

Before a Board of Inquiry
Transmission Gully
Notices of Requirement and Consents

under: the Resource Management Act 1991

in the matter of: Notices of requirement for designations and resource consent applications by the NZ Transport Agency, Porirua City Council and Transpower New Zealand Limited for the Transmission Gully Project

between: **NZ Transport Agency**
Requiring Authority and Applicant

and: **Porirua City Council**
Requiring Authority and Applicant

and: **Transpower New Zealand Limited**
Applicant

Statement of evidence of Dr Stephen Gordon Chiles (Acoustics assessment) for the NZ Transport Agency and Porirua City Council

Dated: 15 November 2011

REFERENCE: John Hassan (john.hassan@chapmantripp.com)
Nicky McIndoe (nicky.mcindoe@chapmantripp.com)

STATEMENT OF EVIDENCE OF STEPHEN GORDON CHILES FOR THE NZ TRANSPORT AGENCY AND PORIRUA CITY COUNCIL

QUALIFICATIONS AND EXPERIENCE

- 1 My full name is Stephen Gordon Chiles.
- 2 I am a Principal Acoustics Engineer with URS New Zealand. I hold Bachelor of Engineering and Doctor of Philosophy degrees in acoustics from Salford and Bath Universities in the United Kingdom. I am a Chartered Professional Engineer in New Zealand and the United Kingdom. I am a Fellow of the UK Institute of Acoustics. I have worked in the field of acoustics since 1996 in both consultancy and research.
- 3 I have conducted the acoustics assessment and design for a large number of infrastructure projects. In addition to road projects, examples include Holcim's cement plant project near Weston, the Central Plains Water scheme, TrustPower's Arnold River Hydroelectric Scheme, and Meridian's Mokihinui Hydro Proposal and Hurunui Wind Farm Project.
- 4 I represented the New Zealand Acoustical Society for the 2008 revisions of the general noise standards NZS 6801 and NZS 6802, and I chaired the committee for the 2010 revision of the wind farm noise standard NZS 6808. I am accredited as a commissioner and have acted in that capacity for plan changes and notices of requirement at Nelson Port, and Wanaka and Queenstown Airports.
- 5 Since 2008 I have been an independent professional advisor to the NZ Transport Agency (*NZTA*) for noise and vibration issues. During 2011 I have also been engaged under a part-time secondment to the NZTA. Through these roles I have worked on all facets of road-traffic noise including:
 - 5.1 Production of guide books on noise barriers, noise effects of different road surface types, acoustics treatment of buildings and assessment and management of construction noise;
 - 5.2 Implementation of NZS 6806;¹
 - 5.3 Development of the NZTA Transport Noise website;
 - 5.4 Production of report and calculation templates for road-traffic and construction noise assessment;
 - 5.5 Development of noise management strategies;

¹ NZS 6806:2010 Acoustics – Road-traffic noise – new and altered roads.

- 5.6 Advising on road-traffic noise reverse sensitivity provisions in district plans;
- 5.7 Investigation of road-traffic noise complaints; and
- 5.8 The review of reports and evidence for new and altered road projects.
- 6 In addition to my work for the NZTA at a national level, my acoustics team at URS has been separately engaged as independent consultants for specific NZTA projects. Through such appointments I am currently the lead acoustics engineer for the Transmission Gully Project, Peka Peka to North Otaki Project and Tauranga Eastern Link. This evidence is given in my role as an independent consultant on the Transmission Gully Project, and not in my role as an advisor or on secondment to the NZTA.
- 7 On 15 August 2011 the NZTA, Porirua City Council (*PCC*) and Transpower NZ Limited (*Transpower*) lodged Notices of Requirement (*NoRs*) and applications for resource consent with the Environmental Protection Authority (*EPA*) in relation to the Transmission Gully Proposal (*the Proposal*).
- 8 The Proposal comprises three individual projects, being:
- 8.1 The 'NZTA Project', which refers to the construction, operation and maintenance of the Main Alignment and the Kenepuru Link Road by the NZTA;
- 8.2 The 'PCC Project' which refers to the construction, operation and maintenance of the Porirua Link Roads by PCC;² and
- 8.3 The 'Transpower Project' which refers to the relocation of parts of the PKK-TKR A 110kV electricity transmission line between MacKays Crossing and Pauatahanui Substation by Transpower.
- 9 My evidence is given in support of the NZTA and PCC Projects (together, *the TGP* or *the Project*). It does not relate to the Transpower Project.
- 10 I am familiar with the area that the Project covers and the State highway and local roading network in the vicinity of the Project.
- 11 I am the author of the Acoustics Assessment report (Technical Report 12) (*TR12*) which formed part of the Assessment of Environmental Effects (*AEE*) lodged in support of the Project.

² The Porirua Link Roads are the Whitby Link Road and the Waitangirua Link Road.

- 12 I have read the Code of Conduct for Expert Witnesses as contained in the Environment Court Consolidated Practice Note (2011), and I agree to comply with it as if this Inquiry were before the Environment Court. My qualifications as an expert are set out above. I confirm that the issues addressed in this brief of evidence are within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE

- 13 My evidence will deal with the following:
- 13.1 Background and role;
 - 13.2 Existing noise environment;
 - 13.3 Assessment of operational noise effects (including engine braking);
 - 13.4 Assessment of operational vibration effects;
 - 13.5 Assessment of construction noise and vibration effects;
 - 13.6 Recommended mitigation (including the construction noise and vibration management plan (*CNVMP*)) and proposed conditions;
 - 13.7 Response to submissions; and
 - 13.8 Conclusions.

