the above referenced property. The purpose of our investigation and assessment was to determine and evaluate the subsurface conditions within the property and provide appropriate recommendations for the proposed concrete floor dwelling.

Our associate company, Geocon Geotechnical Ltd has carried out soil testing of the proposed building site area, with the results of that testing presented in the attached Geocon report dated 22 December, 2020 (Reference G-16581.1).

The subject site is accessed from the south-western side of Pirongia Road and is located in the north-eastern corner of Frontier Estate and slopes gently downward from the roadside boundary towards the Estate Stormwater Retention Pond, located to the South.

This discharge from this retention pond enters into an open drain beyond the western boundary, and then passes through a culvert below Pirongia Road. From that point the discharge and other stormwater flows into a gully system which feeds into the Mangapiko stream.

The results of our geotechnical assessment of the property, together with our recommendations for foundations, are as follows:

#### **1. SOIL CONDITIONS**

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The soils encountered across Lot 2 vary considerably across the 38-metre long lot, as described in the attached Geocon Geotechnical Ltd report.

The near-surface soils to about 2 metres depth consist of Filling of variable composition and possessing low to moderate to high strengths. But below these soils:

- At the northern (Pirongia Road) end, fine to medium grained, dense Sands are present below the filling.
- Within the central part of the lot, the underling soils are competent to 3.3 metres depth, but low-strength soils occur below and continue to 5.8 metres depth.
- At the southern end of the lot, low strength soils are present to about 5.4 metres depth.

## 2. RECOMMENDATIONS – FOUNDATION DESIGN & CONSTRUCTION

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Lot 2 consist of a relatively large area and therefore several possible house locations within the lot are possible. However soils are variable across the lot and therefore, while an engineer-designed, waffle-type “Ribraft”-type concrete slab would suite some of the slab, there is a risk that variations in the supporting soils may result in an uneven support to the slab.

These variations in soil support may be accommodated by a geogrid reinforced, rockfill of about 1.5 metres thick, with an engineer-design concrete slab above. However further test drilling at the actual house location will be required to confirm that consistent soils occur below that replacement raft construction.

Alternatively, the present soils may remain in place, but with a driven timber pile support to the proposed house foundations. For this option, the concrete floor for the proposed dwelling will require an engineer-designed floor slab, incorporating deepened foundation beams around the perimeter and also below the interior pile foundation lines.

For this project, driven timber piles of 175mm SED (Small End Diameter) will be required. The piles would function as end-bearing piles, with the piles being driven into the dense soils that were encountered at depth within the bore hole.

The test data indicates that the expected pile lengths are in the order of 7.5 metres below ground level, but will depend upon the variation in ground conditions across the building site areas and also upon their load capacity requirements.

Test piles will be required to determine the actual length of piles to be delivered to the project. This will involve a minimum of two, 8.0 metre-long test piles to be driven at either end of the building envelope. The data obtained from the driving of these test piles would enable the lengths of the remaining piles to be determined more precisely. The test piles may be used as production piles in the support of the proposed structure.

The design of the pile-supported foundations will require a Specific Engineer design to be carried out by a Chartered Engineer. We would be pleased to provide this design service.

## 3. MINIMUM FLOOR LEVEL

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The property is located adjacent to the Frontier Estate Stormwater Retention Pond, which needs to be considered when establishing a minimum floor height for the proposed new dwelling as both the 10 year and 100-year Annual Return Interval (ARI) Flood Event boundaries are located within the south eastern corner of the property as shown on the Geocon Site Plan.

### a. Dwelling - Minimum Floor Level

A minimum floor height is to be established for the dwelling, which is recommended to be a minimum of 500mm above the projected 100-year ARI Flood Event level (RL 43.4).



#### 4. CONSTRUCTION INSPECTIONS

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In order to satisfy Waipa District Council building requirements, site testing of the prepared excavated base and backfilling to be placed up to underside of slab level, will be required for the raft foundation option. Engineer-Inspections of the driven pile foundations will also be required.

This work is required to be carried out under the direction of a Chartered Engineer, with certification provided to indicate that the foundations are suitable for the support of the proposed building.

