

# Part H

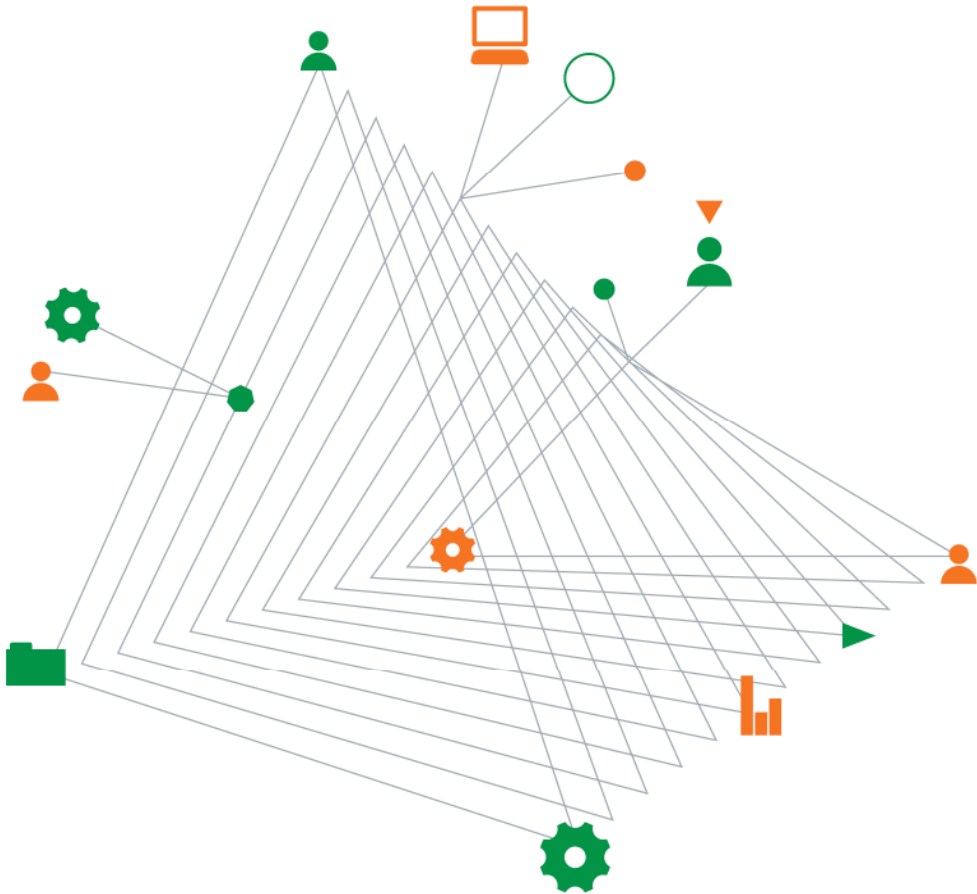
## Additional Technical Reports

**Matamata Piako District Council**

**Stirling Street, Te Aroha**

Stirling Street, Te Aroha - Assessment Report

1 June 2017



Experience  
comes to life  
when it is  
powered by  
expertise

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## Stirling Street, Te Aroha

Prepared for  
Matamata Piako District Council  
PO Box 266  
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Te Aroha 3342

Prepared by  
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1 June 2017

### Document authorisation

Our ref: 773-GENZTAUC16120AB-AB

For and on behalf of Coffey



**Scott Higginson**  
Geotechnical Engineer

### Quality information

#### Revision history

Revision	Description	Date	Author	Reviewer	Signatory
0	Assessment Report	1/06/17	SWH	DAS	DAS

#### Distribution

Report Status	No. of copies	Format	Distributed to	Date
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# 1. Introduction

Coffey Geotechnics (NZ) Limited (Coffey) has been engaged by Matamata Piako District Council (MPDC) to carry out a geotechnical assessment for potential residential development at Stirling Street, Te Aroha. The assessment and report has been undertaken in general accordance with the agreed proposal<sup>1</sup> and variation<sup>2</sup>.