SUMMARY OF EVIDENCE

- 14 I have investigated potential road-traffic and construction noise and vibration effects from the Project.
- 15 Measurements of the existing noise environment show there to be some areas affected by existing roads (in particular in Linden, MacKays Crossing, and by State Highway 58 (*SH58*)) but that the majority of the Project is in more remote areas where natural sounds dominate.
- 16 My assessment of road-traffic noise is based on NZS 6806, and with the Project team I have determined what I consider is the best practicable option (*BPO*) for noise mitigation using that standard. The selected mitigation includes low-noise road surfaces, noise barriers and acoustics treatment of certain buildings. This mitigation is mainly required in the Linden area. Other than a section of noise bund by Flightys Road, for the rest of the Project I

do not consider that any specific noise mitigation measures are necessary.

- 17 From my investigations of engine braking noise and road-traffic (operational) vibration I found that both will meet appropriate criteria without mitigation.
- 18 I have assessed construction noise and vibration, including potential blasting, with reference to criteria from appropriate New Zealand and international standards. For the majority of the Project I have found that standard good practice management should result in compliance with criteria. I have identified areas where enhanced control and management measures are required.
- 19 For each of the parts of my assessment I have provided a summary of my recommended mitigation measures. I have discussed appropriate conditions, which allow for the completion of the process for achieving the BPO for road-traffic noise mitigation, and use of a CNVMP as the cornerstone for controlling and managing noise and vibration emissions from construction activities.
- 20 I have reviewed 20 submissions which raise construction and/or operational noise and vibration as an issue. For each submission I have discussed the matters raised.
- 21 I conclude that all operational and construction noise and vibration will be restricted to within reasonable levels, defined by the relevant standards.

BACKGROUND AND ROLE

- 22 I led all aspects of the acoustics (noise and vibration) assessment documented in TR12. Members of my team conducted the noise and vibration survey, modelling and analysis, under my direction. I reviewed all of this work in detail. I determined the noise mitigation to be tested in the acoustics model, evaluated options and wrote TR12. I engaged Nevil Hegley, an experienced acoustics engineer, as a subconsultant to provide a peer review of my assessment. I have attended Project team meetings for over two years and am the acoustics point of contact for the NZTA and all other members of the Project team.
- 23 As part of the new approach to road-traffic noise mitigation design discussed below, I have spoken to landowners adjacent to proposed noise barriers, including residences and the marae in Waitangirua, Linden Primary School, and He Huarahi Tamariki. In most instances I met with the property owners individually, although in some instances I met a small group of adjacent property owners together. In a few instances I only spoke to the property owners by telephone. I attended two public project information days and I

have met and corresponded with numerous members of the community who requested information about acoustics aspects of the Project. A summary of all consultation is provided in Technical Report 22 and in the evidence of **Mr Rae, Mr Nicholson, and Mr Bailey** .

- 24 During my assessment I worked closely with other members of the Project team to properly understand factors influencing the acoustics effects of the Project, and where practicable to integrate acoustics requirements within the overall design. The road-traffic noise mitigation design required input from many disciplines to determine the BPO. For this I led a specific noise mitigation workshop and also participated in urban design workshops examining specific areas. The urban design aspects of the proposed noise barriers are discussed by **Ms Hancock** in her evidence, and visual aspects are discussed by **Mr Lister** in his evidence.
- 25 My acoustics assessment is based on the road alignment and indicative construction methodology described by **Mr Edwards** in his evidence and the traffic data described by **Mr Kelly** in his evidence. I have proposed designation conditions that will allow for my recommended mitigation, determined on this basis, to be verified and adapted if necessary once the road design and construction methodology have been developed and finalised.

EXISTING NOISE ENVIRONMENT

- 26 In TR12 Section 3.2 I have presented details of the sound survey conducted by my team, which included measurements in general accordance with NZS 6801³ at representative locations along the Project route. The results of the survey are listed in Table 12-7 on pages 12 to 14 of TR12. Near existing roads at Linden, around SH58 and at MacKays Crossing the noise levels are dominated by those roads. In the more remote areas around the outskirts of the eastern suburbs of Porirua and near Flightys Road and Paekakariki Hill Road natural sounds dominate. On the basis of my experience measuring noise in numerous other locations in New Zealand, I consider that all areas have typical noise levels for those environments.
- 27 I found the results of computer modelling of noise from existing State highways to correlate well with measurements near those roads, as shown in TR12 Section 3.3.⁴

³ NZS 6801:2008, Acoustics – Measurement of environmental sound.

⁴ NZS 6806 requires modelling to be within ± 2 dB of measurements. There were some greater differences, as discussed in TR12 Section 3.3.2, due to contamination by other sounds, localised screening not modelled, and uncertainty in road surface characteristics. This does not affect modelling used in the development of the BPO.