Mark T Mitchell Ltd, together with Geocon Geotechnical Ltd, our associated testing company working under our direction, are able to provide this service.

**Mark T Mitchell Ltd**

*Consulting Geotechnical Engineers*



Mark T Mitchell  
Director





# *Geocon Geotechnical Ltd*

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## **Geotechnical Engineers**

Ref: G – 16581.1  
22 December, 2020

Frontier Developments Ltd  
c/- Mark T Mitchell Ltd  
Consulting Geotechnical Engineers  
P O Box 9123  
Hamilton 3240

### **Site Investigation for Proposed Dwelling Lot No. 2 Pirongia Road (Frontier Estate), Te Awamutu**

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This report presents the results of a Site Investigation at the above referenced property, the purpose of which was to determine and evaluate the subsurface conditions within the property and review foundation design requirements for a new concrete floor dwelling.

Lot 2 is accessed from the south side of Pirongia Road and located in the north-eastern corner of Frontier Estate, to the East of Road 1. The property slopes gently to the south from the roadside boundary towards the Estate Stormwater Retention Pond. The Pond itself discharges to the north in an open drain beyond the western boundary, then through a culvert below Pirongia Road to a gully system which feeds into the Mangapiko stream. The surrounding area is urban housing situated on rolling hill topography.

## **1. FIELD INVESTIGATIONS**

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A previous Site Investigation has been carried out by our company as part of Frontier Stage 1 Geotechnical Subdivision Completion Report (Ref: W – 16234, Stage 1 – Lots 2 to 41) prepared by Mark T Mitchell Ltd, Consulting Geotechnical Engineers and dated 4 December, 2019. That report included a series of hand auger bore holes, drilled centrally in each of the lots to a depth of 2.0m, with Scala or shear tests below.

The log of the bore hole that was drilled within Lot 2 at that time is attached as Fig. A-1. That bore hole indicates Topsoil overlying Engineer-certified Filling with Scala values in excess of 140kPa to a depth of 0.9 metres, overlying stiff to very stiff Silt to 2.1m and moderate density sand below. At the time, it was thought that the Filling was part of the road access filling and therefore was classified and 'engineer-certified' on account of the high Scala values recorded.

However recently concerns were raised as to the foundation stability of the soils within this lot and as a consequence, test drilling to a greater depth on Lot 2 was carried out on 15 December, 2020. These test holes consist of Bore Hole Nos. 10, 11 and 12, with each bore hole drilled to a depth of 6 metres and with Scala testing to 8 metres. Bore Hole logs are presented on attached Figs. B-1 to B-3 and their locations are plotted on attached Site Plan Drawing No. 16581-01.

The purpose of the borings and associated testing was to provide guidance as to the general subsurface soil profile, variability, and relative density of soils within the location of the proposed building envelope. Actual conditions may vary across these areas however, and in some locations may differ slightly from those as described below.

## 2. SUBSURFACE CONDITIONS

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### 2.1. Southern Part of Lot – Bore Hole No. 12

The upper 1.5 metres consist of shallow Topsoil overlying moderately compacted Filling to 1.5 metres and very stiff Silt below. However the underlying soils to 5.3 metres depth consist of very soft Silt soils that would have been deposited in a swamp environment, with very much older and stronger, silt soils below. These distinct, orangey-brown, stiff to very stiff, clayey SILT (Walton Subgroup) was then encountered to the base of the 6.0 metre deep bore hole.

### 2.2. Central and Northern Part of Lot - Bore Hole Nos. 2, 10 and 11

The near-surface soil conditions at the Northern (Pirongia Road) end of the site consist of Fill to about 2 metres depth, which is probably related to the filling that was placed in order to raise the formation level of Pirongia Road. The underlying soils consist of moderately dense Sand soils of the Hinuera Formation, which is considerably younger than the Walton Soils to the South.

This indicates that within this single lot, erosion by a much older stream or river has removed soils to about 6 metres throughout and then later, younger Hinuera Age Sands were deposited, some of which are present at the northern boundary. However in the central part of the site, those Hinuera soils were eroded, with the void backfilled with recent, less dense Sand and Silt soils.

