

Before the Board of Inquiry  
Waterview Connection Project

---

*in the matter of:* the Resource Management Act 1991

*and*

*in the matter of:* a Board of Inquiry appointed under s 149J of the Resource Management Act 1991 to decide notices of requirement and resource consent applications by the NZ Transport Agency for the Waterview Connection Project

Expert Caucusing Joint Report to the Board of Inquiry – Topic Noise  
(construction and operational)

---

Dated: 2 February 2011

Due: 7 February 2011

---

## EXPERT CAUCUSING JOINT REPORT TO THE BOARD OF INQUIRY

### INTRODUCTION

- 1 This joint signed report is written in response to the Board of Inquiry's Minute and Directions dated 23 December 2010. The Directions require the experts, following caucusing, to provide a report by 10am on 7 February 2011 "that includes:
  1. Areas that have been resolved and how (e.g. by agreement about conditions)
  2. Areas that are not resolved, and succinctly why."
- 2 This report relates to the caucusing topic of Noise and vibration (construction and operational).
- 3 A caucusing meeting was held on **20 January 2011**,
- 4 Attendees at the meeting were:
  1. Siiri Wilkening (Noise, for the NZTA)
  2. Peter Millar (Vibration, for the NZTA)
  3. Nevil Hegley (Noise, Auckland Council & Transport)
  4. Malcolm Hunt (Noise and vibration, appointed by the Board of Inquiry, and author of the EPA s42a report)
  5. Michael Sullivan (Facilitator, Noise and vibration, appointed by the Board of Inquiry)
- 5 It is noted that Peter Millar was in attendance for the first part of the meeting which was specific and relevant to groundborne noise and vibration.
- 6 The consensus from the experts involved with the caucusing process was that the main areas of disagreement had now been resolved. This report states how these disagreements have been resolved or where an expert had particular concerns how these concerns were alleviated or addressed. The reasons for the formulation of a condition or modification to an existing condition to resolve these disagreements or alleviate a particular concern are also noted.

### AREAS THAT HAVE BEEN RESOLVED

- 7 **Groundborne Noise and Vibration:** Mr Millar noted that there are a range of factors which would influence the groundborne (or structureborne) noise and vibration generated by tunnel excavation were the excavating equipment soil interaction (influenced by the type of tunnel excavating equipment selected); the propagation in soil or ground (influenced by the type of soil or ground), the building foundation response, the vibration propagation in buildings and the room acoustics. Mr Hunt cited the Speakman & Lyons measurements for "Road Header" tunnelling machines in Australia

which illustrates a relationship between sound pressure level and vibration velocity within various building types. Mr Millar and Mr Hunt agreed that the main concern was the groundborne noise resulting from tunnel excavation. It was noted that the groundborne noise is the noise from the motion of the room surfaces and is characterised by a 'hum'.

- 8 Mr Millar went into some detail regarding submissions and discussed the groundborne noise and vibration impacts expected near Te Atatu Interchange at 356a Te Atatu Road, 1520 Great North Road, Unitec and others which are covered in his evidence.
- 9 Mr Millar confirmed that it was difficult to predict the final groundborne noise levels that would result in a particular building or room due to the variations associated with the factors noted above in paragraph 7. Mr Millar also noted that it needed to be recognised that the groundborne noise impact due to tunnel excavation would be a short term impact as the tunnel excavation progressed in the vicinity of buildings foundations. Mr Millar acknowledged that groundborne noise and vibration from tunnelling excavation presented a potential risk of disturbance to residents and some building occupants but it was not a risk to people's health and the impact was readily manageable via the CNVMP.
- 10 Mr Millar confirmed that the Proposed Noise and Vibration Conditions under clause CNV.1 part xii it was a requirement for the CNVMP to implement and maintain measures for receiving and handling complaints about construction noise and vibration.
- 11 Mr Millar also confirmed that the Proposed Noise and Vibration Conditions under clause CNV.1 part xi it was a requirement for the CNVMP to implement and maintain measures for liaising and notifying potentially affected receivers. Mr Hunt requested that condition CNV.1 part xi be amended to specifically allow for additional (timely) forward notice to potentially affected receivers of noise and vibrations from underground works along the tunnel alignment.