OPERATIONAL NOISE

Methodology

- 28 My assessment of road-traffic noise is based on NZS 6806,⁵ which was published in 2010 after development by an independent Standards New Zealand technical committee representing stakeholders. The NZTA has adopted NZS 6806 for the assessment of road-traffic noise in place of the previous in-house 'Transit Guidelines'.⁶
- 29 NZS 6806 fundamentally changed the way noise mitigation measures are designed. Rather than dogmatic adherence to a specific noise limit, regardless of practicality or adverse effects such as shading by barriers, NZS 6806 promotes an integrated design process to establish the BPO.
- 30 NZS 6806 specifies types of protected premises and facilities (*PPFs*) which need to be assessed under that Standard, including dwellings and educational facilities. As set out in TR12, *PPFs* are assessed within 100 and 200 metres of the road in urban and rural areas respectively, as defined by Statistics New Zealand. South of Battle Hill the Project is in an urban area.
- 31 There are noise criteria given in NZS 6806 for three categories: A, B and C. There are different criteria for 'new' and 'altered' roads. Noise mitigation options are to be assessed, and if practicable, the external category A criterion should be achieved. If this is not practicable then mitigation should be assessed against the external category B criterion. However, if it is still not practicable to comply with categories A or B outside a *PPF* then building-modification mitigation should be implemented to ensure the internal criterion in category C is achieved. This represents a new backstop as it means acoustics treatment is provided for the worst affected 'Category C' buildings when other mitigation such as noise barriers and low-noise road surfaces are not practicable.
- 32 NZS 6806 requires significantly more design work during the acoustics assessment, and consequently the noise mitigation is more refined at this stage in the Project. For example, I have already mentioned my meetings with landowners adjacent to proposed noise barriers and the design workshops with the Project team. This is in addition to technical analysis of a significantly larger number of mitigation options than are likely to have been considered under the Transit Guidelines.
- 33 In accordance with NZS 6806 and as detailed in TR12 Section 4.1, I investigated noise mitigation options for each area of the Project,

⁵ NZS 6806:2010, Acoustics – Road-traffic noise – New and altered roads.

⁶ Transit New Zealand's Guidelines for the Management of Road Traffic Noise. 1999.

and these were modelled to determine the resulting noise levels at each PPF. The noise mitigation options were assessed by all relevant members of the Project team to determine the BPO for noise mitigation.

- 34 This assessment process involved circulation of mitigation options and a workshop to review each team members' assessments. The NZTA invited regulatory council officers to observe this process. Several of my initial options were refined when determining the BPO with the Project team, and following consultation with neighbours. This process and the specific factors considered are described in detail in TR12 Section 5.2. The result was the selected options set out in that section and in Figures 12-8 to 12-22 of TR12, which I now address.

Assessment of Operational Noise Effects

- 35 This section of my evidence assesses the effects of the Project, with the proposed mitigation measures in place. For the majority of the Project north of Linden the Project team found the BPO to be for no specific noise mitigation (do-minimum) as the area is not densely populated and houses are not immediately adjacent to the main alignment. I will discuss mitigation around Linden and by Flightys Road, and then turn to effects in other areas.
- 36 Around Linden a low-noise road surface is included as part of the base 'do-minimum' scenario. However, the Project team found the BPO also required extensive noise barriers, and in three instances acoustics treatment of individual houses (those that remained in Category C with the barriers). The barriers are detailed in TR12 Figures 12-18 to 12-22 and Section 5.2.2, and include both specific noise barriers and concrete safety barriers which provide incidental noise mitigation.
- 37 As a result of the new assessment criteria from NZS 6806, the mitigation now proposed at Linden is more extensive than required by the existing designation. For example, the noise barrier proposed adjacent to Linden School is now 3 m high, compared to 2.5 m high under the existing designation. The noise barrier is also continuous between Linden School and Tawa College, whereas under the existing designation there would be a gap at South Street.
- 38 NZS 6806 has also resulted in a benefit for areas such as Apple Terrace in Ranui Heights. In that location the Project actually causes a decrease in future road-traffic noise as traffic is diverted away from the existing State highway. However, under NZS 6806 the area has still been assessed and a noise barrier is proposed, mitigating future noise growth. Under the existing designation and old criteria there is no requirement for this mitigation.

- 39 I have also proposed a noise bund proposed by a section of Flightys Road shown in TR12 Figure 12-11.
- 40 Road-traffic noise levels will unavoidably increase throughout the Project area. In my opinion this will give rise to a significant change in acoustics amenity in areas remote from existing roads. This potential change in amenity has been signalled by the existing designation. While the position of the designation has moved in places, the wider area would become affected by road-traffic noise in either new or old locations. In my opinion the effect of the change in amenity is related to the change in character of noise caused by the presence of the road in the area, moreso than the specific noise levels which depend on the exact position of the road. For the most affected houses on Flightys Road the existing noise levels are in the order of 45 dB $L_{Aeq(24h)}$, and the highest predicted road-traffic noise level from the Project is 63 dB $L_{Aeq(24h)}$. On the basis of the guidance in NZS 6806, I consider that even with the change in amenity these resulting noise levels are reasonable.
- 41 With the mitigation measures selected by the Project team as the BPO, I consider that road-traffic noise will be at reasonable levels as determined by NZS 6806, at all locations.
- 42 **Mr Bowman** has identified St Joseph's Church by SH58 as of historic interest. This location has an existing predicted road-traffic noise level of 60 dB $L_{Aeq(24h)}$ and the Project will result in an increase to 65 dB $L_{Aeq(24h)}$. Within this environment the increase would be noticeable but would not fundamentally alter the acoustics amenity which is already dominated by road-traffic noise.
- Engine braking**
- 43 In addition to the main assessment of road-traffic noise, because of the relatively steep gradients on parts of the route, I have also investigated heavy vehicle engine braking noise. In the absence of any specific criteria for this noise source I have made reference to the guidance in NZS 6802⁷ and the Transit Guidelines, which recommend a maximum level for individual events at night of 75 dB L_{AFmax} .
- 44 My assessment of engine braking noise is based on measurements of trucks on existing State highways as described in TR12 Section 3.2.4. Using this data, I found that for the Project engine braking noise levels on downhill gradients steeper than 4% will be within the criteria adopted. The steepest sections are generally in remote areas, but gradients above 4% also occur: travelling down the Te Puka stream at MacKays Crossing; by Flightys Road, travelling north on the Main Alignment over SH58; on the off-ramps to the SH58 roundabout; approaching Warspite Avenue on the link