### 2.3. Groundwater

Groundwater was encountered at between 2.1 and 2.7 metres below existing ground level at the time of the recent early summer site investigation and at 2.1 metres in November, 2019.

Geocon Geotechnical Ltd



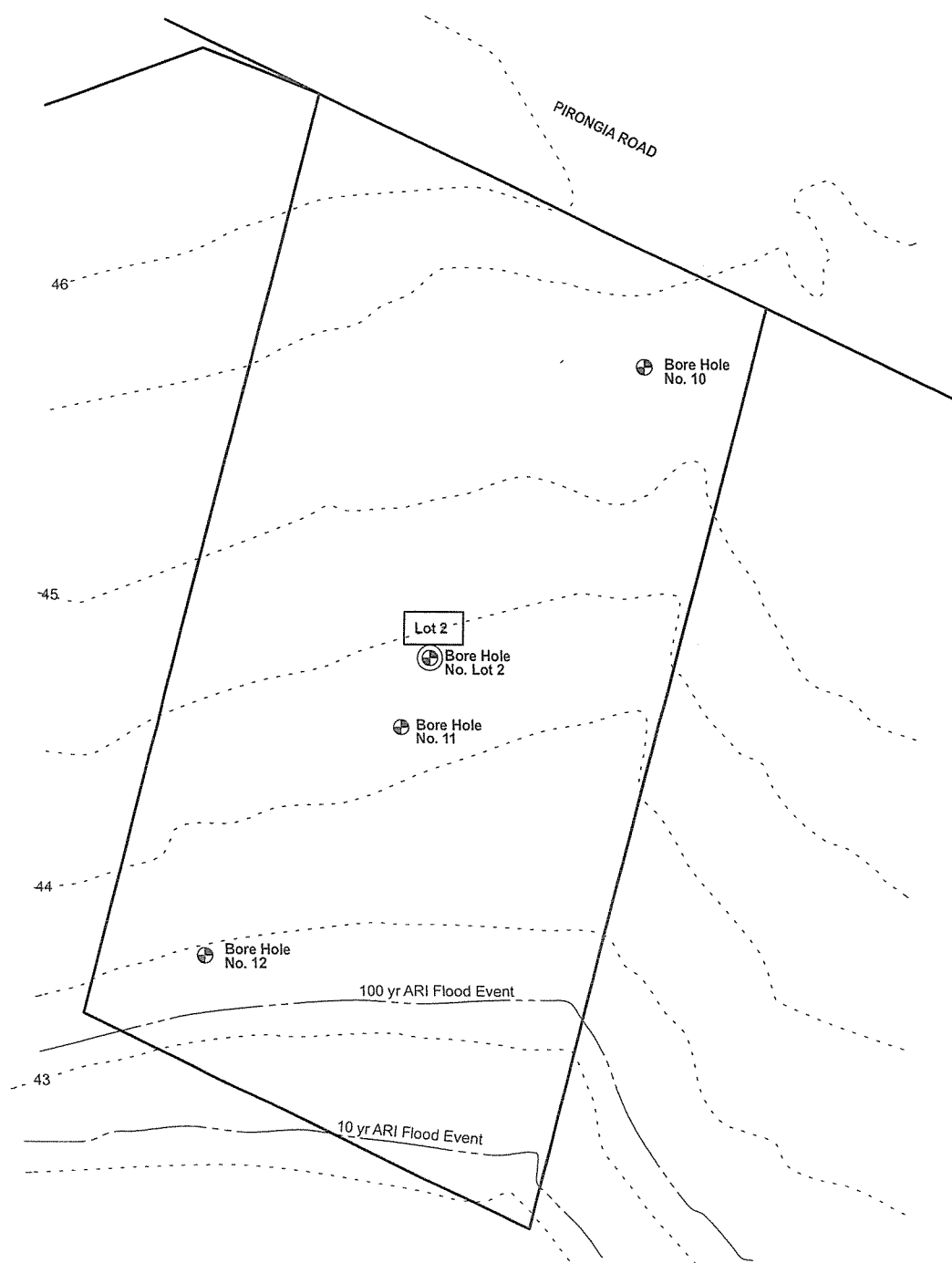
Mark T Mitchell  
Director





NOTE:

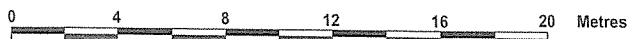
1. This drawing is reproduced from the Site Plan prepared by Frontier Developments Limited.
2. All areas and distances where shown are subject to survey.



