

MEMORANDUM

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Project reference	773-AKLGE290955AD-AA		
Memo subject	Geotechnical Appraisal to Support Private Plan Change at Hall Farm West – Ara Hills, Orewa West		

1. INTRODUCTION

This memorandum presents a Geotechnical Appraisal to support the proposed Private Plan Change at Hall Farm West - Ara Hills residential subdivision. We understand the proposed Plan Change involves rezoning a number of areas as Mixed Housing Urban and amending the existing Precinct Plan for the development as depicted on the Boffa Miskell Limited Zoning Plans in Appendix A.

The purpose of this memorandum is to:

1. Identify potential geotechnical hazards which may affect the proposed Plan Change;
2. Identify measures required to manage geotechnical hazards and facilitate development in accordance with the proposed Plan Change.
3. Assess the geotechnical suitability of the site to support the Mixed Housing Urban zoning.

A previous geotechnical investigation at the subject site was undertaken by KGA Geotechnical Limited (KGA) in 2015 and they published a report titled; Geotechnical Investigation Report (GIR) on proposed Residential Subdivision at Grand View Estate Orewa (reference 7464-10, dated 2 November 2015). The KGA Report is appended.

Our assessment and recommendations are based on the geotechnical information presented in the KGA GIR, together with a desktop study and a recent site walkover. The evaluation and recommendations presented in this memo are intended for the proposed Plan Change only. Further stage specific geotechnical investigations are recommended to support detailed design of the earthworks and civil engineering aspects of the development.

The outcome of our assessment is that the subject site is geotechnically suitable for the zoning shown on the attached Boffa Miskell Zoning plan. Further details are provided below.

2. DESKTOP STUDY

2.1 SITE DISCRIPTION

The Hall Farm West - Ara Hills subdivisional development is located to the west of SH1 and is accessed via Grand Drive. The area affected by the proposed Plan Change is the western portion of Ara Hills, this area is bound to the south and west by agricultural land, and to the north by the Nukumea Scenic Reserve. Prior to purchase for residential development the site was farmland.

The site is typically moderately steep to steeply sloping, site topography and streams and watercourses are indicated on the appended Geomorphology Plans (Figure 101 to 106). Site coverage includes a mix of grass, gorse scrub, regenerating native bush and planted exotic (Pine) trees.

2.2 GEOLOGICAL SETTING

The published geological map indicates the site is within the East Coast Bays Formation of the Warkworth Subgroup (Waitemata Group) comprising of alternating sandstone and mudstone sequences with interbedded volcaniclastic grits¹.

2.3 GROUND CONDITIONS

The KGA investigations in 2013 and 2015 involved a programme of hand auger boreholes, machine boreholes and trial pits.

In summary the following ground conditions were encountered:

- **Topsoil** at the ground surface at most investigation locations;
- **Colluvium** associated with slope instability processes generally comprising firm to very stiff, clay and silt and loose to medium dense sand.
- **Alluvium** associated with streams and water courses typically encountered within gully inverts comprising very soft to hard silt and very loose to loose sand.
- **Residual Soils** derived from in situ weathering of Waitemata Group bedrock were encountered across the site either from the ground surface or underlying colluvial or alluvial soils. These materials typically comprised stiff to hard clay and silt with a varying sand fraction
- **Transitional Waitemata Group** representing an intermediate weathering state between the underlying bedrock and the overlying Residual Soils was encountered at most borehole locations and comprised hard silts and sands or extremely weak to very weak sandstone and siltstone beds.
- **Waitemata Group Bedrock** was encountered at most borehole locations comprising moderately to slightly weathered extremely weak to weak alternating sandstone and siltstone beds of variable thickness.
- **Uncertified Fill** associated with the construction of State Highway 1 ALPURT B1 and B2 was encountered at AH20 within the eastern portion of the site. The fill comprised mixtures of firm to very stiff silt and clay with intermixed topsoil.

A full description of the ground conditions encountered by the KGA investigation are included in the GIR in Appendix B.

¹ Edbrooke, S.W. 2001: Geology of the Auckland area: scale 1:250,000. Lower Hutt: Institute of Geological & Nuclear Sciences Limited

2.4 LIQUEFACTION VULNERABILITY MAP

The site has been classified in Auckland Council Geomaps as very low liquefaction vulnerability which is defined as; *There is a probability of more than 99 percent that liquefaction-induced ground damage will be None to Minor for 500-year shaking.*

3. SITE WALKOVER AND GEOMORPHOLOGY

As part of the preparation of this memo we have undertaken a site walkover and geomorphic mapping exercise to identify key geotechnical hazards present within the subject area, our findings are presented on the appended Geomorphology Plans (Figure 101 to 106).