⁷ NZS 6802:2008, Acoustics – Environmental noise.

road; approaching Kenepuru Drive on the link road; and travelling south on the Main Alignment towards Linden. At all these locations the distances from the roads to the nearest houses are such that engine braking may be audible but will be within reasonable levels. Any peaks of engine braking noise would be no greater than noise limits typically set for peaks of general environmental noise.

OPERATIONAL VIBRATION

- 45 I have assessed potential vibration effects from road-traffic with reference to the criteria from NS 8176.⁸ Predicted vibration is substantially below levels that could cause damage to buildings. This Norwegian Standard provides guidance on how people will feel vibration, which can occur at much lower levels.
- 46 TR12 Section 3.4 shows measured vibration levels by State Highway 1 in Linden at a range of distances from the road. TR12 Table 12-11 and Figure 12-2 show that a NS 8176 criterion of $V_{W,95}$ 0.3 mm/s is achieved at a distance of less than 7 m from the road. The levels of vibration are relatively low which I consider is due to the good condition of the road surface and local geology.
- 47 As a result of the Project, road-traffic vibration levels will increase at Linden where the road is moved slightly closer to houses. On the basis of the modelling data outlined in TR12 Section 4.3, I predict that the levels will remain within the NS 8176 criteria. This vibration may be perceptible but should not cause disturbance. For the rest of the Project there are no houses close enough to the alignment such that vibration could be an issue.
- 48 At St Josephs Church by SH58 the existing road is moved slightly further away and is resurfaced so I predict any existing road-traffic vibration will reduce. The brick fuel tank in the Te Puka valley is over 20 metres from the nearest traffic lane, resulting in predicted vibration levels well below criteria for building damage.
- 49 TR12 Section 5.3 details standard NZTA processes for road condition monitoring, reporting and maintenance. I consider that these established processes provide an appropriate mechanism to maintain the road surfaces sufficient to control road-traffic vibration. In my opinion any additional Project specific controls would be unnecessary and inappropriate.

⁸ NS 8176.E:2005, Vibration and shock – Measurement of vibration in buildings from landbased transport and guidance to evaluation of its effects on human beings.

CONSTRUCTION NOISE AND VIBRATION

Methodology

- 50 I have made an assessment of potential construction noise and vibration effects. As set out in TR12 Section 2.4 I have adopted criteria from NZS 6803⁹ for construction noise, BS 5228-2¹⁰ for construction vibration (which covers building damage, damage to other objects and human perception), and AS 2187-2¹¹ for blasting.
- 51 On the basis of the indicative construction methodology I have used calculated noise and vibration levels at various distances from the works to identify any areas where criteria are likely to be exceeded. I have then examined the activities in those areas to assess appropriate types of mitigation measures, based on my experience controlling construction noise and vibration. The mitigation will be refined under a CNVMP process once the actual methodology and equipment is known to achieve compliance with the noise and vibration criteria set out in condition NZTA.12(4)(A)(b) and (d).

Assessment of Construction Effects

- 52 TR12 Sections 4.4 and 4.5 set out my predictions of construction noise and vibration respectively for typical activities anticipated at representative distances.
- 53 The majority of the construction activity is remote from residential areas and while construction noise may be audible I consider that it can be controlled to within reasonable levels, defined by guidelines in NZS 6803, with good practice construction noise management.
- 54 At Linden and other areas with houses closer to construction works there is the potential for greater construction noise and vibration effects, due to the proximity of neighbours and the likely need for some night-works. In TR12 Section 5.4.2 I have proposed additional management and control measures in these areas such as the early construction of road-traffic noise barriers. My experience is that the implementation of a CNVMP, as specified in the proposed designation conditions, is an effective and appropriate method to manage adverse effects when works are close to houses and at night.
- 55 In some of these instances it will not be practicable to comply with the guideline noise criteria in NZS 6803, due to the proximity to houses, and some night works will be unavoidable at areas of tie-in or overlap with the existing road network due to the traffic volumes on the existing roads.

⁹ NZS 6803:1999, Acoustics – Construction noise.

¹⁰ BS 5228-2:2009, Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration.

¹¹ AS 2187-2:2006, Explosives – Storage and use – Use of explosives.