LEGEND

- ⊕ denotes Bore Hole location
- ⊕ " " " " (November, 2019)
- - - - " Contours

SCALE 1:200



**Geocon Geotechnical Ltd**

Geotechnical Engineers

1150 Victoria Street, P.O. Box 9123, Hamilton

FRONTIER DEVELOPMENTS LTD

Site Investigation for Proposed New Dwelling  
Lot 2 Piringia Road (Frontier Estate),  
Te Awamutu

**SITE PLAN**

DRAWING No. 16581-01

DATE December 2020

ISSUE DATE 22.12.2020



| GRAPHIC LOG   | BORE HOLE LOG No. 10   |                  | DEPTH (metres)   | GEOLOGICAL FORMATION | VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)  | SCALA PENETROMETER (blows/100mm) | PIEZOMETER / WATER LEVEL |
|---|--|------------------|--|----------------------|--|----------------------------------|--------------------------|
|   | SOIL DESCRIPTION   | (RL 45.6 metres) |  |                      |  | 1 2 3 4 5 6 7 8 9 10             |                          |
|   | FILLING: Mixture of Silt, Sand and Gravel. Uncontrolled, variable compaction, moist, brown mottled light grey and orangey brown.   |                  |  | Filling              |  |                                  |                          |
|   | FILLING: Mixture of Clay, Silt and Sand. Uncontrolled, low strength, moist to wet, light greyish brown. Becoming light grey mottled light greyish brown, slightly iron stained and slightly plastic @ 1.6 metres                               |                  | 1  |                      |  |                                  |                          |
|   | SILT with minor fine sand and clay. Soft to firm, moist to wet, slightly plastic, light grey.  |                  | 2  | RA                   |  |                                  | End of Day               |
|   | fine to medium SAND with minor silt. Medium dense to dense, wet, grey. Becoming saturated @ 2.7 metres. " slightly iron stained @ 3.3 metres. Containing some silt @ 4.3 metres. Becoming light grey mottled light greyish brown @ 4.5 metres. |                  | 3  | Hinuera Formation    |  |                                  |                          |
|   |  |                  | 4  |                      |  |                                  |                          |
|   |  |                  | 5  |                      |  |                                  |                          |
|   | silty fine SAND. Very loose to loose, saturated, pumiceous, light brownish grey. Becoming heavily iron stained @ 5.4 metres.   |                  | 6  |                      |  |                                  |                          |
|   | Bottom of Bore Hole completed 15/12/20   |                  | 7  |                      |  |                                  |                          |
|   |  |                  | 8  |                      |  |                                  |                          |
|   |  |                  | 9  |                      |  |                                  |                          |
| <b>NOTES</b> - The stratification lines represent the approximate boundary between soil types and the transition may be gradual.<br>- Scala test was carried out in 1.0 metre depth increments. |  |                  |  |                      |  |                                  |                          |
| JOB NAME: <u>FRONTIER DEVELOPMENTS LTD</u><br>JOB LOCATION: <u>Lot 2 Pirongia Road (Frontier Estate), Te Awamutu</u><br>JOB NUMBER: <u>W - 16581</u>  |  |                  | DRILL METHOD: <u>Machine Auger</u><br>RIG: <u>Hilux</u><br>DRILLER: <u>MMC</u> |                      | LOGGED: <u>TG</u> PLOTTED: <u>TG</u><br>DATE LOGGED: <u>15/12/20</u><br>CHECKED: _____                     |                                  |                          |
| <br><b>Geocon Geotechnical Ltd</b><br>Geotechnical Engineers<br>1150 Victoria Street, P.O. Box 9123, Hamilton   |  |                  | <b>BORE HOLE LOG</b>   |                      | <b>BORE HOLE No. 10</b><br>LOCATION: <u>Refer Site Plan</u> RL (m): _____<br>SHEET: 1 OF 1    Fig. No. B-1 |                                  |                          |



