

Before the Hearings Commissioners at Wellington City Council

under: the Resource Management Act 1991

in the matter of: an application by Ryman Healthcare Limited for resource consent to construct, operate and maintain a comprehensive care retirement village at 26 Donald Street and 37 Campbell Street, Karori, Wellington

between: **Ryman Healthcare Limited**
Applicant

and: **Wellington City Council**
Consent Authority

Statement of evidence of **Pierre John Malan** on behalf of
Ryman Healthcare Limited

Dated: 29 August 2022

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STATEMENT OF EVIDENCE OF PIERRE JOHN MALAN ON BEHALF OF RYMAN HEALTHCARE LIMITED

INTRODUCTION

- 1 My full name is Pierre John Malan. I am a Principal Geotechnical Engineer with Tonkin & Taylor Limited.
- 2 I have a Masters of Engineering (Civil) and a Bachelor of Engineering (Civil) with Honours from the University of Canterbury. I am a Chartered Professional Engineer, an International Professional Engineer and a Member of Engineering New Zealand. I have over 20 years' experience in geotechnical engineering consultancy, primarily in New Zealand and the United Kingdom.
- 3 I have specialised skills in the field of geotechnical engineering. My experience includes leading geotechnical and multidisciplinary teams on projects. These include a team assessing aspects of natural hazards for the Earthquake Commission in Christchurch, supporting the geotechnical hazard assessment for construction of part of Transpower's North Island Grid Upgrade Project, assessing geotechnical aspects of various sites during the construction of the Northern Gateway Toll Road, as well as the development of various commercial, industrial and residential sites around Auckland and Wellington.
- 4 Particularly relevant projects with which I have been associated in my capacity as a geotechnical engineering expert include the development of more than twenty retirement village sites. I have worked on sites with geotechnical challenges similar to this one, with high levels of seismic loading.
- 5 In particular, I directed and led the geotechnical team providing inputs to Ryman's Bob Scott Retirement Village in Petone, Wellington. This village has a similar design concept to the current project, comprising multi-storey, base isolated buildings with high seismic loadings.
- 6 I am familiar with Ryman's resource consent application to construct and operate a comprehensive care retirement village (*Proposed Village*) at 26 Donald Street and 37 Campbell Street, Karori, Wellington (*Site*).
- 7 I designed and directed the geotechnical site investigations, and then supervised and reviewed the preparation of the Geotechnical Engineering Assessment of Environmental Effects dated August 2020 (*Geotechnical Report*). I also supervised and reviewed the preparation of the section 92 response dated 13 November 2020 (*Further Information Response*).
- 8 I have visited the Site and its surroundings on a number of occasions since 2017, most recently on 26 May 2022.

CODE OF CONDUCT

- 9 Although these proceedings are not before the Environment Court, I have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Note (2014), and I agree to comply with it as if these proceedings were before the Court. My qualifications as an expert are set out above. This evidence is within my area of expertise, except where I state that I am relying upon the specified evidence of another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE

- 10 My evidence sets out the following:
- 10.1 A summary of the Geotechnical Report and Further Information Response;
 - 10.2 My response to the geotechnical issues raised in submissions;
 - 10.3 My response to the geotechnical matters addressed in the Council Officer's Report (*Officer's Report*), and particularly the ENGEO report authored by Ayoub Riman and Stephanie Cherfane;
 - 10.4 My comments on the draft conditions; and
 - 10.5 My conclusions.

SUMMARY OF EVIDENCE

- 11 The site specific geotechnical investigations show the Site is underlain by natural deposits, comprising an outwash fan on the more elevated slopes, and more recent alluvium on the lower area. Below this is Greywacke rock, shallow in the south, and deeper in the north. Groundwater is typically measured within a metre or two of the ground surface.
- 12 I have carried out liquefaction, stability and ground deformation assessments at the Site. Typically, I assess only the recent alluvium soils (on the lower flat area) as being likely to experience liquefaction, and the geomorphology (presence of slopes) at the Site supports this conclusion. I do not identify potential for the Proposed Village to exacerbate seismic hazard at adjacent sites.
- 13 I have assessed the stability of slopes at the Site, and considered earthworks for the Proposed Village. Given the cut, fill and building layout, I do not consider there will be adverse effects on land stability on or around the Site.

