UNDER the Resource Management Act 1991 ("**RMA**")

AND

IN THE MATTER of a notice of requirement ("**NoR**") for a designation by KiwiRail Holdings Limited ("**KiwiRail**") for the Palmerston North Regional Freight Hub ("**Freight Hub**") under section 168 of the RMA

STATEMENT OF EVIDENCE OF ANDREW MOTT
ON BEHALF OF KIWIRAIL HOLDINGS LIMITED

GEOTECHNICAL

1. SUMMARY

1.1 A Preliminary Geotechnical Assessment ("**PGA**") has been undertaken for the Freight Hub. While there are some potential geotechnical risks for the proposed site for the Freight Hub ("**Site**"), based on the information in the PGA, I consider that these risks will be able to be managed by developing engineering solutions through the design process.

1.2 The most significant geotechnical risks identified at this stage include potentially soft, liquefiable ground in low lying areas with potential for settlement and the requirement for cut and fill earthworks. The extent to which these risks eventuate will inform engineering design.

1.3 Confirmation of ground conditions will be achieved through ground investigation and ground model development during the design process. This is common for a project of this type or nature. Whether ground improvement measures are required, and if so, what measures are most appropriate to incorporate into design will depend on the outcomes of ground investigations and ground model development.

2. INTRODUCTION

2.1 My full name is Andrew Peter Mott. I am a Principal Engineering Geologist at Stantec. I hold the qualifications of Bachelor of Science (Joint Honours) in Physical Geology and Geomorphology from the Liverpool University (1992)

and Master of Science in Environmental Geotechnology from the University of Newcastle upon Tyne (1994). I am a Fellow of the Geological Society of London and a Chartered Geologist (UK). I am also a member of the New Zealand Geotechnical Society.

Experience

2.2 I have approximately 26 years' experience in civil engineering consultancy including approximately 1 year seconded to the Transpower National Grid upgrade construction between Brown Hill in Auckland and Whakamaru north of Taupō. I have approximately 9 years' experience in the UK with the remainder mainly within the North Island of New Zealand.

2.3 Other infrastructure projects I have worked on include SH3 Manawatu Gorge slip investigations and assessments following the February 2004 rain event, SH1 Otaki to North of Levin Multi Criteria Analysis route optioneering, SH58 Safety Improvements between the Hutt Valley and Porirua, the Hawkes Bay windfarm and Hamilton City Council Pukete 2 and Pukete 3 Wastewater Treatment Plant upgrades.

2.4 Other recent projects I have worked on include Kāinga Ora housing redevelopments in Palmerston North and Hamilton City Council's Rotokauri Greenway Notice of Requirement. For the Greenway project I assessed the geotechnical effects of the requiring authorities proposed swale, ponds and flood storage system in low lying recent alluvial deposits.

Involvement in the Freight Hub

2.5 I have been engaged by KiwiRail to provide advice on the geotechnical related aspects of the Freight Hub development. I have been involved with the multi criteria analysis ("**MCA**") optioneering process inputting on geotechnical and natural hazard considerations and commenting on geotechnical considerations of the Freight Hub.

2.6 I prepared the PGA that was included with the Assessment of Environmental Effects for the Freight Hub ("**AEE**"). I also assisted with KiwiRail's response on 15 February 2021 to Palmerston North City Council's ("**PNCC**") further information request. This included matters relating to cumulative effects of lateral spreading, differential settlement, seismicity and flooding.

Code of conduct

2.7 I confirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2014 and that I agree to comply with

it. I confirm that I have considered all the material facts that I am aware of that might alter or detract from the opinions that I express, and that this evidence is within my area of expertise, except where I state that I am relying on the evidence of another person.

3. SCOPE OF EVIDENCE

3.1 This statement of evidence will:

(a) provide an overview of the methodology and key conclusions of the PGA;

(b) respond to the submissions received that relate to geotechnical matters; and

(c) address relevant matters raised in the Section 42A Report.

4. METHODS OF ASSESSMENT

4.1 The geotechnical assessment of the Site involved undertaking a desktop assessment of available information, outlining possible geotechnical constraints and measures to manage or mitigate those possible constraints. The assessment includes the following elements:

(a) review published geological mapping, the Active Faults Database and reports from Geological and Nuclear Sciences ("**GNS**");

(b) assessment of ground investigation records from the New Zealand Geotechnical Database;

(c) review historical aerial photography from Retrolens and Google Earth;

(d) assess PNCC and Horizons Regional Council ("**HRC**") natural hazard information;

(e) assessment of engineering geological and geomorphological features using Google Earth, Google Streetview, Site lidar contours and drive over of accessible roads adjacent to and through the Site.

