Level 1 | 236 Hereford Street
Christchurch CBD, 8011

19 November 2021

Kapiti Coast District Council

Attention: **Marnie Rydon / Consultant Planner**
Email: marnie@incite.co.nz

RE: **RM210147 Otaihanga Estates Subdivision**
48 & 58 Tieko Street; 131, 139 & 147 Otaihanga Road, Paraparaumu
Geotechnical peer review

Project Number: **MINZ210505.00**

Dear Marnie,

As requested, Miyamoto International NZ Ltd (Miyamoto) has been engaged as an independent geotechnical engineer to undertake a peer review of the geotechnical report submitted to the Kapiti Coast District Council (KCDC) for the Otaihanga Estates subdivision resource consent application, namely:

- "Geotechnical Investigation at Otaihanga Road, Paraparaumu", prepared by Resource Development Consultants Ltd (RDCL), dated 25 April 2021 (project No. R-195340402-02_Rev01).

In preparation of our peer review we were also provided with the below documents in a portable document format (pdf):

- "RM210147 - Application - 48 _ 58 Tieko Street; 131_ 139 _ 147 Otaihanga Road_ Paraparaumu.pdf"
- "RM210147 - FIR Response Received 15 Sept 2021 - 48 Teiko Street_ Otaihanga.pdf"
- "RM210147 - Signed Further Information Request - Tieko Street and Otaihanga Road_ Paraparaumu.pdf"
- "RM210147 - FIR Response Received 17 Sept 2021 - Otaihanga Road_ Paraparaumu.pdf"

In addition, RDCL kindly provided us the raw Cone Penetration Testing (CPTu) data and evaluation files which used to inform our review process.

The purpose of this peer review is to ensure that the information provided follows best practice and the conclusions are sound for the site conditions and intent development involving earthworks with cut and fill depths of approximately 8.2m.

RDCL undertook a detailed geotechnical investigation, reasonably covering the area under the current resource consent application including test pits, dynamic cone penetrometer tests (DCPs aka 'scalas'), and 11No. CPTu tests. The geotechnical report follows current geotechnical practice, is suitable for the resource consent application, however, Miyamoto considers the following comments and

suggestions important to clarify few potential issues identified in our review process.

- Although we are in general agreement with the presented, descriptive, generalised ground profile, we suggest inclusion of the ground elevation (R.L.) to the presented geotechnical investigation logs and reported ground water levels in Table 1.

  The ground profile can be further 'divided' to maximum 0.5m thick silty/sandy topsoil across the entire site, followed by a 'transition' layer of loose to medium dense sand and silty sands down to a depth 3.0mbgl (meter below ground level), underlying by medium dense sand (fine silty dune sand) to R.L. 3.0 – 6.0m, and/or dense sands depending on the location/elevation at the investigation point. Similarly, the ground water level can be assumed at 1.6 to 4.0mbgl or within R.L. 4.5 to 5.9m.

- Shallow ultimate bearing capacity (UBC) values are presented in Table 2 as a 'direct' correlation from the recorder DCP values. A large depth variation is given for the reported 200 and 300kPa ultimate values for the current ground conditions, which are not representative or 'usable' for the final subdivision levels considering the cuts and fills. If required, an ultimate bearing capacity of 200kPa can be assumed below the topsoil, and 300kPa at depths greater than 0.9mbgl. In addition, a bearing capacity estimation using the B1/VM4 verification method can be added for the estimated strength parameters (mostly friction angle ϕ' and unit weight γ) for the underlying soil layers or the minimum required for the fill.

- We agree with the presented liquefaction triggering analysis, however depending on the ground water level (hence why inclusion of R.L. considered necessary), liquefaction triggering is likely within the top 2.0 to 3.0m along the transition layer before getting into the medium dense or dense sands. The location of the lower elevation CPTs, such as CPT 1 as shown below with a cut and fill for the construction of the required fill and a wetland, should be carefully considered for the slope stability of the final development under static, and more importantly, under seismic and post-seismic conditions.