- 14 I have assessed the ground deformation effects from the Proposed Village. These effects typically comprise a combination of settlement from buildings and filling, mechanical deformation from excavations near boundaries and groundwater drawdown below historic low levels.
- 15 Loading from buildings and filling are located away from Site boundaries. Given the setbacks and loads I do not assess there to be any consequential settlement effects beyond the Site.
- 16 There are two locations where significant excavation is proposed near boundaries; B01A North (cutting into the slope), and B07. The northern retention for Building B01A will be designed to be high stiffness, and is located away from the Karori pool at its highest location. B07 retains a lower height, is set back further from the boundary and is not located near structures or services. I do not therefore consider these excavations will have consequential adverse effects inside or outside the Site.
- 17 I have also considered the proposed trenching, and made a (conservative) assessment of potential deformation. My assessment indicates less than 5 mm movement at site boundaries, except where identified below, and I note this is a routine activity typically carried out without adverse effects.
- 18 Groundwater drawdown below historic levels can induce consolidation settlement of soils. I have carried out an assessment of potential effects. This assessment concluded that boundary settlements are expected to be negligible, or less than 5 mm.
- 19 I have then considered the combined effects of groundwater drawdown and mechanical settlement. I assess expected deformations at the boundary in the northern area of less than 10 mm, and at B07 potentially up to 15 mm. I do not assess either to have consequential adverse effects.
- 20 Along Scapa Terrace and Campbell Street trenching for services may (conservatively) cause up to 10 mm settlement at the boundary in specific areas, and less than 5 mm at residential structures. I conclude that this level of deformation would not cause adverse effects based on other similar typical situations.
- 21 I have reviewed the submissions. A number raise concerns about the potential for deformation to affect their dwellings. I assess the potential for deformation in the main body of my evidence and do not consider adverse effects are expected. Despite this conclusion, I understand Ryman will offer to carry out pre construction condition surveys to provide a baseline if any potential effects are identified.
- 22 I have reviewed the Officer's Report. That report concludes that *"stability and geotechnical matters can be appropriately managed and mitigated as much as practicable, and that effects will be less*

than minor".¹ I agree with this conclusion. I comment later on the conditions in Appendix 1 of the Officer's Report, noting these are matters of detail as to the appropriate management of geotechnical risks, rather than fundamental differences of opinion. In my view, Wellington City Council's (*Council*) conditions are, in places, overly onerous and unnecessary for this Site.

ASSESSMENT OF GEOTECHNICAL EFFECTS

Assessment methodology

- 23 In summary, my assessment comprised the staged development of a geological and geotechnical model for the Site. Following the development of the model, the potential geotechnical effects of the Proposed Village was considered in the context of subsurface conditions as set out below. The assessment methodology is set out in more detail in Section 7 of the Geotechnical Report.

Existing Environment – subsurface conditions

- 24 The Site is located on an elevated terrace bounded by the Khandallah and Wellington Faults. Subsurface investigations indicate that an outwash fan comprising interbedded silts and sands with minor gravel forms the more elevated slopes in the northeast of the Site. Bedded alluvial soils occur on the flatter terrain below, referred to as 'recent and lower alluvium'.
- 25 The entire Site is underlain by Greywacke rock, with the surface dipping down towards the north east, from around 5 m to more than 29 m below ground level.
- 26 Groundwater levels monitored at three locations around the Site ranged between 1.1 to 3.5 m below ground level.

Potential geotechnical considerations

- 27 In my opinion, the key geotechnical considerations for the construction of the Proposed Village at the Site relate to the potential for:
- 27.1 Liquefaction effects under seismic loading;
- 27.2 Land stability effects; and
- 27.3 Ground deformation and settlement effects.
- 28 I discuss each of these as follows. I note the effects of a groundwater bore (including any dewatering) are addressed in a separate application to the Regional Council.

¹ Council Officer's Report, Recommendation Report – Laura Brownlie, paragraph 406.