4.2 Being a desktop assessment, no geotechnical walkover of the Site or any ground investigation has been undertaken as part of this assessment.

5. EXISTING ENVIRONMENT

5.1 The Site is largely undulating and predominantly located on an alluvial terrace above a lower lying alluvial plain. The terrace is likely to consist of sands, silts and clays and is between approximately 24,000 and 59,000 years old. Two streams flow across the Site from east to west cutting across the terrace in broad gullies at a lower alluvial plain level. The alluvial plain material consists of geologically younger soils than the terrace and are likely to include loose or soft sands, silts, clays, and possibly peat with possible high groundwater levels. Due to the extent of alluvial soils covering the region and published geological mapping, rock is not likely to be encountered within at least 20 m of the ground surface.

5.2 Fill is likely to be present on the Site of up to several metres of thickness where Railway Road and the North Island Main Trunk line cross the gullies, and may be present elsewhere due to historic agricultural activities. Elsewhere, farm rubbish pits may be present.

5.3 While no known active faults underlie the Site there are several active faults and fault structures within the region, as indicated on the GNS Active Fault Database and a recently completed GNS study for HRC. Significant active regional faults include the Northern Ohariu, Wellington and Ruahine Faults. Other faults are present including those with unknown details or low slip rates and / or recurrence intervals.

5.4 The NZ Geotechnical Database shows 28 Cone Penetration Tests ("**CPT**") across the Site and one borehole has been added to the database since the geotechnical assessment was undertaken.

6. POTENTIAL GEOTECHNICAL CONSIDERATIONS RELEVANT TO THE FREIGHT HUB

6.1 The following geotechnical factors have been considered relevant to the development of the Freight Hub:

(a) seismic hazards;

(b) liquefaction, lateral spread;

(c) soft ground and settlement;

(d) earthworks;

(e) slope instability; and

(f) road paving.

Seismic hazards

6.2 The Site is located in a highly seismic region with several active faults and regionally significant active faults within 20 km of the Freight Hub. Concealed active faults under the Site obscured by relatively recent alluvial deposits cannot be ruled out.

6.3 Since writing the PGA, additional fault information has become available including a recent GNS study commissioned by HRC. While the study shows additional active faults in the region and a fault related structure approximately 2 km from the Site it has not affected my conclusions or recommendations.

6.4 While the majority of the Site is in a zone that is expected to have low amplification of ground shaking, low lying ground is indicated on the Palmerston North District Plan to be of moderate to high liquefaction potential. The consequence is that higher shaking events may be encountered more frequently in the younger alluvial material.

Liquefaction

6.5 A liquefaction assessment report undertaken by GNS in 2011 divided Palmerston North into liquefaction zones based on soil type and age. Older, higher terrace soils were assessed as having negligible liquefaction damage potential while low lying recent alluvial soils were assessed as having moderate to high liquefaction damage potential.

6.6 Lateral spreading can occur where slopes have high groundwater levels and are adjacent to watercourses. While gullies will be infilled to create a platform for rail and associated infrastructure, lateral spreading could still occur at the perimeter of the Site adjacent to water courses, or where open water courses flow through the Site.

6.7 Lateral spreading and differential settlement will be managed through engineering design, as is common engineering practice. Seismic design assumes normal water and groundwater levels since the probability of the Site experiencing both flooding and a significant seismic event at the same time is extremely low.

Soft Ground and Settlement

6.8 Soft ground is likely to be present on the Site, particularly on low lying ground and may cause settlement or differential settlement when loaded for example by earthworks fill, structures or heavy live loads (such as locomotives).

Earthworks

6.9 As set out in Mr Skelton's evidence, extensive earthworks will be required to form a level surface for the Freight Hub.[1]

6.10 Granular soils (sands and gravels) are generally more suitable to use as engineering fill while cohesive soils (silts and clays) tend to be more moisture sensitive and may require treatment to make them suitable for use. Published GNS geological mapping and limited existing ground investigation from the New Zealand Geotechnical Database indicates soils to be a mixture of granular and cohesive materials. The materials appear to be highly layered which may make reuse challenging, particularly if the materials vary significantly horizontally.