| GRAPHIC LOG   | BORE HOLE LOG No. 11   |                  | DEPTH (metres)  | GEOLOGICAL FORMATION | VANE SHEAR STRENGTH - kPa (In-situ/Remoulded) | SCALA PENETROMETER (blows/100mm)   |   |   |   |   |   |   |   |   |    | PIEZOMETER / WATER LEVEL |
|---|--|------------------|---|----------------------|---|--|---|---|---|---|---|---|---|---|----|--------------------------|
|   | SOIL DESCRIPTION   | (RL 44.4 metres) |   |                      |   | 1  | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |                          |
|   | TOPSOIL.   |                  | 0   | Filling              |   |  |   |   |   |   |   |   |   |   |    | <br>End of Day           |
|   | FILLING: Mixture of Clay, Silt and Sand. Uncontrolled, moderate strength, moist, brown mottled light and dark brown.   |                  | 1   |                      |   |  |   |   |   |   |   |   |   |   |    |                          |
|   | SILT with minor fine sand and trace clay. Stiff to very stiff, moist to wet, moderately iron stained, slightly plastic, light grey. Containing some clay @ 2.2 metres.                           |                  | 2   |                      |   |  |   |   |   |   |   |   |   |   |    |                          |
|   | fine SAND with some silt. Medium dense to loose, wet, moderately iron stained, light grey mottled light brown.   |                  | 3   |                      |   |  |   |   |   |   |   |   |   |   |    |                          |
|   | SILT with minor fine sand. Very soft to stiff, moderately iron stained, dilatant. Containing some clay and becoming moderately plastic @ 4.1 metres.   |                  | 4   |                      |   |  |   |   |   |   |   |   |   |   |    |                          |
|   | silty fine to coarse SAND with trace fine gravel. Medium dense, saturated, slightly organic, residual grains, dark brownish grey. Becoming very loose to loose, moderately organic @ 5.2 metres. |                  | 5   |                      |   |  |   |   |   |   |   |   |   |   |    |                          |
| SILT with some fine to coarse sand. Stiff, dilatant, light grey mottled brown and dark brown.   |  | 6                |   |                      |   |  |   |   |   |   |   |   |   |   |    |                          |
| Bottom of Bore Hole completed 15/12/20  |  | 7                |   |                      |   |  |   |   |   |   |   |   |   |   |    |                          |
|   |  | 8                |   |                      |   |  |   |   |   |   |   |   |   |   |    |                          |
|   |  | 9                |   |                      |   |  |   |   |   |   |   |   |   |   |    |                          |
| <b>NOTES</b> - The stratification lines represent the approximate boundary between soil types and the transition may be gradual.<br>- Scala test was carried out in 1.0 metre depth increments. |  |                  |   |                      |   |  |   |   |   |   |   |   |   |   |    |                          |
| JOB NAME: FRONTIER DEVELOPMENTS LTD<br>JOB LOCATION: Lot 2 Pirongia Road (Frontier Estate), Te Awamutu<br>JOB NUMBER: W - 16581   |  |                  | DRILL METHOD: Machine Auger<br>RIG: Hilux<br>DRILLER: MMC |                      |   | LOGGED: TG<br>DATE LOGGED: 15/12/20<br>CHECKED:  |   |   |   |   |   |   |   |   |    |                          |
| <br><b>Geocon Geotechnical Ltd</b><br>Geotechnical Engineers<br>1150 Victoria Street, P.O. Box 9123, Hamilton   |  |                  | <b>BORE HOLE LOG</b>                                      |                      |   | <b>BORE HOLE No. 11</b><br>LOCATION: Refer Site Plan<br>SHEET: 1 OF 1<br>RL (m):<br>Fig. No. B-2 |   |   |   |   |   |   |   |   |    |                          |