Seismic and Liquefaction assessment

- 29 I quantitatively assessed the potential for liquefaction under seismic shaking based on Cone Penetration Test (*CPT*) data using the method set out by Boulanger and Idriss (2014).²
- 30 This calculation has been supplemented by my qualitative assessment of the Site geomorphology, borehole logs and other investigation data, and observations on the performance of the Site during the 2016 Kaikoura Earthquakes.
- 31 My qualitative analysis shows that the risk of liquefaction is confined to the upper recent and lower alluvium soils with potentially liquefiable beds occurring from the surface to around 6.5 m depth. Calculated 'free field' (away from building or other loads) liquefaction induced settlements are:
- 31.1 Less than 25 mm under 25 year return period seismic loadings (Serviceability Limit State (*SLS*) events);
 - 31.2 Up to 60 mm from a 100 year return period seismic loadings; and
 - 31.3 Up to 100 mm for 500 year return period seismic loadings (Ultimate Limit State (*ULS*) events).
- 32 The nature of soils at the Site are typically silty or dense, and (except in some localised recent and lower alluvium areas) not particularly susceptible to liquefaction. Under significant seismic loading, the materials may still experience post-liquefaction settlement, and a reduction in bearing capacity, lateral support and stiffness.
- 33 The Site geomorphology also suggests that liquefaction is not a significant hazard around the Site. Slopes like those present at the Site cannot be present if repeated, consequential liquefaction occurs over time.
- 34 I am not aware of any damage to the land or the structures at the Site as a result of the shaking experienced in the 2016 Kaikoura earthquakes and did not observe any effects during my site inspections.
- 35 Liquefaction effects, including calculated settlement magnitude, must be considered during the detailed design phase for Building Code compliance, but in my opinion can readily be accommodated with normal design methods.

² Boulanger, R, Idriss, I, (2014); *CPT and SPT based liquefaction triggering procedures*. Center for Geotechnical Modelling Department of Civil and Environmental Engineering University of California Davis, California. Ref: UCD/CGM-14/01, April 2014.

36 Therefore, I consider the seismic hazard risks for the Proposed Village can be accommodated by normal design methods. Given the proposed earthworks, the size and likely foundations structures, I do not consider the Proposed Village buildings and earthworks likely to exacerbate seismic hazard effects at adjacent sites.

Land stability effects

37 There are steeper slopes in the north east part of the Site. These slopes are typically up to 20°, but with local steps associated with building footprints. The remainder of the Site is flat to gently sloping (less than 10°). My visual assessment of the slopes did not identify any signs of consequential slope instability.

38 Any significant cuts or excavations to be undertaken for the Proposed Village will be assessed and supported with suitably designed and constructed retaining walls. The effects of the retention are discussed in the next section.

39 Isolated areas of fill are proposed to level local depressions within the Site. Given the geometry and scale of the earthworks, I do not consider these areas of fill will affect land stability. I note that no significant filling is proposed on sloping ground, and any cuts will be appropriately retained.

40 In summary, I do not consider the Proposed Village will adversely affect land stability on or around the Site.

Ground deformation and Subsidence (settlement) effects Overview

41 This section addresses the potential for ground movement associated with:

41.1 Proposed foundation systems for buildings and fill/structural loads near the boundary causing consolidation settlement;

41.2 Reduced lateral confinement from soil excavation leading to mechanical deformation; and

41.3 Groundwater drawdown below historic low levels leading to consolidation settlement.

42 I discuss each of these further below.

Foundation systems and fill/structural loads

43 Any fill earthworks required for the Proposed Village that have the potential to cause settlement effects are located away from the Site boundaries.

44 By inspection, and based on my other assessments at the Site, I do not consider there will be any consequential settlement effects beyond the Site boundaries due to fill earthworks.

45 Aside from Building B01A at the northern boundary, the foundations for the new buildings are greater than 4 m from the boundaries. Building B01A is set back 3 m from the northern boundary. The major buildings (B01A and B01B) are likely to be founded on base isolated bearings. These bearings can either be piled (typically using bored piles extending to rock or forming a raft) or founded at grade on shallow foundations. B02-B07 are lower height buildings and likely to be founded on shallow foundations.

46 Given the distance from boundaries and potential foundation systems, I do not consider there will be any consequential settlement effects beyond the Site boundaries due to structural loading from the buildings.

Excavations and retaining walls

47 Several areas of permanent cut will be required to form the proposed levels across the Site, and permanent ground retention will be adopted. Temporary excavations during construction will either be battered or retained.

48 Excavation, even for a single level basement, inevitably leads to some deformation of the surrounding soil. Therefore, as the soils are removed from inside the basement areas, there is the potential for these soils to deform (mechanically) and affect adjacent sites. The proposed retention system has been designed to minimise these effects, and the proposed system means that at no stage will the basement walls be left unsupported.

49 Excavations can cause deformation effects by either mechanical deformation, or by drawing down groundwater and inducing ground settlement, or a combination.