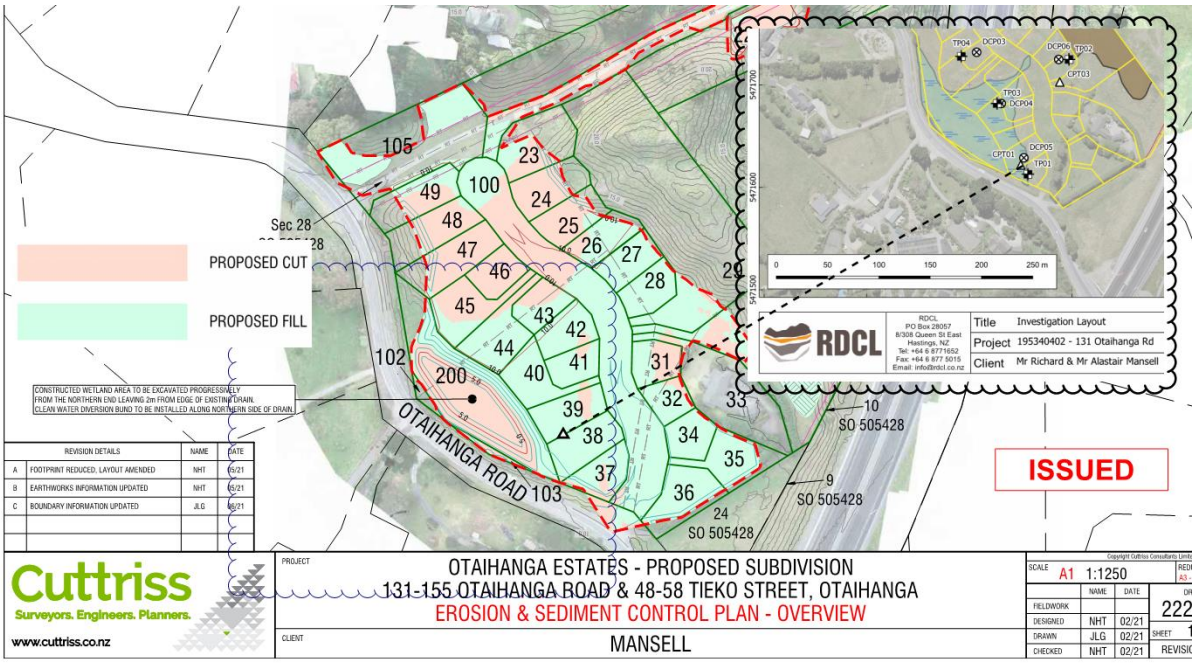


Fig 1. Extract from Cuttriss plan (scale as shown) showing the location CPT1

- Although we agree the site is geotechnically suitable for the proposed land development, the conditions included in RDCL's geotechnical report section 5 should be further detailed by providing the required backfill material suitability criteria (i.e. compaction characteristics and/or soil classification), and minimum strength parameters to satisfy future stability of the fill slopes (with critical care for the conditions of the 8.2m maximum slope height).

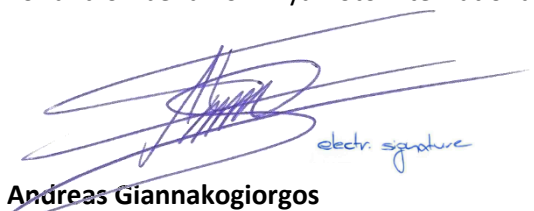
- Section 5.3 proposed setback from slopes are not consistent with the parameters given in section 5.4 (i.e. permanent batters and estimated effective stress strength values), and are not supported by some form of limit equilibrium slope stability checks.

  We are not certain how the proposed 3.0m setback derived, or how they were revised from 5.0 to 3.0m, hence our proposed need to clarify and supported with slope stability analysis capturing future loading conditions. Miyamoto's preliminary stability checks using the proposed slopes and Table 5 effective strength parameters cannot justify the given setback under the investigated loading conditions (i.e. static, seismic and increased pore water pressure using an r_u value of 0.15) for a loose silty sand slope, and a denser slope. A yield or critical acceleration value k_y of 0.119 and 0.204g identified for the examined slopes.