This report has been prepared to assist with the planning for future land development. Whilst it is not suitable to support a resource consent application in its current format, it may be used as one of the supporting documents for a resource consent application subject to specific geotechnical investigation and assessment.

# 2. Scope & Objectives

The objectives of this desktop study assessment were to:

- Identify the potential geological and geotechnical hazards affecting the proposed site;
- Assess the development potential of the site for residential use; and
- Provide geotechnical recommendations to support preliminary planning works being undertaken for the site.

# 3. Previous Reporting

Coffey has previously undertaken a desktop study and geotechnical assessment of five sites (including the subject site of this report), with the results presented in an assessment report<sup>3</sup> as part of a Plan Change application. The report concluded that the geotechnical conditions identified should not constrain the land change, although on-site geotechnical investigation, assessment and engineering measures would be required.

The geotechnical assessment for the site and presented in the previous report, is summarised below:

- The site is likely to be underlain by alluvial and colluvial sands. The nearest active fault is located approximately 6km west of site, and a concealed fault is potentially located approximately 200m west of site.
- We consider that the site is potentially susceptible to liquefaction, and recommend that a more detailed liquefaction assessment is undertaken prior to development.
- We consider that certain areas of the site may be prone to flooding, and recommend that specific flood considerations should be made for future development consents.
- We consider that certain areas of the site may be prone to slope instability, and recommend that a more detailed slope stability assessment is undertaken prior to development.

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<sup>1</sup> "Geotechnical Services Proposal for District Plan Review", ref: GENZTAUC16120AA-AA, dated 10 December 2015

<sup>2</sup> "Variation 001", District Plan Change 47 – Plan your Town, signed 31 May 2017

<sup>3</sup> "Geotechnical Assessment for Zoning Plan Change", ref: GENZTAUUC16120AA-AB, dated 10 February 2016

## 4. Site Description

The site is situated to the west of Stirling Street and east of the Hauraki Rail Trail, on the north-western fringe of Te Aroha Township. It covers an area of approximately 20ha and is made up of approximately 6 smaller privately owned properties ranging in size from 0.1ha to 12.4ha. The north-flowing Waihou River is situated approximately 400m west of the site. SMap Online<sup>4</sup> indicates that the more-elevated, eastern portion of the site is likely to be underlain by stony, silt loam. The map also indicates that the lower-lying, western portion of the site is likely to be underlain by silt loam.

The general site topography is gently sloping at approximately 1V:20H (3°) down to the west. However, several very steep gullies extend through the site, containing streams which flow west into the Waihou River. Sections of the site have been designated as a 'Flood Hazard' on the Council GIS<sup>5</sup>, which appears to be associated with the floodplain of the river and local streams.

The site is generally occupied by rural residential properties, with open paddocks. A Maori reservation is situated near the northern site boundary, as well as a cemetery reserve.

The location of the site is shown on the Site Plan in Appendix A.

### 4.1. Site History

Historical aerial photographs<sup>6</sup> and mapping<sup>7</sup> of Te Aroha indicate that there has been development along Stirling Street since at least 1943. An aerial photograph from 1960 (refer to Figure 2 in Appendix A) appears to show large areas of the southern portion of the site subject to overland, stormwater flow.

Google Earth aerial photographs show that the site and surrounding area has remained virtually unchanged since at least 2007.

## 5. Site Geology

The local geology map<sup>8</sup> describes the site as being underlain by alluvial fan deposits, consisting of sands, silts and gravels. This subsoil material is typically found in the Hauraki Plains, and generally coincide with the materials encountered from previous worked undertaken by Coffey in the area.

Historic aerial photographs indicate that the site has generally not been subject to significant earthworks, and so significant filling would not be expected. Some filling may be encountered towards the residential buildings and the embankment of the Hauraki rail trail.

The nearest active fault listed on the New Zealand active faults database is the Kerepehi Fault, situated approximately 6km to the west of the site and running north-south. The fault has a recurrence level of 2,000 to 3,500 years, with a low slip rate (0.2 to 1.0 mm per year) and was active within the last 1,000 years. In addition, the local geology map<sup>5</sup> shows Mangakino Fault located approximately 4.5km to the east of the site running north-south, and the Hauraki Fault located approximately 200m west of the site, running north-south through the centre of Te Aroha. The Hauraki Fault is a concealed fault and is often shown in different locations on different geological maps.

