WAIKATO DISTRICT PLAN REVIEW SUBMISSION

SUBMITTER KONING FAMILY TRUST

TOPIC: Extent of residential zoning at Raglan

STATEMENT OF EVIDENCE OF KENNETH JOHN READ

Dated: 16 February 2021

Introduction

1. My full name is Kenneth John Read

2. I am a Principal Geotechnical Engineer employed by CMW Geosciences (NZ) Limited Partnership.

Qualifications and Experience

3. I have the qualifications and experience described in the following paragraphs.

4. I have BSc in Geology (2:1 Honours) 1982, from the University of Edinburgh, and a MSc in Engineering Geology, 1984, from the University of Newcastle upon Tyne.

5. I am a Registered Chartered Professional Engineer (CPEng) with Engineering New Zealand, and a Chartered Geologist with the Geological Society of London (UK).

6. I have 38 years' experience in engineering geological and geotechnical engineering consultancy, the last 14 of which have been in New Zealand. The previous 24 years were based in the UK.

7. I have experience in preparing slope stability assessments for residential and infrastructure development, earthworks engineering, foundation design and settlement estimation. Over the last 3 years I had oversight and input to ground investigation, earthworks assessment and geotechnical reporting for Phases A and B of the nearby residential development at Rangitahi.

Code of Conduct

8. I have read the Environment Court's Code of Conduct for Expert Witnesses in the Environment Court of New Zealand and I agree to comply with it. My qualifications and experience as an expert are set out above. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

9. The evidence that I give in these proceedings is within my area of expertise, except when I rely on the evidence of another witness or other evidence, in which case I have explained that reliance.

Scope of evidence

10. In my evidence I address the following issues:

11. The results of my assessment of potential geotechnical constraints that may affect development of the properties identified by the Koning Trust for possible residential development, in particular the risk of slope instability and the potential presence of weak and compressible soils.

12. My evidence will also address the findings of an intrusive ground investigation undertaken to provide additional information on slope instability risk and to aid assessment of likely remedial works where necessary.

13. The results of these works are presented in my reports entitled “Koning Holdings Proposed Plan Change, Geotechnical Constraints Mapping” Ref HAM2018-0021AB Rev 1, dated 20 October 2020 and “Koning Property Raglan, 142 Te Hutewai Road, Raglan, Preliminary Geotechnical Investigation Report” reference HAM2018-0021AF Rev 1, dated 20 October 2020. My evidence summarises those two reports.

SUMMARY OF EVIDENCE

Identification of Potential Geotechnical Constraints

14. Identification of potential geotechnical constraints with respect to residential development of the subject land has been carried out in two phases to date. An initial desk study and site inspection identified slope instability and possible weak or soft compressible soils to be potentially significant constraints. This was followed by further work involving boreholes, test pits and geophysical surveying techniques to better assess these risks together with liquefaction risk, and preliminary earthworks design calculations to help determine the practicality of possible remedial works.

15. The borehole and geophysical investigation identified a previously unrecognised constraint with respect to solution of limestone bedrock to form open voids beneath one part of the site.

16. I have also prepared a preliminary Natural Hazards Risk Assessment (as required under Section 106 of the Resource Management Act at the time of seeking resource consent) which is presented in Appendix D of my Preliminary Geotechnical Investigation Report.

17. In my preliminary Natural Hazards Risk Assessment Erosion of cut and fill batters, and gully areas, bearing capacity failure, and subsidence due to soft soils were all identified as being 'high' or 'very high' latent risk. Landslip (global slope stability and soil creep), and subsidence due to sinkholes were identified as being of 'extreme' latent risk. All of the 'high' and 'very high' latent risks I identified can be remediated to 'medium' and 'low' residual risk by adopting appropriate engineering measures. 'Medium' is the highest acceptable level of residual risk. I concluded that the 'extreme' latent risk due to sinkholes could only be remediated to 'very high' level of residual risk, which is not an acceptable level for development. The particular area of land where the level of 'extreme' latent risk is applicable is discussed in my evidence below and is to be excluded from the proposed residential sub-division development.

18. I consider that the land under consideration for residential sub-division development can be developed for this purpose provided good engineering practice is followed.

19. I further consider, that with the exception of the 'High Hazard Slope Instability' area discussed in Clauses 26 to 30 below, the level of engineering required is within that regularly undertaken in the wider area and of a similar level to that adopted in nearby sites on the same geological strata and terrane.