Features identified by our geomorphic mapping include:

- Structural liniments indicative of large-scale geological faults and fractures
- Recent and historic head scarps indicative of slope instability
- Distinct debris mounds, terraces or blocks indicative of slope instability
- Soil creep indicative of shallow slope movement
- Streams and watercourses
- Areas of boggy and wet ground

4. GEOTECHNICAL HAZARD ASSESSMENT

Table 1 below presents our summary assessment of the geotechnical hazards present on site based on our desktop study, site walkover and the findings of the previous investigations (2013 and 20150 at the site by KGA. The hazards below include all Geohazards listed in *The Auckland Code of Practice for Land Development and Subdivision Chapter 2: Earthworks and Geotechnical July 2022, Version 2.0*

Table 1: Geohazard Appraisal

Geohazard	Comment	Assessed Risk Pre-Development
Seismic hazards	Alluvial deposits have the potential to liquefy as discussed in Section 5.3.	Medium
Compressible soils	Alluvial deposits and uncertified fills are present on site and are potentially compressible under loading from fills or structures as in discussed in Section 5.2.	Medium
Acid sulphate soils	Not present on site.	Very Low
Expansive soils	Are present on site, can be managed at subdivision completion through appropriate foundation design.	Low
Sensitive soils	Not encountered by the previous ground investigation.	Very Low
Collapse soils	Potential for alluvial soils to collapse once liquefied as discussed Section 5.3.	Medium
Landslide susceptible ground/slope instability	Landslide susceptible ground is present on site as discussed below in Section 5.1.	High
Stream instability and erosion	Streams are present within the development area. Erosion can be managed through development setbacks or specific	Low

	design of anti-scour structures and does not present a major risk to the development proposal.	
Coastal instability and erosion	The site is not in proximity of the ocean.	Very Low
Geothermal issues	The site is not in a geothermal area.	Very Low
Soil erosion	Soil erosion can be managed through specific design of stormwater disposal and outlet structures and does not present a major risk to the development proposal.	Very Low
Rockfall or falling debris	No significant rock fall sources present on site.	Very Low
Uncontrolled fill	Present locally within the eastern portion of the site associated with the construction of State Highway 1 ALPURT B1 and B2 . Will be managed as discussed in Section 5.2.	Medium
Contamination	Considered unlikely based on previous site land-use	Very Low

5. GEOTECHNICAL HAZARD APPRAISAL AND SITE SUITABILITY

Based on our hazard assessment described above we consider that the primary geotechnical hazards on site are;

1. Landslide susceptible ground/slope instability associated with overburden soils
2. Consolidation settlement/subsidence of alluvial soils and uncontrolled fill
3. Potential liquefaction of alluvial soils

These hazards and the risk associated with these hazards are described in detail below.

5.1 SLOPE INSTABILITY

As discussed above in Section 3 there are a number of relict and active slope instability features present throughout the site. Slope instability is triggered through seismic loading, seasonal groundwater fluctuations, deforestation, erosion of slope toe support and changes in slope loading conditions (i.e. placement of fills onto slopes) or removal of support at the toe of a slope.

Slope instability can be managed through the use of development setbacks or specific engineering design of slopes and earth fills which we anticipate will typically involve the installation of subsoil drainage (counterfort and underfill drains) and the construction of geotechnical treatment such as shear keys or inground shear pile (Palisade) walls to stabilise the land. A concept Geotechnical Treatment Plan (Figure 101A to 106A) including geotechnical treatment to address slope instability is appended.

A lower lot density will apply within the Nukumea Reserve Protection overlay which are adjacent to the steep slopes along the edge of the Nukumea Reserve and there will be required due to limitations on earthworks and the requirement to set-back building platforms from the slopes.

5.2 CONSOLIDATION SETTLEMENT/SUBSIDENCE

The soils which present the highest risk with regard to consolidation settlement on site are the unconsolidated alluvial deposits present within streams and gullies, and uncertified fills associated with the construction of SH1 (ALPURT B1/B2) to the east of the site. These soils may be susceptible to excessive post earthworks settlement if loaded by new fills or structures.

The existing requirements of the AUP for future earthworks ensure that settlement is managed. Geotechnical treatment to address consolidation settlement within alluvial deposits and uncertified fills will comprise undercutting compressible soils, the installation of subsoil drainage, or preloading.

5.3 LIQUEFACTION

In our experience saturated sandy/silty alluvial deposits may have the potential to liquefy under a 1/500 year return period ULS design earthquake event. However, we anticipate that these soils would be limited to the base of gullies and that any potentially liquefiable soils within proximity of proposed development areas would be removed through undercutting operations as part of the bulk earthworks involved in developing the land. Therefore, we have no undue concerns regarding the impact of potentially liquefiable soils on future development.