  It should be clarified that our previous comments are mostly to highlight the discrepancy between the proposed and reported values, the lack of additional criteria for the backfill forming the slope(s) and shouldn't be considered as an indication of a wider slope stability concern affecting the land development. The reported setback values and proposed parameters should be revised and supported as required.

I trust that this provides enough clarification/justification around the requested geotechnical review and specified scope of works. Should you have any further queries, please do not hesitate to contact me.

Yours faithfully/sincerely
For and on behalf of Miyamoto International Ltd



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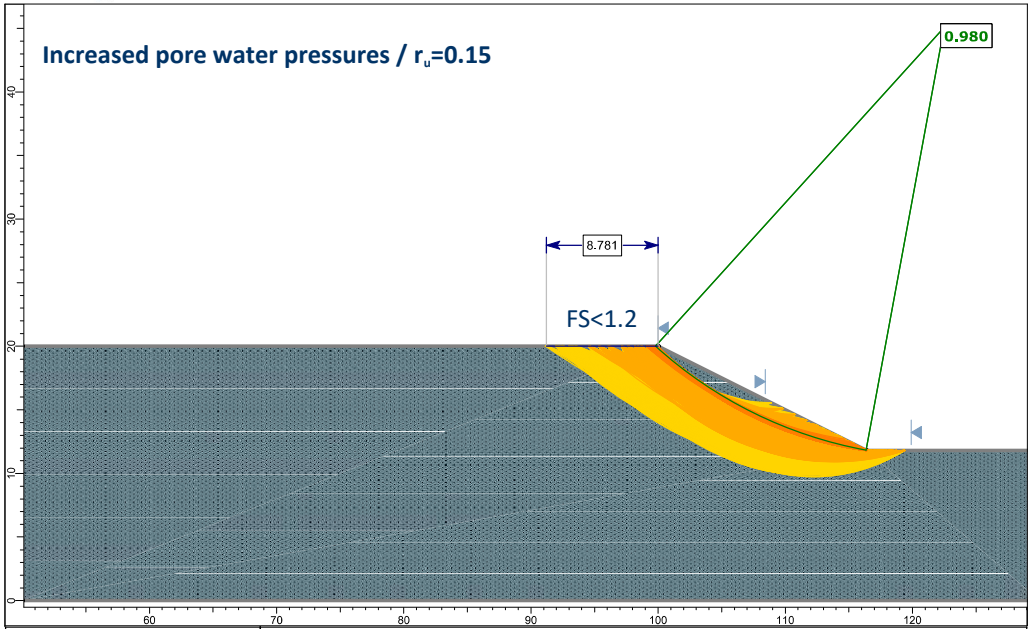
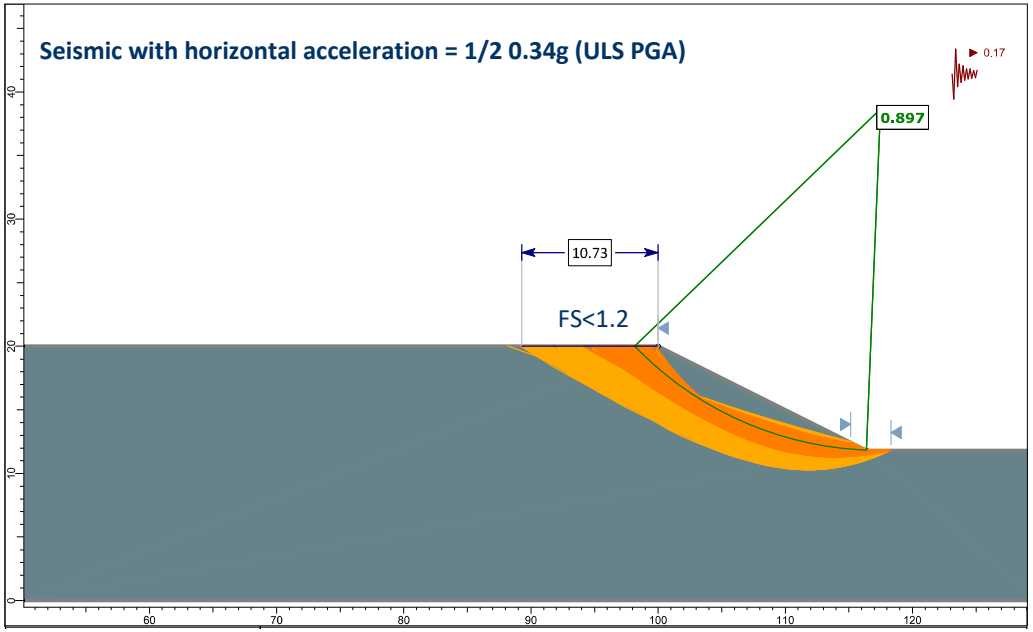
Appendix