| GRAPHIC LOG   | BORE HOLE LOG No. 12  |                  | DEPTH (metres)  | GEOLOGICAL FORMATION | VANE SHEAR STRENGTH - kPa (In-situ/Remoulded) | SCALA PENETROMETER (blows/100mm)                                      |   |   |                         |   |   |   |   |   |    | PIEZOMETER / WATER LEVEL |
|---|---|------------------|---|----------------------|---|---|---|---|-------------------------|---|---|---|---|---|----|--------------------------|
|   | SOIL DESCRIPTION  | (RL 43.9 metres) |   |                      |   | 1   | 2 | 3 | 4                       | 5 | 6 | 7 | 8 | 9 | 10 |                          |
|   | TOPSOIL.  |                  | 0   | Filling              |   |   |   |   |                         |   |   |   |   |   |    |                          |
|   | FILLING: Mixture of Clay, Silt and Sand. Uncontrolled, moderate strength, moist, slightly plastic, brown mottled light orangey brown with dark brown mottle.  |                  | 1   |                      |   |   |   |   |                         |   |   |   |   |   |    |                          |
|   | fine sandy SILT with minor clay. Very stiff, moist, slightly iron stained, slightly plastic, light grey.  |                  | 2   | Recent Alluvium      |   |   |   |   |                         |   |   |   |   |   |    |                          |
|   | silty fine SAND. Medium dense, saturated, slightly iron stained, slightly plastic, light grey mottled light greyish brown.  |                  | 3   |                      |   |   |   |   |                         |   |   |   |   |   |    |                          |
|   | clayey SILT with minor fine sand. Very soft to soft, dilatant, moderately plastic, grey. Becoming moderately organic @ 3.0 metres. " mottled light and dark grey @ 3.7 metres. Containing trace fine to medium sand @ 3.8 metres. |                  | 4   |                      |   |   |   |   |                         |   |   |   |   |   |    |                          |
|   | SILT with minor fine to coarse sand and clay. Stiff, dilatant, orangey brown.   |                  | 5   |                      |   |   |   |   |                         |   |   |   |   |   |    |                          |
|   | clayey SILT with trace fine to coarse sand. Stiff to very stiff, dilatant, heavily iron stained, moderately plastic, residual grains, orangey brown.  |                  | 6   | Walton Subgroup      |   |   |   |   |                         |   |   |   |   |   |    |                          |
| Bottom of Bore Hole completed 15/12/20  |   | 7                |   |                      |   |   |   |   |                         |   |   |   |   |   |    |                          |
|   |   | 8                |   |                      |   |   |   |   |                         |   |   |   |   |   |    |                          |
|   |   | 9                |   |                      |   |   |   |   |                         |   |   |   |   |   |    |                          |
| <b>NOTES</b> - The stratification lines represent the approximate boundary between soil types and the transition may be gradual.<br>- Scala test was carried out in 1.0 metre depth increments. |   |                  |   |                      |   |   |   |   |                         |   |   |   |   |   |    |                          |
| JOB NAME: FRONTIER DEVELOPMENTS LTD<br>JOB LOCATION: Lot 2 Pirongia Road (Frontier Estate), Te Awamutu<br>JOB NUMBER: W - 16581   |   |                  | DRILL METHOD: Machine Auger<br>RIG: Hilux<br>DRILLER: MMC |                      |   | LOGGED: TG<br>DATE LOGGED: 15/12/20<br>CHECKED:                       |   |   |                         |   |   |   |   |   |    |                          |
| <br><b>Geocon Geotechnical Ltd</b><br>Geotechnical Engineers<br>1150 Victoria Street, P.O. Box 9123, Hamilton   |   |                  | <b>BORE HOLE LOG</b>                                      |                      |   | <b>BORE HOLE No. 12</b><br>LOCATION: Refer Site Plan<br>SHEET: 1 OF 1 |   |   | RL (m):<br>Fig. No. B-3 |   |   |   |   |   |    |                          |