Other overburden soils on site have a low liquefaction potential based on composition and inferred geological age.

Further assessment of the effects of liquefaction if relevant to future development should be undertaken as part of detailed subdivision design.

5.4 CONCLUSION

Provided that further stage specific geotechnical investigations and geotechnical design is undertaken to support landform design and address the geotechnical hazards identified above we consider the site is suitable for the proposed zoning changes shown on the attached Boffa Miskell Zoning plan.

6. LIMITATION

This report has been prepared solely for the use of our client, AV Jennings, 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.

For and on behalf of Tetra Tech Coffey

Prepared By:



James Livingston
Associate Geotechnical Engineer

Reviewed and Authorised By:



Peter Bosselmann
Senior Principal

Figures:

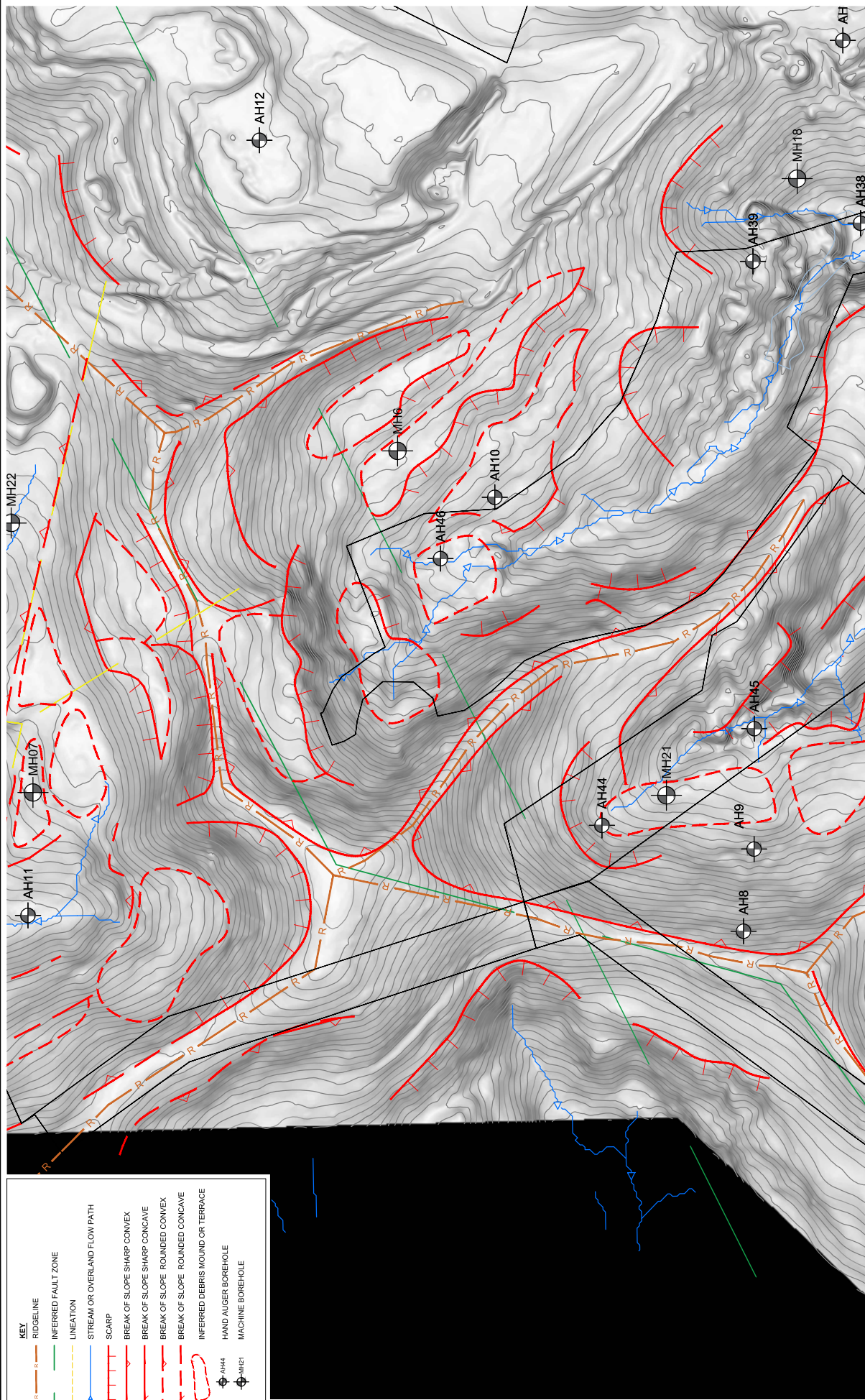
Figure 100-106 Geomorphology Plans

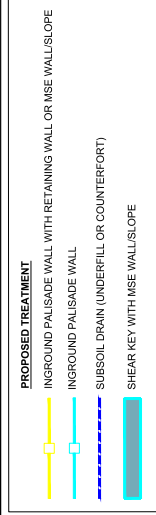
Figure 100A-106A Draft Geotechnical Treatment Plans