Increased pore water pressures / r_u=0.15

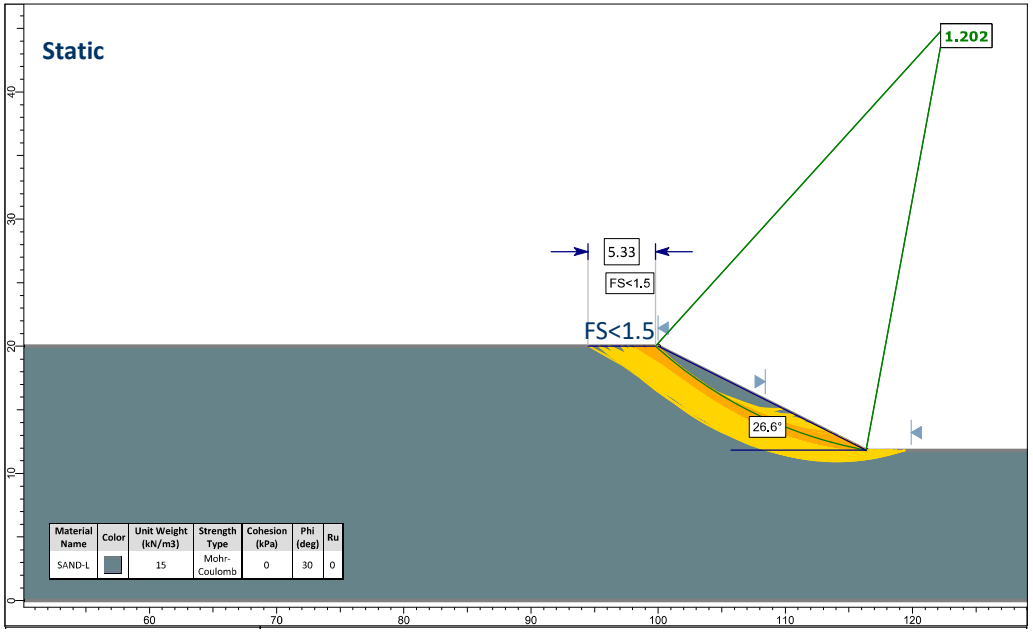


Seismic with horizontal acceleration = 1/2 0.34g (ULS PGA)