Categorisation and Zonation of Potential Geotechnical Constraints

20. In my Geotechnical Constraints Mapping report I prepared preliminary zonation maps showing four categories of geotechnical hazard, Low Hazard, Moderate Hazard, High Hazard (soft/wet ground), and High Hazard (slope instability). These are presented on Figures 05, 06 and 07 of that report. Copies of these are appended to my evidence in Appendix A.

21. These zones correspond to areas which I consider require minor earthworks and engineering measures, or an increased degree of earthworks and engineering measures commensurate with that seen on nearby similar development sites, or specific engineering design to mitigate the effects of soft wet soils, or specific engineering measures to mitigate against slope stability respectively. A more detailed description of each category and engineering measures appropriate to each is presented in Section 7 of my report on geotechnical constraints mapping. Avoidance of developing in high hazard areas is also considered as a mitigation measure.

22. Of particular concern with respect to the residential development is a large east facing area identified as a 'High Hazard (slope instability)' zone located to the west of Te Hutewai Road. (See Figure 07 in Appendix A.) This area was observed to have a high density of large historic landslips and was considered to show a greater degree of surface deformation than seen elsewhere on the property. Further this slope instability is on a westward slope, whilst all the other comparatively small 'High Hazard (slope instability)' zones are on east or north facing slopes. (See Figures 05, 06 and 07 in Appendix A.) This suggests a possible difference in the geological conditions promoting the observed slope instability.

Preliminary Geotechnical Investigation Objectives

23. Two machine boreholes and 15 test pits were carried out at selected locations within the targeted High Hazard (slope instability) zone. This was supplemented by a geophysical survey using Electrical Resistivity Tomography (ERT) to aid interpretation of the borehole data. This is discussed in more detail in Paragraphs 26 to 30 of my evidence. Exploratory hole locations are shown on Drawing 01 of my 2020 Geotechnical Investigation Report and a copy of that drawing is appended in Appendix B of my evidence.

24. Both boreholes and seven test pits were located to specifically target the High Hazard (slope instability) zone west of Te Hutewai Road. This was to help assess the causes and risks posed by the apparent ground movement in this area. The remaining seven test pits were primarily located in Moderate and High Hazard zones across the site to help assess the degree of engineering required to allow residential development in those areas.

25. In addition to the above the findings were to be used to gain confidence in general geotechnical issues such as likely foundation bearing capacity, liquefaction and seismic faulting risk, expansive soils and earthworks properties of those soils.

Preliminary Geotechnical Investigation findings
Large High Hazard (Slope Instability) Zone

26. The boreholes encountered stiff to very stiff silts and clays over limestone bedrock. The upper 3.5 to 4.9m of soil is considered to be 'colluvium' derived by slippage and down slope movement. A possible shear plane was observed at 4.9m depth in core from Borehole 2. Colluvium was encountered in the test pits and buried topsoil fragments were also observed in one of the test pits. This confirmed the presence of historic landslips.

27. Borehole 2 located in the northern half of the zone encountered a void within the limestone which was measured to extend a distance of 28m from 15m to 43m below existing ground level.

28. An ERT survey was undertaken to further investigate the nature and extent of possible cavities within the deeper limestone rock. The results of this survey suggest that the limestone rock below this zone is highly fractured, saturated, and may contain some water filled void spaces. No features are observed in the ERT survey results that suggest the presence of a large cavern(s) in the limestone.

29. I consider that there is a strong likelihood that the greater concentration and degree of surface deformation seen over this part of the site (in the form of slips and disturbed ground) may be related to the limestone void features. As such, any remedial works to ensure the integrity of any development within this zone would need to address potential slope stability and settlement risks associated with the limestone bedrock as well as the surface soils. This would require extensive deep ground investigation which still may not fully resolve the level of risk.

30. In my Preliminary Ground Investigation Report, I conclude that the cost of measures to suitably mitigate and resolve the level of risk posed by the voids in the limestone rock would, based on my experience, make development in this area uneconomic.

Slope Stability Elsewhere on the Site

31. In my Preliminary Ground Investigation report, I present the results of site-specific slope stability analyses carried out for one of the steeper slopes with evidence of historic slope instability located in a 'Moderate Hazard' area. These were based on the premise that there is a slip plane present along which movement could occur in wet and saturated conditions, such as during or after a major storm event. This is discussed in Sections 6.6.3 and 6.6.4 of my report.

32. Further analyses has been carried out for the same slope to assess preliminary options for earthworks profiles to demonstrate that developable platforms could be created at that location without potentially excessive engineering and costs. This is discussed in Section 7.3 of my report.

33. The analyses carried out demonstrated that conventional earthworks, in this case incorporating a shear key into the base of the engineered fill and slope, can be designed and adopted to create a practical and cost effective means of developing the 'Moderate Hazard' areas for residential dwellings and associated infrastructure. This methodology is widely used and has been successfully employed in nearby developments on very similar geology and terrain.