50 Figure 1 below (reproduced from the Geotechnical Report) shows the Site with identified retention/excavation (excluding service trenches).

51 The minor retention at Areas 4 and 5 are less than 1.5 m high and have low levels of deformation associated with them. I do not assess there will be any adverse effects from these walls and do not discuss them further.

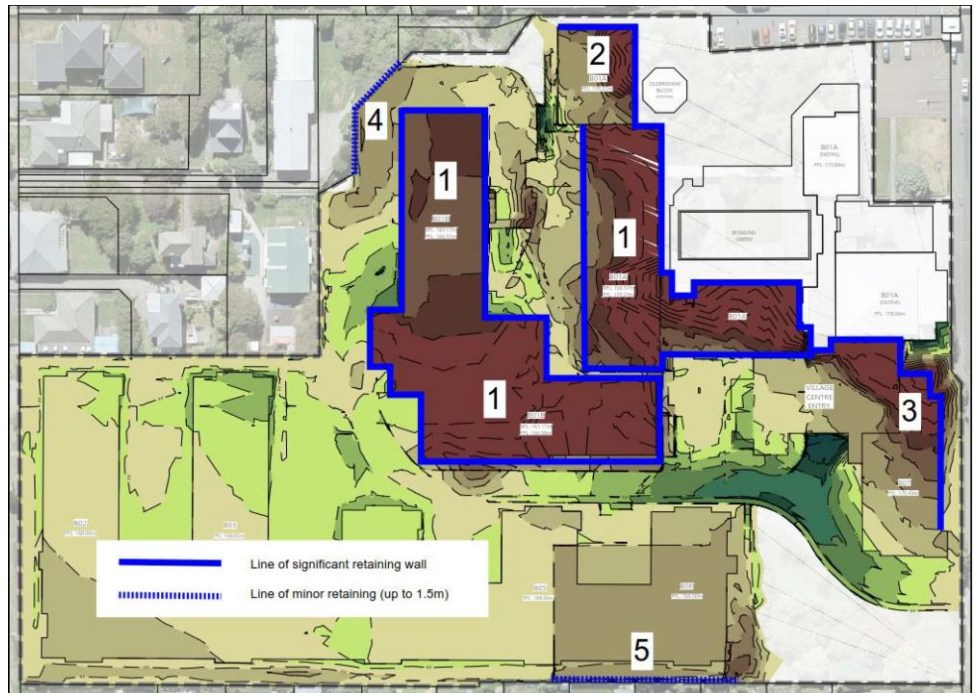


Figure 1: Site with identified retention/excavation

52 I summarise the mechanical effects of the excavation/retention for buildings in Areas 1-3 at the site in Table 1 below, as well as the proposed stormwater tank. The assessment process is set out in the Geotechnical Report.

Table 1 – Summary of assessed mechanical deformation settlement at Site boundaries

Area, Location	Excavation/ Retention Height	Assessed boundary settlement	Comment
1, B01B	Less than 2.5 m at closest approach to boundaries	Negligible	More than 9 m from boundaries
1, B01A Central eastern face	Up to 7 m (internal face)	Negligible	At least 40 m from site boundaries
2, B01A Adjacent to Northern Boundary	Up to 5.5 m	Less than 5 mm	High stiffness retention (as discussed in paragraphs 53-54 below)

3, B07 Donald Street boundary	Up to 4 m	Less than 10 mm	Low stiffness retention system, set back 5 m from boundary
B03/B04 Stormwater tank	3 m	Negligible	Set back more than 6 m from southern boundary

53 At Area 2, B01A, there is a cut into the existing slope, that grades up to a maximum height of 5.5 m. Beyond the boundary is a concrete footpath and stairs, with Karori Pool set back a further 5 m. I note the excavation depth increases to the east (cutting into the slope), and is at its highest away alignment from the pool footprint. A specifically designed 'high stiffness' wall (probably propped internally) can mitigate the potential for adverse effects.

54 In my experience, the magnitude of retaining deformations and settlement effects presented in Table 1 are normally accepted by councils, and do not typically cause consequential effects unless sensitive structures are present. I therefore do not assess there will be consequential settlement effects for any buildings, structures or assets outside the Site boundaries as a result of mechanical deformation.

55 I have also considered the potential effects of trenching to install services at the Site. Trenches are temporary cuts that are generally propped while constructed, and do not normally cause any consequential adverse effects. However, I have carried out an assessment using the same approach as the retention systems, noting I consider this to be a very conservative assessment. This assessment suggests there may be minor settlements around the Site (typically less than 5 mm at boundaries), except where identified in paragraph 45.