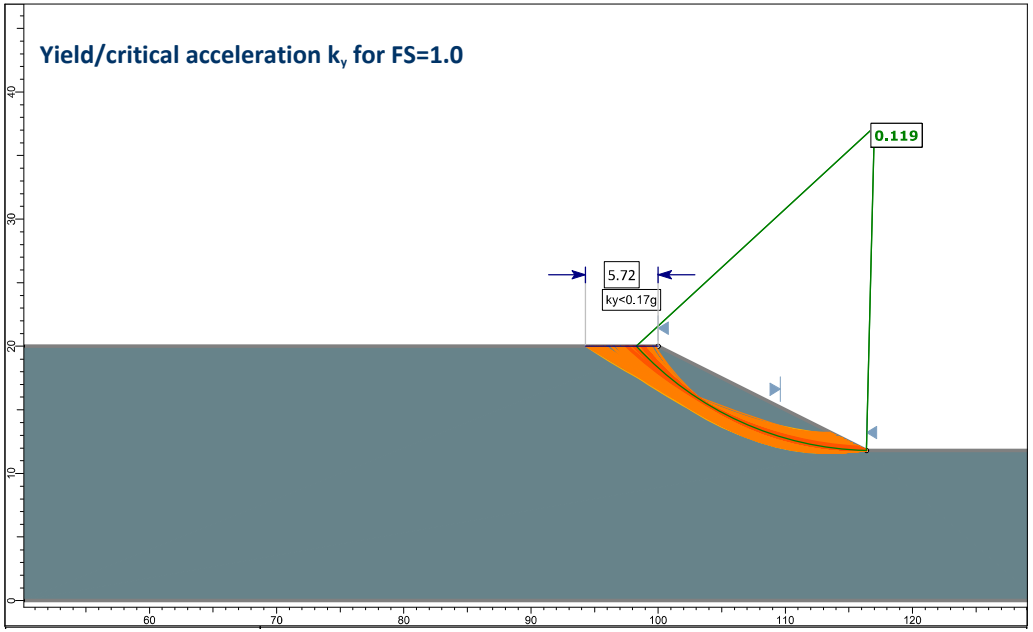


Permanent 1V:2H (26.6° or 50%) slope on Loose material

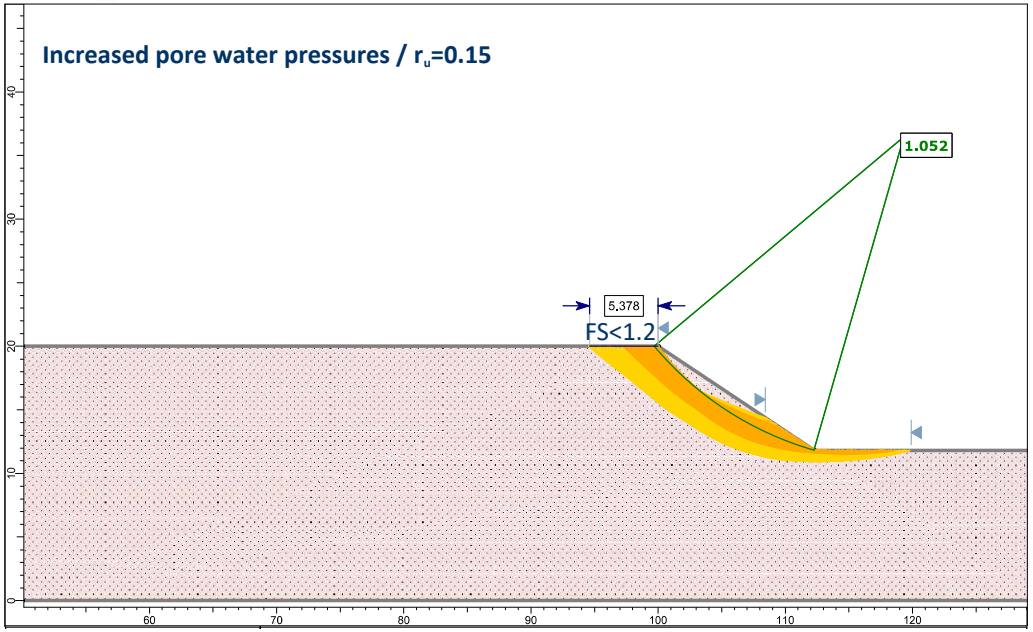
Static



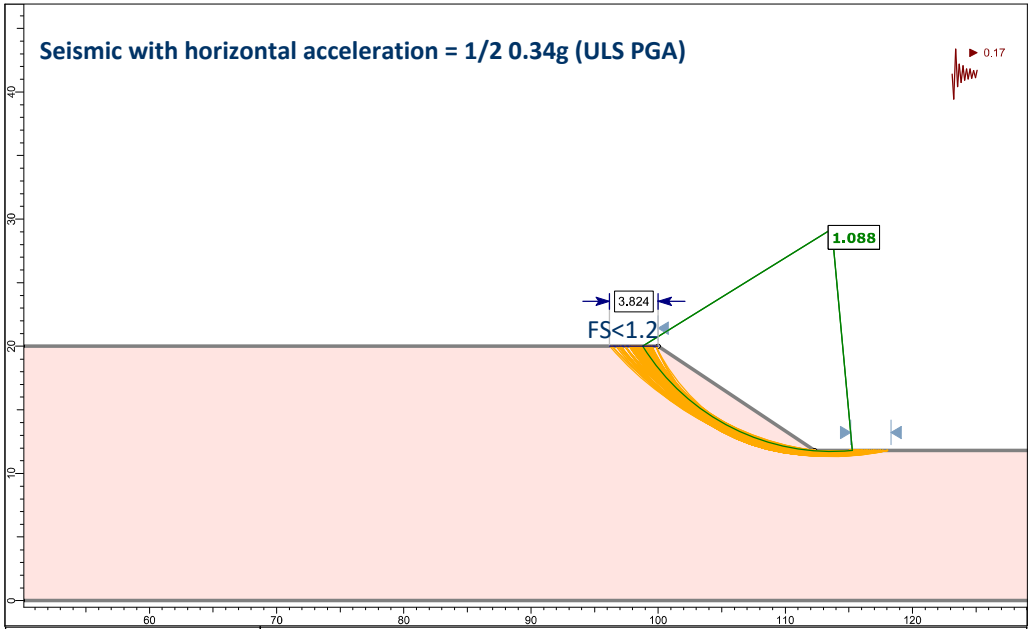
Yield/critical acceleration k_y for FS=1.0