34. The Preliminary Risk Remediation Plan presented as Drawing 02 of my Preliminary Ground Investigation report shows areas where I consider slope instability risks can be suitably remediated and allow development (a copy of the drawing is presented in Appendix C of my evidence). The location of shear keys and areas developed will ultimately be a function of development requirements (e.g. ground levels and gradients).

Seismic and Liquefaction Risks

35. There are no known active faults in close proximity to the site. The nearest known active fault is the Kerepehi Fault some 80km east of Raglan.

36. The liquefaction risk on this property has been assessed in accordance with current guidelines. The soils encountered across the site are low to high plasticity, stiff to hard clays and silts, with minor areas of firm to stiff high plasticity clay, and low plasticity clayey silt and silt. Case history data suggests that these soils are not

susceptible to liquefaction on the basis of soil fabric and strength.

37. Weaker alluvial soils in the valley and gully bases (High Geotechnical Hazard: Soft / Wet Ground areas) may be susceptible to liquefaction and seismic softening during and after an earthquake event. The potential effects of such liquefaction and soil softening can be mitigated by avoiding these areas, removal of these soils, and/or ground improvement works to strengthen or drain these soils.

Earthworks and Foundation Conditions

38. Excavation of the soils that will be encountered in earthworks cuts across the site should be readily achieved with normal earthworks plant, such as scrapers and bulldozers with scoops. The site soils are expected to be generally suitable for use in cut to fill bulk earthworks carried out by a competent earthworks contractor under summer conditions.

39. Some underfill drainage and shear key construction will be needed as part of the earthworks in order to create stable development platforms. However, in my experience I consider this will be of an order typical for developments of this type in the Waikato.

40. Geotechnical ultimate bearing pressures of 300kPa and associated ‘good ground’ foundation conditions with respect to NZS3604:2011 should be achievable for both engineered fill and the natural soils outside the High Hazard (wet/soft soils) areas after slope stability remedial works.

41. I expect settlement of fills and foundations generally to be low over the majority of the site. Where any potentially unacceptable levels of settlement may occur, such as infilling over soft soil zones, they should be made manageable by conventional earthwork practices. These include undercutting and removal of the soft soils, and/or preloading these soils to force rapid settlement before housing and infrastructure development proceeds.

CONCLUSION

42. I consider that the land under consideration for residential sub-division development can be developed for this purpose provided good engineering practice is followed.