Groundwater drawdown

56 I have assessed the potential for basements at the Site to draw down groundwater and induce settlement through primary consolidation. I have assessed the potential groundwater drawdown based on measured groundwater levels and the proposed basement extents. Table 2 below provides a summary of my assessment of drawdown settlement. I consider these assessments to be moderately conservative, as I did not take into account beneficial effects such as previous seasonal groundwater drawdown and the potential for higher than assumed groundwater recharge from offsite.

Table 2 – summary of groundwater drawdown settlement assessment

Building	Max assessed drawdown at Basement	Geological profile adopted	Calculated settlement	Distance to nearest boundary	Assessed settlement at the nearest boundary
B01A (ex Oldershaw Building location)	1.8 m (Note 1)	BH02	6 mm	3 m	<5 mm
B01A (ex Gray Building location)	2.4 m	BH03	<5 mm	30 m	Negligible
B01A (ex Waghorn Building location)	1.1 m	BH02, BH03	<5 mm	30 m	Negligible
B01B (ex Pankhurst Building location)	1.3 m	BH01, BH02	<5 to 13 mm (Note 2)	10 m	Negligible
B01B (ex Theatre and Dance Studio)	3.9 m	BH01, BH06	<5 to 35 mm (Note 2)	25 m	Negligible
B07	0.5 m	BH05	<5 mm	5 m	< 5 mm
Stormwater tank	1.5 m	BH04	<2 mm	6.4 m	Negligible

Notes: 1 – Additional drawdown below ex Oldershaw lower floor level
 2 – The upper range of settlement is based on greater thickness of weak alluvial soils encountered in BH01. These materials are not present to similar extents in other surrounding boreholes and therefore settlement effects are expected to be limited in extent within the Site.

57 I consider groundwater drawdown will result in less than 5 mm of settlement at Site boundaries. Based on this magnitude, I therefore do not predict any consequential settlement effects for buildings, structures or assets outside the Site boundaries due to groundwater drawdown.

Combined deformations and settlement effects

58 I have assessed the combination of mechanical deformation and settlement from groundwater drawdown at the Site boundary. In general, I assess the combined settlement to be negligible, and no more than 5 mm. I discuss below the two areas where the combined settlement may exceed 5 mm at the Site boundary, with a discussion on residential dwellings after that. I note that 5 mm settlement is at the threshold of detectability, and in my experience does not cause consequential effects.

- 58.1 22 Donald St (adjacent to proposed Building B01A): Combined deformations based on a high stiffness retaining system are assessed as less than 10 mm at the Site boundary, and probably less than 5 mm. This reduces further to the nearest structure (Karori Swimming Pool, which is set back 3 m from the boundary). Given the basement geometry and retaining wall stiffness, the setback of the pool, I consider the expected deformation magnitude of a few millimetres to be sufficiently low that I do not expect any consequential adverse effects.
- 58.2 Donald Street road reserve (adjacent to proposed Building B07): Combined deformations based on a low stiffness retaining system are assessed to be in the order of 5 to 10 mm, and possibly up to 15 mm at the Site boundary. Unless sensitive structures or services are present (which is not the case here), this is smaller deformation than councils normally accept for road reserves. I assess the risk of ground deformation at the identified cast iron water main within the road reserve (9 m from the wall) to be very low (likely to be 1-2 mm at most) due to the setback distance. I therefore assess the potential for consequential adverse effects for the road reserve as negligible.
- 59 The below residential properties are predicted to have less than 5 mm of settlement potential at any structure not owned by Ryman. The settlement is associated with the installation of services in trenches and (as I note in paragraph 41) I consider this to be a very conservative assessment. I therefore assess the risk of consequential adverse effects as negligible.
- 59.1 16 and 18 Scapa Terrace: I assess mechanical deformation at the boundary and within the neighbouring landscaped area of 5 to 10 mm during installation of stormwater infrastructure (and probably less). I expect this deformation to reduce to negligible deformation at the nearest residential and ancillary structures within the property.
- 59.2 29 Campbell Street: I assess mechanical settlement of less than 10 mm at the boundary and within the neighbouring landscaped area. I expect this deformation to reduce to less than 5 mm at the nearest secondary structure within the property.
- 59.3 33 Campbell Street: I assess mechanical settlement of 5 to 10 mm at the boundary and neighbouring residential type structure. I note that the potentially affected property in this case is owned by Ryman and written approval has been provided, but I include this comment for completeness.
- 59.4 33A Campbell Street: I assess mechanical settlement of less than 10 mm at the boundary and within the neighbouring

landscaped area. I expect this deformation to reduce to less than 5 mm at the nearest residential structure within the property.