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<sup>4</sup> S-map online, <https://smap.landcareresearch.co.nz/home>

<sup>5</sup> Matamata Piako Council Maps and GIS, <http://maps.mpdc.govt.nz/qisp2/framesetup.asp>

<sup>6</sup> Retrolens Historical Image Resource, <http://maps.mpdc.govt.nz/qisp2/framesetup.asp>

<sup>7</sup> Te Aroha Topographic Map, 1<sup>st</sup> Edition, 1943, The University of Waikato

<sup>8</sup> "Geology of the Auckland Area", Institute of Geological and Nuclear Sciences, 1:250000 geological map

The most recent significant earthquake in Te Aroha was a 5.1 magnitude earthquake occurring on 9 January 1972. The earthquake damaged some homes, but most of the damage was confined to chimneys and the contents of buildings<sup>9</sup>.

## 5.1. Groundwater

Based on the level of the Waihou River, and the lack of visual evidence of surface water within the site from Google Earth aerial photographs, it can be inferred that the groundwater table beneath the western portion of the site lies at approximately RL5m to RL10m. Beneath the more-elevated eastern portion of the site, the groundwater level is likely at approximately RL15m.

Groundwater levels may fluctuate during particularly wet or dry seasons.

## 6. Geotechnical Development Zones

Based on the geomorphology and geological conditions discussed above, the site can be divided up into three areas for geotechnical design purposes. These areas are shown on Figure 3 in Appendix A.

### 6.1. Geotechnical Zone 1

Geotechnical Zone 1 comprises the more elevated, generally flat to moderately sloping areas towards the eastern portion of the site. The zone has a plan area of approximately 9.3ha. As shown on Figure 3, the ground surface within Zone 1 typically grades at less than 1V:10H, although there are areas within this zone situated near steep gullies, which are up to approximately 5m deep.

Geotechnical Zone 1 is generally considered to be adequate for residential development in its current state. The steeper slopes along the gully sides may however be subject to Building Restriction Lines (BRLs) to limit development along the crests of the gullies. These BRLs would need to be confirmed by specific analyses as part of the subdivision design. Alternatively, the gullies could be infilled to increase the available land for residential development, as stated in Section 6.3 below.

Given the elevation of Zone 1, seismic liquefaction is unlikely to pose a significant barrier to residential development. The potential and effects of liquefaction on the stability of the slopes along the gullies (if not filled) would however need to be assessed during the design of the subdivision.

Of the areas assessed in this report, Zone 1 is considered to be the most appropriate for residential development following relatively minor earthworks. However, an on-site geotechnical investigation and assessment will be required as part of the resource consent.

### 6.2. Geotechnical Zone 2

Geotechnical Zone 2 covers a plan area of approximately 3.8ha and generally comprises lower-lying, flat to moderately sloping areas, and areas of apparent, historic overland stormwater flow (as shown on the 1960 aerial photograph on Figure 2). Zone 2 is generally located towards the western side of the site, near the Waihou River floodplain. The ground surface in this zone typically grades at less than 1V:10H, although there are areas situated near steep gullies.

Generally, Zone 2 comprises land which is more likely to be subject to flooding, seismic liquefaction, and soft soils than the land within Zone 1. Residential development within Zone 2 will therefore likely require filling to raise the land above potential flood levels. The likely presence of soft, saturated soils

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<sup>9</sup> "Te Aroha Earthquake, 9 January 1972" R.D Adams, M.G Muir and R.J Kean



underlying the zone may necessitate the monitoring static settlement as part of the earthworks, and it may be required to preload areas of the site.

Deep, on-site geotechnical investigations will be required prior to residential development within Zone 2, likely to comprise Cone Penetrometer Tests (CPTs). Depending on the results of liquefaction assessments, it may be required to found dwellings on specifically-designed pod-raft type foundations, capable of tolerating settlements.