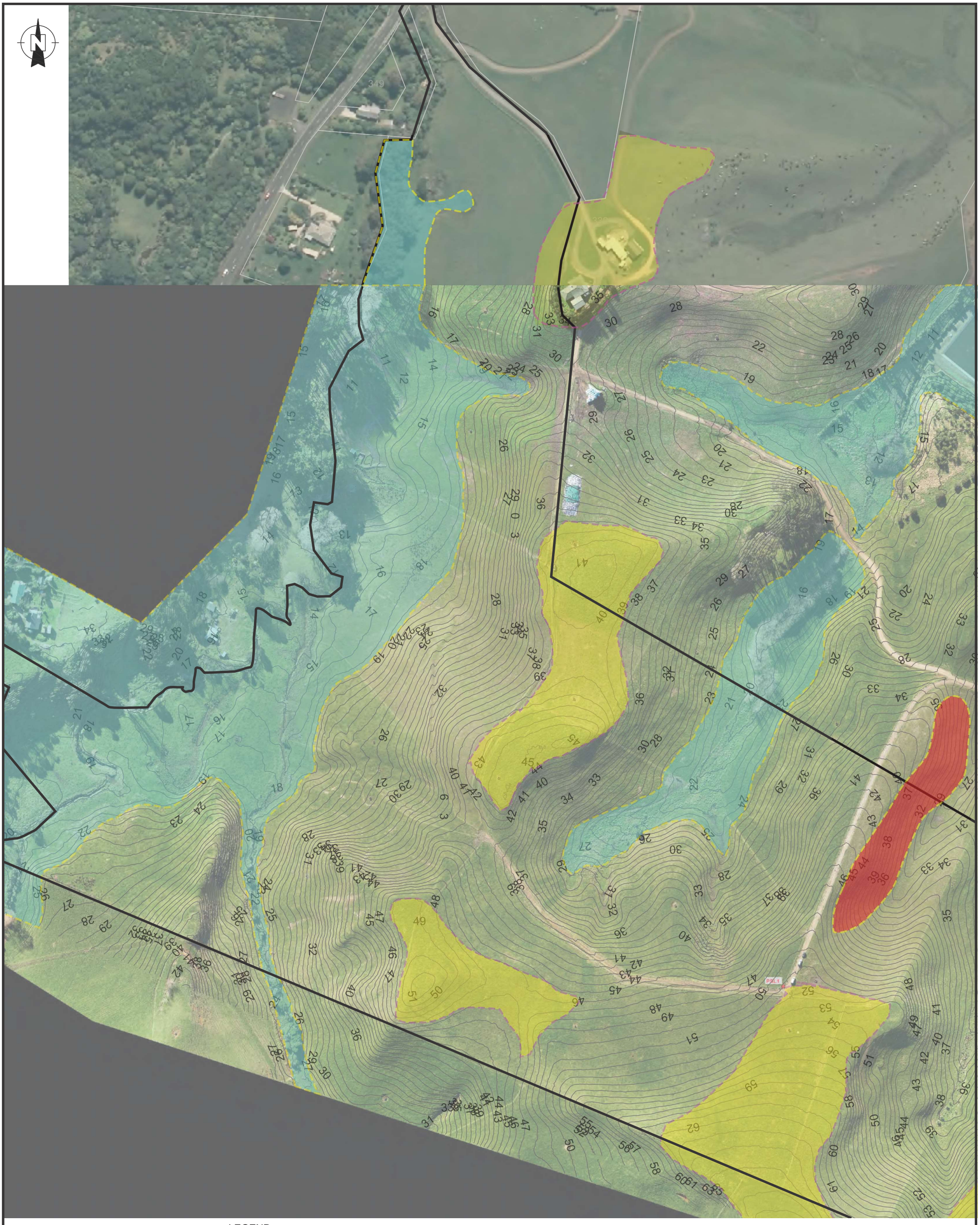
43. I further consider, that with the exception of the ‘High Hazard Slope Instability’ area discussed in Clauses 26 to 30 above, the level of engineering required is within that regularly undertaken in the wider area and of a similar level to that adopted in nearby sites on the same geological strata and terrane.

Dated: 16 February 2021

Kenneth John Read

APPENDIX A

Copies of Figures 05, 06 and 07 of my report entitled “Koning Holdings Proposed Plan Change, Geotechnical Constraints Mapping” Ref HAM2018-0021AB Rev 1, dated 20 October 2020



NOTES:

BASE PLAN ADAPTED FROM:
AERIAL IMAGERY AND CONTOURS PLAN

0 25 50 75 100 125 m

LEGEND:

ZONE A - LOW GEOTECHNICAL HAZARD

ZONE B - HIGH GEOTECHNICAL HAZARD (SOFT GROUND)

ZONE C - HIGH GEOTECHNICAL HZARDS (SLOPE INSTABILITY)

APPROX. SITE BOUNDARY

UNSHADED AREAS OF THE MAP INDICATE MODERATE GEOTECHNICAL HAZARD

REV	DATE	DESCRIPTION	BY
A	27/08/2018	FOR INTERNAL REVIEW	YSL
B	26/09/2018	FOR COMMENT	YSL
C	26/09/2018	FOR COMMENT - PORTRAIT	YSL

CMW Geosciences

CLIENT: KONING FAMILY TRUST		DRAWN: YSL	PROJECT No: HAM2018-0021
PROJECT: PROPOSED PLAN CHANGE 146 TE HUTEWAI ROAD & 339B WAINUI ROAD, RAGLAN		CHECKED: KJR	FIGURE: 05
		REVISION: C	SCALE: 1:2500
TITLE: GEOTECHNICAL HAZARD MAP 1 (WESTERN EXTENT)		DATE: 26/09/2018	SHEET: A3 p

NOTES:

BASE PLAN ADAPTED FROM:
AERIAL IMAGERY AND CONTOURS PLAN

0 25 50 75 100 125 m

LEGEND:

ZONE A - LOW GEOTECHNICAL HAZARD

ZONE B - HIGH GEOTECHNICAL HAZARD (SOFT GROUND)

ZONE C - HIGH GEOTECHNICAL HZARDS (SLOPE INSTABILITY)

APPROX. SITE BOUNDARY

UNSHADED AREAS OF THE MAP INDICATE MODERATE GEOTECHNICAL HAZARD

REV	DATE	DESCRIPTION	BY
A	27/08/2018	FOR INTERNAL REVIEW	YSL
B	26/09/2018	FOR COMMENT	YSL
C	26/09/2018	FOR COMMENT - PORTRAIT	YSL