- 12 Accordingly, after discussions and correspondence between Mr Millar and Mr Hunt it is proposed that the following amended condition be adopted to ensure residents affected by noise and vibrations resulting from underground works along the tunnel alignment are notified (as CNV.1):

*“...The CNVMP shall, at a minimum, address the following: ...*

*xi Measures for liaising and notifying potentially affected receivers of proposed construction activities and the potential for noise and vibration effects.*

*-PPF’s located within 100 metres of surface works shall be notified not less than 30 days prior to the works.*

*-PPF’s within 35 metres of underground excavation works along the tunnel alignment shall receive prior notification no greater than 1 week (and not less than 24 hours) prior to the works of the commencement of works.*

*Maps showing PPF’s to be notified shall be included within the CNVMP.”*

- 13 Mr Millar left the meeting after this point of the discussion.
- 14 **Installation of traffic noise barriers early during construction:** Mr Hegley and Mr Hunt were of the opinion that the benefits that permanent (traffic) noise barriers afforded to the control of construction noise during the course of the construction project should be captured. Ms Wilkening was in agreement with this proposal in principal but noted that in some instances installing the traffic noise barriers first would not always be practicable. Ms Wilkening also noted that the installation of the barriers prior to the commencing of any works should be applicable on a sector by sector basis.
- 15 Following further discussion between experts it is proposed that the following new condition be adopted (as CNV.7):

*“Where practicable, permanent (traffic) noise barriers required in any sector as Detailed Mitigation Options for operational noise following completion of the Project (in accordance with conditions ON.3 – ON.5) shall be erected prior to major construction works occurring.”*

- 16 **Construction Noise Measurement Period.** Mr Hunt noted that construction noise assessment and measurement period have a time base which accords with New Zealand Standard 6803:1999 “Acoustics – Construction Noise”. Mr Hunt also noted that approach should apply to the internal project construction (for residential and school) receivers. Ms Wilkening agreed with this and noted the proposed conditions would be amended to reflect this.

- 17 Mr Hegley was of the opinion that from the perspective of assessing compliance with conditions it was often better to nominate a measurement period, e.g. 30mins. However, Mr Hegley also noted that in certain circumstances, for example when the noise source was 'steady' and not varying with time it resulted in a longer measurement than was really necessary. To simplify conditions, it was agreed by the experts to include within the proposed conditions a reference to (T) which in turn is referenced to NZS 6803:1999. This will ensure consistency with the Standard and avoid the need for any special measurement/assessment time period to be defined for this project.
- 18 It was agreed that all the tabulated Project Construction Noise Criteria in the proposed conditions (refer CNV.2 parts i, ii, iii and iv) would make reference to (T) with new text added to state this measurement period is to be defined in accordance with NZS 6803:1999.
- 19 **Installation of building modification mitigation early during construction:** Mr Hegley was of the opinion that any proposed sound mitigation to dwellings should be completed prior to noisy construction commencing near these dwellings. Ms Wilkening pointed out it would be difficult in many instances to determine whether modifications would be needed until the completion of detailed design and that a more extensive or "carte blanche" approach to building modifications to enable construction activities to begin would potentially result in project delays or project budget issues.
- 20 Following discussion between experts and further consultation between Mr Hegley and Ms Wilkening it is proposed that the following new condition be adopted (as CNV.1):
- "...The CNVMP shall, at a minimum, address the following: ...*
- xiv Investigation of the practicability of implementing Building Modification Mitigation, as required in accordance with conditions ON.6 to ON.11 prior to commencement of construction within 100m of the relevant PPF;"*
- 21 **Night Time Construction Noise/Notification of Night Time Construction Works:** Mr Hegley and Mr Hunt have previously noted concerns regarding the raising of the construction night time noise limit to 60dB LAeq for every night and night time activity. Related to this Mr Hegley and Mr Hunt were concerned about ensuring that residents were notified of any noisy construction activities occurring at night. Mr Hegley and Mr Hunt considered noisy construction activities being those above 45dB LAeq. Ms Wilkening noted that it is proposed that the residential locations nearest the night time construction works would be subject to night time noise levels at 60dB LAeq but the properties further away from the works would be subjected to lower levels of construction noise

due to distance and shielding attenuation. Ms Wilkening also mentioned the existing night time traffic noise impact on the residential properties and the existing night time background noise levels in support of the 60dB(A) Limit. The night-time construction noise limit adopted for a recent major road works project in Newmarket was also noted as a supporting argument for 60 dB LAeq.