- 60 In summary, I consider the combination of mechanical deformation and settlement from groundwater drawdown will typically result in less than 5 mm of settlement at boundaries, with a worst case (excluding the Ryman property) of less than 10 mm of settlement at the specific boundary locations and landscaped areas identified. In my experience, this magnitude of deformation is typically accepted by councils, and does not tend to cause issues to normal structures. I do not assess the Site to have features that would suggest different outcomes to the typical situation. On this basis, I do not consider the Proposed Village will have any consequential adverse ground deformation and settlement effects on adjacent properties.

RESPONSE TO SUBMISSIONS

- 61 I have reviewed all 75 submissions, and address the geotechnical issues raised by submitters below. With the exception of Mr King and Ms McKinnon-King (75), the submitters are concerned about the potential for ground movement at their properties.

Ground movement potential

- 62 A number of submitters raise concerns about deformation effects on their properties.³ They reference effects from excavation, piling and the potential for 'mud like' subsurface conditions to be present.
- 63 A number of these submitters also raise the offer made by Ryman to have their homes assessed prior to and post-construction, and request that this offer be required.
- 64 I have assessed the potential ground movements and present my conclusions in my evidence above in paragraphs 40 to 46. The potential for ground movement near these submitters' properties is primarily associated with trenching to install buried pipes. These works are commonly carried out without any adverse effects. As set out above, I have assessed the potential settlement effects of these works as negligible at structures, and less than 5 mm at Site boundaries.
- 65 The geological features noted by Mr Hamilton (45) have been appropriately acknowledged and considered in the Geotechnical Report.
- 66 For completeness, I also note that foundation driven piles are not contemplated at the Site. Given the expected construction

³ Submission 43 (Wallace), 45 (Hamilton), 46 (Mattlin), 49 (Gestro), 50 (van Amelsfort), 56 (Cooper), 57 (Leikis & Porter), 58 (Moran), 60 (Sprott), 65 (Responsible Development Karori Inc), 70 (Moore), 72 (Ingham) and 74 (Major).

techniques, and based on my experience with similar projects, I do not consider there is a credible mechanism for vibration causing the ground to compact or settle (deferring also to the Statement of Evidence of Siiri Wilkening).

- 67 Notwithstanding my assessment, I understand Ryman intends to offer adjacent landowners pre-condition surveys of structures to provide a 'baseline', with post-construction surveys to occur if any potential effects are identified. Although not strictly necessary in my opinion, I support this approach to provide certainty.

David King & Anna McKinnon-King (75)

- 68 Mr King and Ms McKinnon-King⁴ consider that *"no evidence is provided or assessment is given as to whether the adverse effects will be minor at most or not"*. They also consider that *the [geotechnical] expert report does not consider applying or apply a s3(f) test... Consequently, the potential adverse geotechnical effects are possibly greater than minor. Further, expert advice needs to be provided by Ryman on this matter"*.

- 69 Section 3(f) of the RMA defines the term 'effect' to include *"any potential effect of low probability which has a high potential impact"*. The Geotechnical Report considers all potential geotechnical effects, including low probability, high consequence effects. The Geotechnical Report aligns with good industry practice for geotechnical assessments. As set out in this statement of evidence, I consider all potential geotechnical effects will be negligible or will not be consequential for adjacent properties.

RESPONSE TO COUNCIL OFFICER'S REPORT

- 70 I have reviewed the Officer's Report dated 22 August 2022 prepared by Ms Laura Brownlie and the geotechnical peer review of my geotechnical report by ENGEO (Mr Ayoub Rimani and Ms Stephanie Cherrane), as well as a copy of Mr Rimani's assessment.
- 71 Mr Rimani notes, and Ms Laura Brownlie accepts, that *"the proposed development can be successfully constructed if the potential geotechnical risks identified and discussed in the reviewed Tonkin and Taylor report and letter are considered during the building consent and construction stage."*
- 72 Ms Brownlie concludes that, *"based on the expert advice received and through the imposition of and adherence to the recommended conditions of consent, I consider stability and geotechnical matters can be appropriately managed and mitigated as much as practicable, and that effects will be less than minor."*

⁴ Submission 75 (King & McKinnon-King).