CMW Geosciences

CLIENT: **KONING FAMILY TRUST**		DRAWN: YSL	PROJECT No: HAM2018-0021
PROJECT: **PROPOSED PLAN CHANGE 146 TE HUTEWAI ROAD & 339B WAINUI ROAD, RAGLAN**		CHECKED: KJR	FIGURE: 06
		REVISION: C	SCALE: 1:2500
TITLE: **GEOTECHNICAL HAZARD MAP 2 (CENTRAL)**		DATE: 26/09/2018	SHEET: A3 p

NOTES:

BASE PLAN ADAPTED FROM:
AERIAL IMAGERY AND CONTOURS PLAN

0 25 50 75 100 125 m

LEGEND:

ZONE A - LOW GEOTECHNICAL HAZARD

ZONE B - HIGH GEOTECHNICAL HAZARD (SOFT GROUND)

ZONE C - HIGH GEOTECHNICAL HZARDS (SLOPE INSTABILITY)

APPROX. SITE BOUNDARY

UNSHADED AREAS OF THE MAP INDICATE MODERATE GEOTECHNICAL HAZARD

REV	DATE	DESCRIPTION	BY
A	27/08/2018	FOR INTERNAL REVIEW	YSL
B	26/09/2018	FOR COMMENT	YSL
C	26/09/2018	FOR COMMENT - PORTRAIT	YSL

CMW Geosciences

CLIENT: KONING FAMILY TRUST		DRAWN: YSL	PROJECT No: HAM2018-0021
PROJECT: PROPOSED PLAN CHANGE 146 TE HUTEWAI ROAD & 339B WAINUI ROAD, RAGLAN		CHECKED: KJR	FIGURE: 07
		REVISION: C	SCALE: 1:2500
TITLE: GEOTECHNICAL HAZARD MAP 3 (EASTERN EXTENT)		DATE: 26/09/2018	SHEET: A3 p

APPENDIX B

Copy of Drawing 01 – Site Investigation Plan from my report entitled “Koning Property Raglan, 142 Te Hautewai Road, Raglan, Preliminary Geotechnical Investigation Report” reference HAM2018-0021AF Rev 1, dated 20 October 2020.

LEGEND:

- BH01 — BORE HOLE (BH) LOCATION
- TP01 — TEST PIT (TP) LOCATION
- ERT SURVEY LINE
- SITE BOUNDARY
- CROSS SECTION LINE

NOTES:

1. BASE PLAN ADAPTED FROM180622 AERIAL SOLUTIONS RAGLAN - CONTOURS

CMW Geosciences

CLIENT: KONING FAMILY TRUST		DRAWN: WPJ	PROJECT No: HAM2018-0021
PROJECT: KONING DEVELOPMENT		CHECKED: JW	DRAWING: 01
		REVISION: 0	SCALE: 1:4500
TITLE: SITE INVESTIGATION PLAN		DATE: 31/07/2020	SHEET: A3

C:\USERS\WINNIEPJ\CMW GEOSCIENCES PTY LTD\CMW CONNECT - HAM\2018\HAM2018-0021 RAGLAN PROPOSED PLAN CHANGE\07 DRAWINGS\CROSS SECTION\HAM2018-0021 SITE PLAN REVA.DWG

APPENDIX C

Copy of Drawing 02 – Preliminary Risk Remediation Plan from my report entitled “Koning Property Raglan, 142 Te Hautewai Road, Raglan, Preliminary Geotechnical Investigation Report” reference HAM2018-0021AF Rev 1, dated 20 October 2020.

Key

- Site Boundary
- Main Road (22m road reserve)
- Secondary Road (20m road reserve)
- Road Reserve
- Further Road Connection
- Residential
- Residential (out of the boundary)
- Stream
- Gully
- Farmland
- Open Space
- Planting Area

Legend

- High Geotechnical Hazard - Slope Stability
- Expected soft soil zone
- Expected slope remediation zone
- Possible shear key location

CMW Geosciences

CLIENT: KONING FAMILY TRUST		DRAWN: WPJ	PROJECT No: HAM2018-0021
PROJECT: KONING DEVELOPMENT		CHECKED: JW	DRAWING: 02
		REVISION: 0	SCALE: 1:5000
TITLE: PRELIMINARY RISK REMEDIATION PLAN		DATE: 07/08/2020	SHEET: A3

C:\USERS\WINNIEPJ\CMW GEOSCIENCES PTY LTD\CMW CONNECT - HAM\2018\HAM2018-0021 RAGLAN PROPOSED PLAN CHANGE\07 DRAWINGS\CROSS SECTION\HAM2018-0021 SITE PLAN REVA.DWG