- 56 The NZTA has developed standard procedures that will form part of the CNVMP, including the production of individual management schedules for specific activities such as night works. The specific mitigation required for each activity will be confirmed in the schedules. A flexible approach is required to take account of the individual circumstances of residents, but in general, a hierarchy of mitigation is followed:
- 56.1 Managing times of activities to avoid night works and other sensitive times,
 - 56.2 Liaising with neighbours so they can work around specific activities,
 - 56.3 Selecting equipment and methodologies to restrict noise,
 - 56.4 Use of screening/enclosure/barriers,
 - 56.5 Offering neighbours temporary relocation, and
 - 56.6 For long duration works, treating neighbouring buildings.
- 57 Part of the management process will also include condition surveys of all buildings close to the works, before and after construction, so that any cosmetic damage due to the works can be identified and repaired.
- 58 I have recommended that construction traffic on local roads should be minimised by utilising State highway access where possible, as detailed in TR12 Section 5.4.3.
- 59 Since preparing TR12 I have been made aware that blasting is an option in the areas east of Porirua as well as around the Wainui Saddle, as identified in TR12 Section 4.5.3. The nearest houses in the Porirua eastern suburbs are separated from works by around 200 m. If blasting is used it will therefore still only be in areas that are not immediately adjacent to houses. I consider that standard practices can be used to achieve compliance with the criteria, as occurs at various quarries and mines in New Zealand including some locations close to houses. The main practices controlling vibration and airblast are the selection of appropriate charge sizes, limitation of charge sizes if necessary and for larger blasts using multiple charges in a delay sequence.
- 60 **Ian Bowman** identifies two structures of historic significance near the construction works in his evidence. Neither structure is immediately adjacent to the works. In TR12 Section 5.4.4 I recommend management and monitoring procedures to ensure construction vibration at these locations does not exceed criteria for structural or cosmetic damage.

- 61 My assessment of construction noise and vibration effects is in TR12 Section 6.3. In summary, I consider that there will be construction noise and vibration effects, but the noise and vibration levels will be reasonable and generally within the adopted criteria. With the proposed management and control measures set out in TR12 Section 5.4 and the draft CNVMP, I consider the construction noise and vibration effects acceptable.

RECOMMENDED MITIGATION

- 62 I have discussed mitigation under each of the separate parts of my assessment above. In summary, I recommend the following mitigation, where appropriate to achieve the criteria set out in conditions NZTA.12(4)(A) and NZTA.22:
- 62.1 Low-noise road surfaces (TR12 Table 12-21);
 - 62.2 Noise barriers (TR12 Table 12-22);
 - 62.3 Building-modification (TR12 Table 12-23);
 - 62.4 Construction noise and vibration management (TR12 Section 5.4);
 - 62.5 Early installation of traffic noise barriers (TR12 Section 5.4.2);
 - 62.6 Enhanced management of night works (TR12 Section 5.4.2);
 - 62.7 Building condition surveys (TR12 Section 5.4.2);
 - 62.8 Minimisation of construction traffic on local roads (TR12 Section 5.4.3); and
 - 62.9 Vibration monitoring by historic structures (TR12 Section 5.4.4).
- 63 I discuss appropriate conditions to give effect to this recommended mitigation in TR12 Section 7.
- 64 NZS 6806 is a process based standard, and not a performance based standard (albeit that the standard uses Categories A, B and C to assist in the determination of the BPO). The proposed conditions NZTA.21 to NZTA.31 for road-traffic noise mitigation allow the completion of this process to achieve the BPO. The conditions enable the development and finalisation of the detailed design for both the road itself and the noise mitigation. To ensure my assessment remains valid through this process, conditions NZTA.23 and NZTA.24 require the final design to be conducted by an acoustics specialist, and any changes to NZS 6806 categories are to

be approved by the Council. Where building-modification to the dwelling (or other PPF) is required, conditions NZTA.26 to NZTA.30 specify the process to be followed working with residents.

- 65 For the PCC designation there is only one noise barrier by the Marae, and it can be directly specified by its nominal height and length rather than allowing for any further process.
- 66 I do not recommend any conditions for road-traffic (operational) vibration as the NZTA already has an established and comprehensive national system to monitor and maintain road surface conditions.
- 67 For construction noise and vibration condition NZTA.12 sets out criteria based on NZS 6803, BS 5228-2 and AS 2187-2 and requires the use of a CNVMP. The conditions require works to be in compliance with the relevant criteria as far as practicable but allow for exceedance of the criteria for activities such as essential night works in Linden, subject to appropriate management.
- 68 I recommend a condition requiring vibration monitoring at the identified historic structures when construction works are nearby.

RESPONSE TO SUBMISSIONS

- 69 The NZTA planning team has reviewed submissions and forwarded those to me that raise noise and/or vibration as an issue. I have addressed these individually below.

Linden

- 70 Submission **0047**¹² raises issues of construction and operational noise effects at three dwellings on 55 Collins Avenue. I have visited this location and met with the submitters to discuss the potential noise effects. The predicted future road-traffic noise level at this location with the Project is 62 dB $L_{Aeq(24h)}$, which is within NZS 6806 Category A (64 dB $L_{Aeq(24h)}$) for this section of 'altered road'. Without the Project the future predicted noise level would be 65 dB $L_{Aeq(24h)}$ (Category B). That is, the Project results in a noise improvement (a decrease in future road noise) at 55 Collins Avenue.
- 71 There appears to be a misunderstanding in the submission as there is no incremental increase in noise due to the Project and the buildings are not in Category C even without mitigation. In accordance with NZS 6806 acoustics treatment of these buildings is not appropriate.
- 72 The submission raises the issue of additional noise from vehicles braking and accelerating. I understand that this interchange has

¹² By Suresh and Nilu Seenadera.

been designed to allow free flowing traffic. It is not an on-ramp to a State highway where vehicles need to accelerate. It is the merging of two roads in a similar manner to say SH1 and SH2 merging at Ngauranga. Sufficient length has been allowed for this merge such that vehicles should not need to noticeably brake and accelerate at most times.