Increased pore water pressures / r_u=0.15

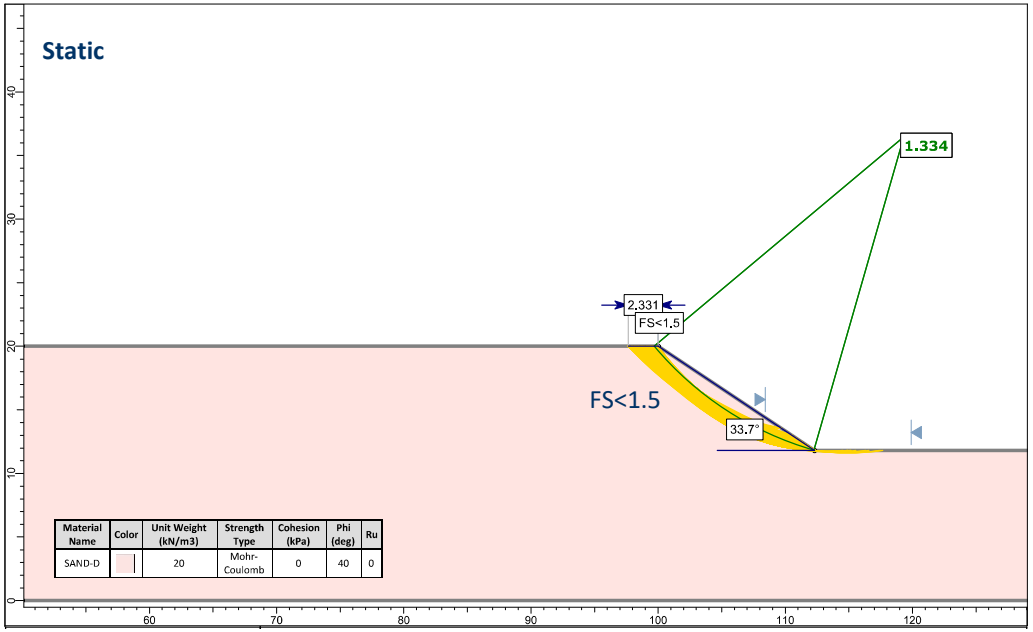


Seismic with horizontal acceleration = 1/2 0.34g (ULS PGA)



Permanent 1V:1.5H (33.7° or 66.7%) slope on Dense material

Static



Yield/critical acceleration k_y for FS=1.0