Subject to the earthworks and restrictions given above, residential development within Zone 2 is considered to be achievable.

### **6.3. Geotechnical Zone 3**

Geotechnical Zone 3 (approximately 4.6ha in plan area) comprises the eroded, steep gullies which extend through the site. These areas include slopes up to 5m high and comprise gradients of up to approximately 1V:1H.

In its current state, Zone 3 is not considered to be appropriate for residential development. However, earthworks could be undertaken to allow development within these areas, as detailed below.

If the gullies are not filled, the areas above the gully crests should be subject to a BRL to limit development along the slope crest. The BRLs would need to be confirmed by specific analyses as part of the subdivision design, and may be on the order of 5m from the gully crests. The stability of the gully slopes should also be assessed, to ensure that residential areas of the site won't be affected by the damming of the gully streams.

Alternatively, the gullies within Zone 3 could be infilled to allow residential development across these areas. This would require engineer certified earthworks, and would negate the need for BRLs along the gully crests. However, the low-lying areas of Zone 3 are likely to be underlain by soft soils and a high groundwater table. Static settlement beneath the filled areas would therefore need to be monitored as part of the earthworks program. Given adequate earthworks practices and a sufficient monitoring period, static settlements within these areas could be mitigated.

The low-lying areas within Zone 3 are also likely to be prone to liquefaction. Earthworks and residential development in Zone 3 would therefore require deep, on-site geotechnical investigations, such as CPTs, to assess the area for liquefaction triggering potential. Depending on the results of liquefaction assessments, it may be required to found dwellings on specifically-designed pod-raft type foundations, capable of tolerating settlements.

## **7. Flooding Hazard**

The council GIS identifies certain areas of the site as 'Flood Hazard areas', generally located within the gullies extending through the site, and the lower-lying western area of the site. As such, it is recommended that specific flood considerations should be made for future development consents.

It is noted that the proposed intensification of development within the subject site will increase the rate and volume of runoff from the site, and that stormwater management and detention measures will likely be required.

## **8. Conclusions**

Based on the observations and analyses discussed in this report, the site is considered appropriate for residential development, subject to geotechnical issues and restrictions described herein. The site is divided into three geotechnical zones.

Geotechnical Zone 1 covers an area of approximately 9.3ha and comprises predominantly flat or gently sloping ground which should be adequate for residential development in its current form.

Geotechnical Zone 2 includes the lower-lying areas to the west of the site, and is more likely to be underlain by soft soils with a high water table. This zone should be suitable for residential development, however may require more extensive geotechnical assessment and constraints than Zone 1.

Geotechnical Zone 3 comprises the steep gullies and streams, and is not suitable for residential development in its current form. However, the zone could be made adequate for residential development, subject to extensive earthworks and geotechnical assessment.

## 9. Limitations

This report has been prepared solely for the use of the client, Matamata Piako District Council, their professional advisers, and the relevant Territorial Authorities in relation to the specific project described herein. No liability is accepted in respect of its use for any other purpose or by any other person or entity. All future developers of the subject area should seek professional geotechnical advice to satisfy themselves as to its ongoing suitability for their intended use.

This document should always be read in its entirety and in conjunction with the previous reports provided for this project. It is not to be split for further distribution.

The opinions, recommendations and comments given in this report result from a desktop study, which may only provide preliminary information adequate for preliminary planning purposes. As on-site geotechnical investigations or a site walkover were not included within the scope of this report, there may be conditions pertaining to the sites which have not been taken into account in this report.

For and on behalf of Coffey,

Written by:



**Scott Higginson**  
Geotechnical Engineer

Reviewed by:



**David Sullivan**  
Principal Geotechnical Engineer

## Important information about your Coffey Report

As a client of Coffey you should know that site subsurface conditions cause more construction problems than any other factor. These notes have been prepared by Coffey to help you interpret and understand the limitations of your report.

### **Your report is based on project specific criteria**

Your report has been developed on the basis of your unique project specific requirements as understood by Coffey and applies only to the site investigated. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the client. Your report should not be used if there are any changes to the project without first asking Coffey to assess how factors that changed subsequent to the date of the report affect the report's recommendations. Coffey cannot accept responsibility for problems that may occur due to changed factors if they are not consulted.