Appendices:

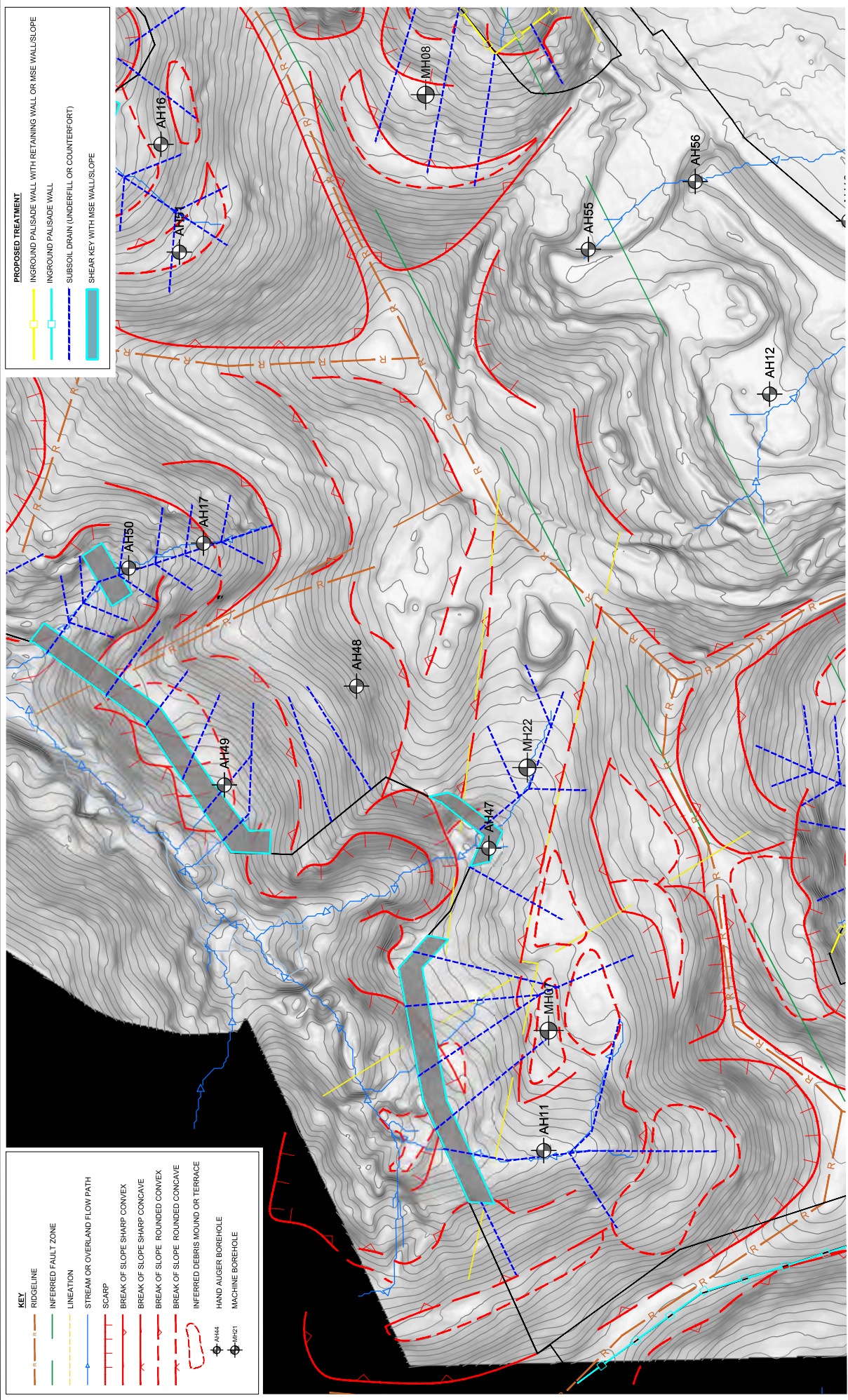
Appendix A: Boffa Miskell Zoning Plan

Appendix B: KGA Geotechnical Limited (KGA) GIR

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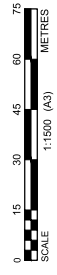
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project:		ARA HILLS MASTER PLANNING	
title:		PROPOSED GEOTECHNICAL TREATMENT	
project no:	AKLGE290955AD	figure no:	103A
rev:	A		



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