Slope stability

6.11 Slope stability is not anticipated to be an issue for the Freight Hub. Gullies crossing the Site will be infilled as part of development and most of the slopes are likely to consist of engineered cuts and fills which will be designed with a sufficient Factor of Safety to take account of slope instability and the potential for seismically induced lateral spreading. Some natural slopes may remain, particularly around the western part of the Site including the stormwater detention ponds. These areas will be engineered to ensure appropriate stability.

Road paving

6.12 Weak road subgrades may be encountered where new roads cross recent low-lying alluvial materials, requiring more extensive pavement design than on higher terrace areas.

7. CONCLUSIONS OF PRELIMINARY GEOTECHNICAL ASSESSMENT

7.1 From the assessment undertaken, I prepared a preliminary geotechnical risk appraisal, and qualitative risks were assigned to the geotechnical factors

[1] Evidence of Michael Skelton, dated 9 July 2021, at section 6.

outlined in section 6 above. The outcomes of the preliminary geotechnical risk appraisal are outlined at Table 7-1 of the PGA and summarised below.

7.2 The most significant geotechnical risks to the Freight Hub are anticipated to be from the low-lying alluvial soils with potential poor engineering properties, in particular:

(a) the availability and suitability of material for earthworks; and

(b) the potential soft and liquefiable ground, particularly associated with low lying / gully deposits.

7.3 I do not consider that the extent to which these risks eventuate will impact the feasibility of the Freight Hub being constructed on the Site, but will influence the engineering design of the Freight Hub to ensure that these risks are appropriately managed during construction.

7.4 Confirmation of ground conditions through detailed ground investigation and ground model development will occur during the detailed design process. These investigations are likely to consist of boreholes, CPT's test pits, hand augers and laboratory testing. This is a common approach for a project of this scale or type.

7.5 Whether ground improvement measures are required, and if so, what measures are most appropriate to incorporate into design, will depend on the outcomes of ground investigations and ground model development. Examples of typical ground improvement measures include pre-loading of fill for settlement, digging and replacement of unsuitable fill, and stone columns.

8. RESPONSE TO SUBMISSIONS

8.1 HRC's submission comments on natural hazards including, active faulting and liquefaction.

8.2 HRC commissioned GNS to undertake a report which mapped active faults within the Horowhenua District and suggested fault avoidance zones. I have since reviewed a copy of this report dated May 2019. The faults discussed in this report match those obtained from other sources I have commented on in my PGA report together with new faults and fault related structures. However, none of these faults or active folds are within 2 km of the site and therefore the GNS report does not alter the conclusions in my PGA or this statement of evidence.

8.3 HRC also outlined that GNS and PNCC have completed liquefaction susceptibility mapping for the area. My PGA has considered this data and reflects the latest susceptibility mapping for the area. As outlined at section 6 of my evidence, I agree that these matters will be required to be addressed as part of the detailed engineering design for the Freight Hub and can be appropriately managed as part of Freight Hub construction.

9. RESPONSE TO SECTION 42A REPORT

9.1 I have reviewed the sections of the Section 42A Report relevant to my evidence, particularly Section 9.16.[2]

9.2 The Council Officers' comment on the potential and risks for damage caused by a seismic event due to the Freight Hub being located in an active seismic area, and presence of liquefaction prone land. I agree with the Council Officers that the primary seismic risk is to infrastructure and assets within the Freight Hub. As outlined in sections 6 and 7 of my evidence, these matters are capable of being managed through standard engineering design measures, and will be addressed by KiwiRail as part of the design process, and will meet Building Act obligations.[3]

9.3 The Council Officers consider there is insufficient detailed geotechnical information regarding Freight Hub construction to form a conclusion as to the severity of these risks and whether they can be avoided, remedied or mitigated.[4] In my opinion, geotechnical risks for the Site can be suitably managed. As outlined in my evidence above, engineering solutions will be chosen to manage geotechnical risks. Which solutions are suitable and implemented will be determined during the design process following ground investigation.

9.4 I consider that the level of investigations undertaken to date are appropriate for the nature and stage of this project.

Andrew Mott

9 July 2021

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2 Section 42A Report, dated 18 June 2021, at paragraphs [860] to [866].

3 Section 42A Report, dated 18 June 2021, at paragraph [866].

4 Section 42A Report, dated 18 June 2021, at paragraph [866].