- 73 Subject to my comments on the conditions, I generally agree with these conclusions.
- 74 The Officer's Report⁵ also discusses cut and fill depths at paragraphs 400 to 402, and asks (for completeness) that the maximum cut and fill heights be confirmed. The Statement of Evidence of Mr Ajay Desai addresses this request.
- 75 The Officer's Report notes at paragraph 405 that the Council's Earthworks Engineer includes a recommended condition of consent that requires a PS4 to be supplied to Council.⁶ I consider this will be addressed at Building Consent stage (and it is not therefore necessary to duplicate this requirement in the resource consent process).

DRAFT CONDITIONS

- 76 I have reviewed the Council's draft conditions in the Officer's Report.⁷ I have the following main comments (leaving aside drafting, clarity and process matters, which are addressed in the Statement of Evidence of Mr Richard Turner):
- 76.1 Conditions 3, 4, 5 and 6 – as a general comment, these conditions currently apply to 'all earthworks foundations and excavations'. If these conditions are in fact necessary given the operation of Condition 1 (addressed in the Statement of Evidence of Mr Turner), they should be limited to specific affected areas (B01A north and B07). If a monitoring plan is required (noting the low levels of deformation assessed), then deformation alert / action / alarm levels should be set to normally accepted tolerances (typically 10-20 mm at boundaries), rather than being based on the assessed deformation. Small amounts of deformation can be difficult to accurately measure with seasonal changes, and survey baseline and monitoring accuracy, and therefore inadvertently trigger alert / action / alarm responses unnecessarily.
- 76.2 The other elements of Condition 5 relate to slope stability, and the need for pre-certification. I have addressed slope stability in paragraphs 36-39 above. As excavations will be retained in the permanent case, and accounting for the good condition of the slopes in regards to instability and the strength of the subsurface materials, I have not identified any risk of global instability. I consider slope instability risks to

⁵ Council Officer's Report, Recommendation Report – Laura Brownlie, paragraphs 400 to 402.

⁶ Council Officer's Report, Recommendation Report – Laura Brownlie, paragraph 405.

⁷ Council Officer's Report, Appendix 1 – Recommended Conditions of Consent.

have the potential for local deformation (associated with the construction), rather than global instability with the potential to cause adverse effects outside the Site. I note that the Geotechnical Review commissioned by Council agreed with my assessment of slope instability risk.⁸

- 76.3 In my opinion, pre-certification of works would potentially be appropriate where there are critical sequences to avoid significant hazards from manifesting (such as global instability). This is not the case here as the slope instability risk is low. Pre-certification removes flexibility to respond to developments during construction, including changing weather conditions, supply chain issues, or programmes changing and evolving through the build sequence.
- 76.4 Given the risk profile discussed above, the conditions appear overly onerous and unnecessary in relation to slope instability.
- 76.5 Conditions 7-9 relate to the Construction Management Plan (CMP) and are written with a similar focus on land instability, although with more onerous requirements in places. These include defining maximum height increments of earthworks and a requirement to adopt 'current engineering best practice' (which I do not consider readily definable in this context) in the review and certification process. My evidence at paragraph 76.2 applies here as well. Given the assessed risk profile of slope instability at the Site, these are overly onerous and unnecessary.
- 76.6 Conditions 15 and 16 - Given the scale of earthworks proposed at the Site, and in particular the reasonably small amount of filling (2,500 m³), the requirement for certification at the end of each stage of earthworks is onerous and unnecessary. I consider the original wording in John Davies' assessment tying the construction review statement to the completion of earthworks to be more appropriate.⁹
- 76.7 Condition 16 requires a PS4 – Construction Review, which is associated with the Building Consent process, rather than a Resource Consent. I suggest this Condition be removed, and Council identify the need for any PS4 in individual Building Consent applications.

⁸ Council Officer's Report, Appendix 10 – Geotechnical - Ayoub Riman, paragraphs 11 to 13.

⁹ Council Officer's Report, Appendix 8 – Earthworks - John Davies, Condition 11.

CONCLUSION

- 77 I conclude that there is no geotechnical issue that would preclude the granting of consent for the Proposed Village on the basis of the conditions discussed in this evidence.

Pierre John Malan
29 August 2022