- 73 With respect to construction noise, submission **0047** seeks specific conditions around temporary construction noise barriers and controls on night works. I agree with the submission that the residents of 55 Collins Avenue should be notified at least one week prior to night works and that those works should be done expeditiously. Communications about construction noise are required by proposed condition NZTA.15 and are detailed in Section 5 of the draft CNVMP in Volume 5 of the AEE.
- 74 At this stage it is not feasible to specify details of temporary construction noise barriers as the submitters request, as the design of the road has not been developed and the construction methodology has not been confirmed. In this location a priority should be constructing the permanent noise barrier as detailed in proposed condition NZTA.12(4) A.C.V. If temporary construction noise barriers are also appropriate these will be detailed in a specific Construction Noise and Vibration Management Schedule to the CNVMP, once the construction methodology is known. I will address construction traffic on Rangatira Road with respect to the following submissions below. In this particular location I would not expect the use of minibuses over private cars for staff transport to make a noticeable difference to any noise effects.
- 75 Submissions **0031, 0036, 0051, 0052, 0062** and **0063**¹³ relate to 17, 21, 25, 23, 4 and 19 Rangatira Road respectively. All have a similar attachment detailing the submissions. The submissions relate to both construction noise and vibration, and operational road-traffic noise effects.
- 76 With respect to construction noise and vibration, the Rangatira Road residents raise five points and suggest four mitigation measures. Most issues raised are already addressed by the CNVMP required by proposed condition NZTA.12. Issues such as the location of the Kenepuru Interchange, and the use of a rock crusher and other heavy earth moving equipment, have already been factored into my assessment of construction noise, which determined no specific mitigation is required for these dwellings.
- 77 One of the issues I have actively pursued with the Project team has been to achieve access to works areas from State highways as

¹³ By submitters CJ Sheridan and AD Osborne, G and M Milner, J Li, JE Gray, D and J Barnes, and SB Hill and J S Grace.

quickly as practical, to avoid the use of local roads by heavy vehicles. The site compound at 11 Rangatira Road is an example of an area where I consider it important to quickly establish an access from SH1 rather than using Rangatira Road for heavy vehicles.

- 78 The submitters contend that removal of trees will increase the perception of noise at Rangatira Road. I agree that while trees usually have negligible effect on measured noise levels they do provide a valuable psychoacoustic benefit and should therefore be retained wherever practicable, as required by condition NZTA.47.
- 79 I disagree with the submissions that the valley to the east of the Rangatira Road properties will cause 'amplification' of construction and operational noise. There may be reflections from the terrain, but this effect would not significantly increase the construction noise levels experienced, due to the reflection energy losses and dissipation, and increased distance travelled across the valley. I therefore consider that a construction noise barrier as requested in the submissions is not necessary and would not be effective to control noise travelling up the valley in any event.
- 80 The residents of Rangatira Road wish to be included in consultation under the CNVMP. Section 5 of the draft CNVMP in Volume 5 of the AEE sets out that construction noise information should be distributed to all neighbours within 100 metres of the works, and I recommend that all Rangatira Road properties be included in such distributions. As set out in Section 5 of the draft CNVMP, I consider that individual consultation is only required for neighbours within 50 metres of works which would not include Rangatira Road. However, given the particular concerns regarding construction noise expressed by this group of residents I can see no harm in consulting these residents despite this not being strictly necessary.
- 81 With respect to operational road-traffic noise, these houses were not included in my assessment in accordance with NZS 6806, as they are further than the specified distance of 100 metres from the road. However, I note that the future road-traffic noise levels with the Project are predicted at 4, 17, 19, 21, 23 and 25 Rangatira Road to be 53 to 63 dB $L_{Aeq(24h)}$. The road in this location is classified as an 'altered road' so the Category A criterion of 64 dB $L_{Aeq(24h)}$ is achieved at all houses.
- 82 The modelling accounts for the specific road geometry (i.e. the location of the proposed Kenepuru Interchange), questioned in the submissions, the Projected traffic levels, and for reflections from barriers, (although these are negligible). On the basis of the guidance in NZS 6806 I consider the noise levels to be reasonable in this location. I note that the State highway in this area will be open graded porous asphalt, which is a low-noise surface.

- 83 The Rangatira Road submissions seek a noise barrier on the eastern side of the approach to Kenepuru Interchange. In response to this submission, my team has modelled 5 metre high barriers in this location, but these only provide 2 dB benefit at one house and 1 dB or less benefit at the other five houses – a difference which is not significant. At 5 metres high these are substantial barriers with potentially significant visual effects, and could not be justified on acoustics grounds given the insignificant benefits achieved.
- 84 The submissions from residents of Rangatira Road also seek an engine braking restriction on the southbound lanes into Linden. I have assessed potential engine braking noise, including the Main Alignment north of Kenepuru Interchange where the gradient towards Linden is steeper than 4%, and found it to comply with relevant criteria set out in TR12 Section 2.2.2, without any specific controls. The NZTA does not, in any event, have the authority to prohibit engine braking on State highways with speed limits above 70 km/h, as is the case in this location. The NZTA does install signs requesting heavy vehicle drivers not to use engine brakes in locations where they are a persistent nuisance, as is the case on the existing State highway by Tremewan Street in Linden. However, there is a risk that these signs will become less effective if installed indiscriminately. I recommend that a sign is not installed in this location until the road has been constructed and it is established whether heavy vehicle drivers regularly choose to use engine brakes in this location.
- 85 Submission **0018**¹⁴ raises concerns over construction noise and vibration, and road-traffic noise at 23 Tremewan Street in Linden. This location will be adversely affected by temporary construction noise and vibration, which will need to be managed in accordance with the CNVMP as I have already described. Potential mitigation measures in this location include the installation of temporary noise barriers. Cosmetic damage due to construction vibration should not occur in this location. The house is on the opposite side of Tremewan Street from the works and the separation distance of around 50 metres from earthworks means that vibration should be well below the criteria.¹⁵
- 86 The operational road-traffic noise levels predicted at 23 Tremewan Street will decrease fractionally from present levels as a result of the Project, even if the NZTA owned houses on the opposite side of Tremewan Street are all removed. This is because the nearest traffic lane is lowered in a cutting and other traffic lanes are partially screened by concrete safety barriers and the bridge structure.