### **Subsurface conditions can change**

Subsurface conditions are created by natural processes and the activity of man. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult Coffey to be advised how time may have impacted on the project.

### **Interpretation of factual data**

Site assessment identifies actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from literature and external data source review, sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, owners should retain the services of Coffey through the development stage, to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

### **Your report will only give preliminary recommendations**

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only Coffey, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Coffey cannot be held responsible for such misinterpretation.

### **Your report is prepared for specific purposes and persons**

To avoid misuse of the information contained in your report it is recommended that you confer with Coffey before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

### **Interpretation by other design professionals**

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain Coffey to work with other project design professionals who are affected by the report. Have Coffey explain the report implications to design professionals affected by them and then review plans and specifications produced to see how they incorporate the report findings.

### **Data should not be separated from the report**

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, drawings, etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These logs etc. should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

### **Geoenvironmental concerns are not at issue**

Your report is not likely to relate any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site unless specifically required to do so by the client. Specialist equipment, techniques, and personnel are used to perform a geoenvironmental assessment. Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Coffey for information relating to geoenvironmental issues.

### **Rely on Coffey for additional assistance**

Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction. It is common that not all approaches will be necessarily dealt with in your site assessment report due to concepts proposed at that time. As the project progresses through design towards construction, speak with Coffey to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

### **Responsibility**

Reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Coffey to other parties but are included to identify where Coffey's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Coffey closely and do not hesitate to ask any questions you may have.

## **Appendix A - Figures**

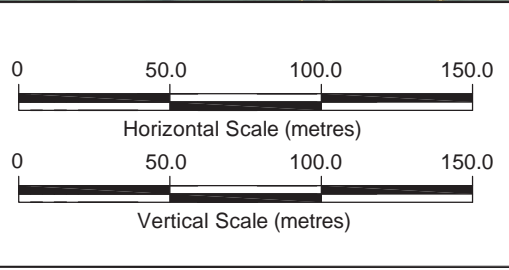


**NOTES**  
 1: Background image and contours taken from Waikato Regional Council online GIS, accessed May 2017.  
 2: Contours shown at 1.0m intervals to Moturiki Datum.

**LEGEND**

— APPROXIMATE SITE BOUNDARY

revision	rev	description	drawn	approved	date
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drawn	SWH
approved	DAS
date	30/05/17
scale	1:2500
original size	A3

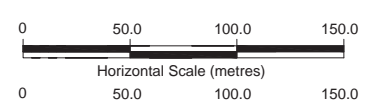


client:	MATAMATA PIAKO DISTRICT COUNCIL		
project:	DESKTOP STUDY ASSESSMENT STIRLING STREET TE AROHA		
title:	SITE PLAN		
project no:	GENZTAUC16120AB	figure no:	01
rev:	0		



NOTE:  
Background image taken from Retrolens.nz. Image taken in 1960.

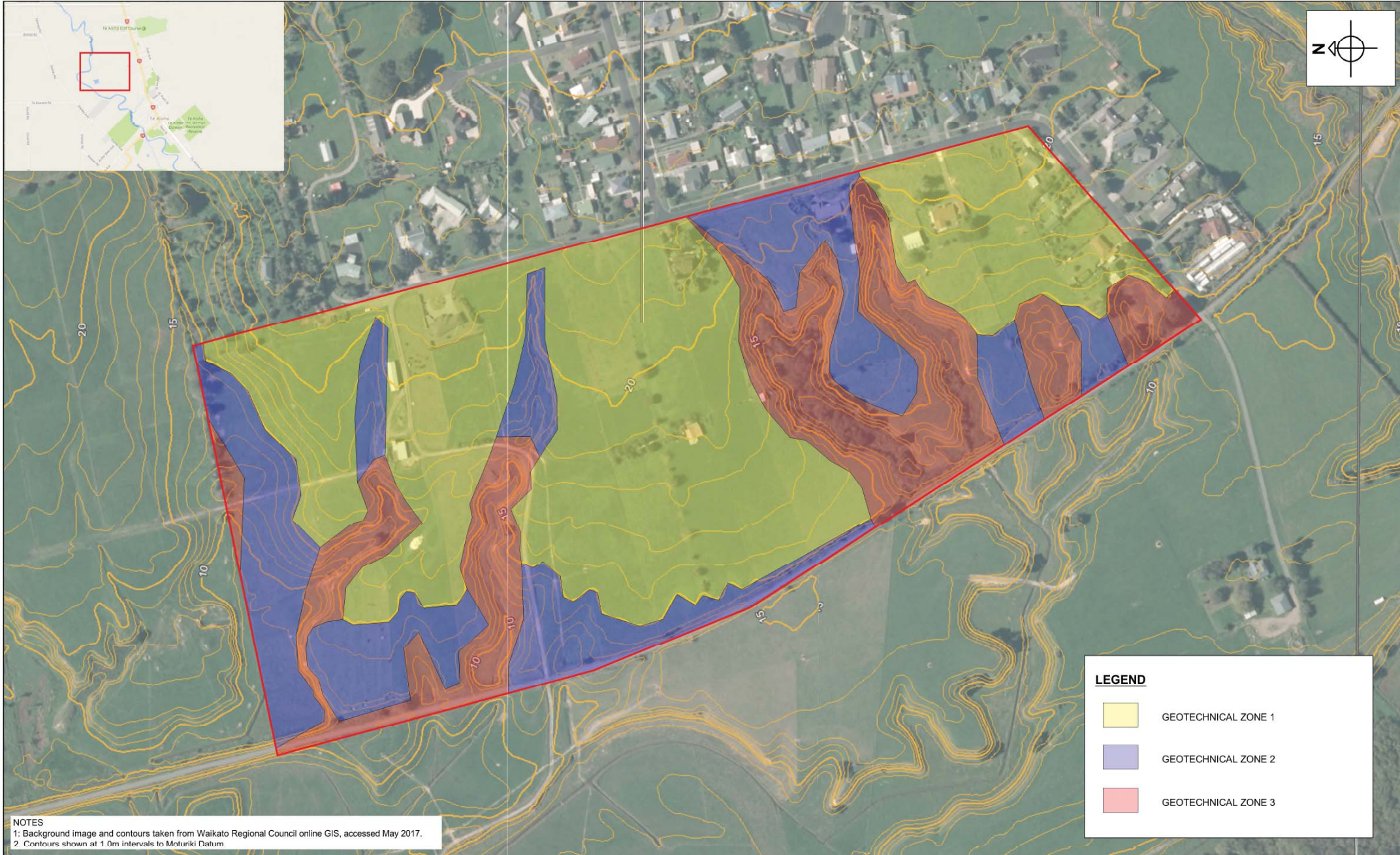
rev	description	drawn	approved	date



drawn	<b>SWH</b>
approved	<b>DAS</b>
date	<b>30/05/17</b>



client:	<b>MATAMATA PIAKO DISTRICT COUNCIL</b>
project:	<b>DESKTOP STUDY ASSESSMENT STIRLING STREET TE AROHA</b>

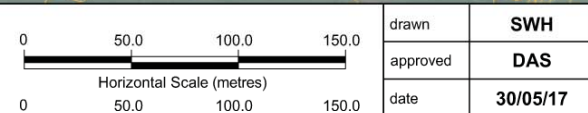


NOTES  
 1: Background image and contours taken from Waikato Regional Council online GIS, accessed May 2017.  
 2: Contours shown at 1.0m intervals to Moturiki Datum

**LEGEND**

- GEOTECHNICAL ZONE 1
- GEOTECHNICAL ZONE 2
- GEOTECHNICAL ZONE 3

rev	description	drawn	approved	date



drawn	<b>SWH</b>
approved	<b>DAS</b>
date	<b>30/05/17</b>



client: **MATAMATA PIAKO DISTRICT COUNCIL**  
 project: **DESKTOP STUDY ASSESSMENT  
 STIRLING STREET  
 TE AROHA**