¹⁴ By Cecil and Susan Edmonds.

¹⁵ As specified in BS5228-2:2009, Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration.

Waitangirua

- 87 Submission **0015** by the Cannons Creek Residents & Ratepayers Association raises a concern about noise from additional traffic in the Waitangirua and Cannons Creek areas due to the Waitangirua Link Road. **Mr Kelly** addresses the traffic volumes in his evidence, noting that the effect is primarily a redistribution of existing traffic, and that the traffic volumes on local roads do not increase by significant percentages. As such I predict that any changes in noise levels due to the link road will be in the order of only 1 or 2 dB. In a laboratory comparison such small differences in noise level are not noticeable, and the changes are less than measurement and prediction uncertainty. I therefore do not consider them to be significant.

State Highway 58

- 88 Submission **0067**¹⁶ relates to construction noise and vibration effects at 51 Paremata-Haywards Road (SH58) which is immediately opposite the main site compound. During my assessment I determined that construction noise effects at this house would be prolonged over several years and it would not be practicable to achieve compliance with the NZS 6803 guideline criteria. I therefore recommended that the property should be included in the designation so that the NZTA can ensure it would not be used for noise sensitive purposes during the works.
- 89 The owner and occupier of 51 Paremata-Haywards Road has submitted that he does not wish to leave the house during the works but instead has requested measures be implemented to result in satisfactory noise levels. While some of these measures may be practicable, others are not. For example, the main works areas in the site compound would not be located under the transmission lines running across the compound or split either side of the transmission lines. The largest area suitable for the main elements is opposite the submitter's house and this has therefore been identified for the batching plant and other works. The submission also seeks to control hours of operation. While works throughout the Project will generally be controlled to weekday and Saturday daytime hours, greater flexibility is required for the site compound servicing all those other areas. While I consider that some steps could be taken to reduce construction noise levels at this house I do not consider it practicable to achieve reasonable levels over several years of construction.
- 90 If the submitter wishes to remain at 51 Paremata-Haywards Road for the duration of the works then I recommend that acoustics treatment is investigated for the house, as well as a front fence as suggested in the submission. The primary issue is likely to be the provision of mechanical ventilation so that windows can be kept

¹⁶ By submitter C Edge.

closed, but the exact works would depend on a detailed building inspection. The degree to which the house would be habitable will still depend on the noise tolerance of the submitter.

- 91 Submission **0065** by Transpower NZ Limited raises the issue of vibration from the main site compound affecting the Pauatahanui Substation. I have not assessed this previously as substation equipment is generally not sensitive to vibration and there are no significant vibration sources in the site compound, other than possibly compaction during establishment. Furthermore, as the main activities in the compound cannot be located beneath the transmission lines serving the substation this has the effect of creating a buffer between major activities and the substation. I consider that any vibration effect from the site compound affecting the substation would be negligible.

Flightys Road and Paekakariki Hill Road

- 92 Submissions **0053**¹⁷ and **0054**¹⁸ relate to neighbouring properties 129E and 129F Flightys Road respectively. These submissions request that the road alignment be lowered and a low-noise road surface be used. The predicted road-traffic noise levels at these houses are 56 and 60 dB $L_{Aeq(24h)}$ respectively, which are in NZS 6806 Categories A and B, and I consider these to be reasonable levels. The practicality of lowering the road at this location is discussed by **Mr Edwards** in his evidence. My team has modelled the effect of lowering the road by a nominal 5 metres, and found it only provides a 2 dB benefit, which as I have discussed above is not significant and therefore would not be justified on the basis of a noise reduction even if it were practicable
- 93 During the noise mitigation assessment for the Flightys Road area I investigated low-noise road surfaces and noise barriers, but none were determined to be the BPO. Low-noise road surfaces are significantly more expensive to install and maintain than a standard chip seal, and therefore tend to be used in urban areas where they benefit many houses. At Flightys Road around 7 km of low-noise road surface would be required over the four lanes of the road to achieve a benefit at nine houses. Given that the houses are in Categories A and B without mitigation it was determined that a low-noise road surface would not be the BPO.
- 94 Submissions **0041**¹⁹ and **0056**²⁰ relate to neighbouring properties 247B and 247C Flightys Road respectively. These submissions both request an earth bund to reduce road-traffic noise levels. The

¹⁷ By submitters T Maguire and B Dowie.

¹⁸ By submitter G Tombs.

¹⁹ By submitters S and C Redit.

²⁰ By submitter D Harris.

predicted road-traffic noise levels at both these houses is 60 dB $L_{Aeq(24h)}$, which is in NZS 6806 Category B, and I consider this a reasonable noise level. As discussed above, I investigated noise barriers in this location during the noise mitigation design process. An approximately 800 metre long earth bund extending 3 metres above the proposed road height would provide a 3 to 4 dB benefit at these houses. Under NZS 6806, structural mitigation should not be installed for isolated houses unless it provides at least a 5 dB benefit, which is not achieved in this instance. The 5 dB threshold in NZS 6806 is set to ensure noise mitigation measures provide a worthwhile benefit.

- 95 Submission **0019**²¹ relates to noise effects at 462 Paekakariki Hill Road. In his evidence **Mr Edwards** addresses the approximate distances quoted in this submission, which differ from those he has measured. The new road would be over 200 metres from the submitter's house and the predicted noise level at the house is 53 dB $L_{Aeq(24h)}$. This house is outside the 100 metre 'urban' area buffer within which PPFs are included in an assessment under NZS 6806, and even if the area were classified as 'rural' it is still beyond the 200 metre buffer that would apply. Regardless, the predicted noise level is significantly below the 57 dB $L_{Aeq(24h)}$ Category A criterion. The road-traffic noise will be audible at this location but should not interfere with normal domestic activity, and on the basis of the guidance in NZS 6806 I consider it reasonable. If the road were in the old alignment the increased distance from the house at 462 Paekakariki Hill Road would reduce the predicted level by in the order of 3 dB.
- 96 Submission **0020**²² relates to noise effects at 436A Paekakariki Hill Road. I have visited this house and met with the submitter to discuss the potential noise effects. I confirm that the noise level predictions quoted in the submission are correct, although the subjective description of the change attributed to me is incorrect. The Project would significantly change the acoustics amenity at this house. However, the resulting road-traffic noise level of 56 dB $L_{Aeq(24h)}$ is below the 57 dB $L_{Aeq(24h)}$ Category A criterion, and as for 462 Paekakariki Hill Road discussed above, I consider this a reasonable level.
- 97 Submission **0020** also raises concerns with construction noise. Temporary construction noise would be louder than operational road-traffic noise, and this is allowed for by NZS 6803, which has a guideline daytime criterion of 70 dB $L_{Aeq(1h)}$ for long duration works. The submission correctly quotes one of my predictions of 67 dB $L_{Aeq(1h)}$ for unmitigated noise at 200 metres from earthworks. Whilst there would be activity in the area over a long duration,

²¹ By submitter E Deuss.

²² By submitters D and C Christensen.

specific works in this location, such as the earthworks represented by this prediction, would only be for shorter periods. The level would also be reduced by terrain screening and would decrease as works move further from the house. I expect construction noise levels at this location to comply with the NZS 6803 guidelines at all times, and to be significantly below them for the majority of the construction period. There are no night works anticipated in this area.

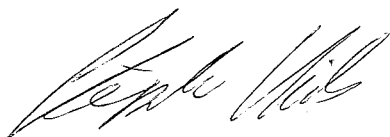
- 98 Submission **0044** by Battlehill Eventing Inc. raises concerns over construction noise and vibration being a risk to the safety of riders and horses using Battle Hill Farm Forest Park, with blasting being mentioned in particular. Under the CNVMP, it would be normal for construction activities to be scheduled to avoid noise disturbance to occasional special annual events. However, in this instance the submission indicates that there are numerous events occurring throughout the year, in which case it would generally not be practicable to avoid them all. Most of the construction activity in this area will be by earth moving equipment, for which the predominant noise is from engines that do not have impulsive characteristics likely to give rise to startle effects. The noise will be audible from a distance, so riders will be aware of the activity before getting too close. If there is blasting in the Wainui Saddle area it would be audible at Battle Hill as a thud. This would typically occur at a set time, and under the CNVMP forewarning of blasting will be provided at Battle Hill Farm Forest Park.

Historic structures

- 99 Submission **0023** by the Kāpiti Coast District Council supports the proposal subject to certain conditions. One of those matters is historic heritage with respect to the brick fuel tank in the Te Puka valley. The submission is mainly related to issues such as access, but does also raise vibration. I have specifically assessed this issue in Section 5.4.4 of TR12. I consider that the structure should be subject to condition surveys before and after construction; that there should be individual assessment of machinery operating within 20 metres of the structure; and that compaction equipment should be selected to minimise vibration. These steps would occur under proposed conditions NZTA.9 and NZTA.12.(4)A, subsections d and e.
- 100 Submission **0033** by the New Zealand Historic Places Trust (NZHPT) also raises the issue of vibration affecting the brick fuel tank, as well as St Josephs Church by SH58. As the NZHPT acknowledges, potential vibration effects are to be controlled through the CNVMP required by proposed condition NZTA.12.(4)A. Levels of operational vibration at these structures will be significantly lower than construction vibration, and are well below criteria for cosmetic or structural damage.

CONCLUSIONS

- 101 The Transmission Gully Project has significant potential road-traffic and construction noise and vibration effects. I have investigated all aspects of these potential effects. I have proposed road-traffic noise mitigation measures where required, and I have identified construction noise and vibration management and control measures. With the mitigation proposed, I consider that all road-traffic and construction noise and vibration will be restricted to within reasonable levels, as defined by the relevant standards.



Stephen Gordon Chiles
15 November 2011