- 22 It was established by the noise experts that the disagreement relating to noisy night time construction activities could be resolved by formulating a condition which ensures that residents affected by night time construction activities are notified and the extent of the potentially affected residents are identified or defined in some appropriate manner.
- 23 Accordingly, after discussion and correspondence between the experts it is proposed that the following new condition be adopted to ensure residents affected by night-time construction activities are notified (as CNV.1):

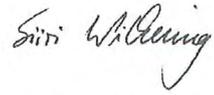
*“...The CNVMP shall, at a minimum, address the following: ...*

*xv Methods for ensuring affected residents are notified of scheduled night-time works (i.e. any works during the hours of 2000-0630) at least 5 days prior to the commencement of any such works .”*

- 24 Accordingly, it was also agreed amongst the noise experts that the extent of the properties affected by noisy night time construction activities be identified on a map or maps. It was agreed by the consultants that the maps would be incorporated into the CNVMP. A draft set of maps or figures illustrating the extent of dwellings requiring night time notification are shown in Annex A.
- 25 **Night-time pile driving:** Mr Hegley raised concerns regarding the carrying out of extended night-time pile driving. Mr Hegley clarified that he understood that it would be acceptable in particular tidal circumstances so as to avoid project delays. Mr Hegley also noted that the impulsive nature of pile driving made the characteristics of the construction noise particularly annoying to residents. Ms Wilkening noted that night-time pile driving was only being considered at limited locations and if tidal conditions dictated it necessary to avoid project delivery delays but acknowledged the concerns and confirmed she would discuss the requirements for any night time pile driving with the construction team. It has since been confirmed by Ms Wilkening following discussion with the construction team that night-time pile driving will not occur.

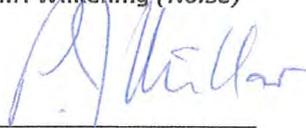
- 26 Accordingly, following further consultation between experts it is proposed that the following new condition be adopted (as CNV.9):
- “Pile driving shall not be undertaken at night (i.e. during the hours of 2000-0630).”*
- 27 **Internal Noise Criteria:** Mr Hunt noted that NZS6803:1999 *Acoustics – Construction Noise* was the appropriate standard for assessing construction noise. Ms Wilkening confirmed that Australian New Zealand Standard AS/NZS 2107:2000 *“Acoustics – Recommended design sound levels and reverberation times for building interiors”* was utilised as a guide for establishing appropriate internal conditions for schools in the absence of explicit internal criteria being nominated in NZS6803:1999. It was acknowledged that AS/NZS 2107:2000 standard was not strictly intended for either the assessment or prescription of acceptable noise levels from variable construction noises such as jackhammers and pile-drivers. However, Ms Wilkening noted that adopting the internal criteria for teaching spaces as recommended in AS/NZS 2107:2000 provided for more stringent noise criteria than NZS6803. Mr Hunt agreed with Ms Wilkening on the recommended indoor noise criteria set out within the proposed conditions which it was agreed would provide sufficient protection provided that measurement periods were in accordance with NZS6803:1999 (see section dealing with construction noise measurement period within this report).
- 28 It was agreed amongst the noise experts that the appropriate internal noise criterion for teaching space in schools was 45dB LAeq.
- 29 It was agreed amongst the noise experts that the appropriate internal noise criterion for school halls was 40dB LAeq.
- 30 It was agreed by the noise consultants that the proposed construction noise criterion of 30dB LAeq inside bedrooms between 1800-0730 was appropriate. It was also noted that the criterion applies to groundborne noise received from tunnelling excavation and the residents were being afforded a good standard of protection.
- 31 Ms Wilkening noted the revised proposed conditions would reflect these agreements.

Date: 2 February 2011



---

Siiri Wilkening (*Noise*)



---

Peter Millar (*Vibration*)



---

Nevil Hegley (*Noise*)



---

Malcolm Hunt (*Noise and Vibration*)



---

Michael Sullivan (*Facilitator, Noise and vibration*)

**List of Annexures**

Annex A Draft Figures illustrating night time notification areas for inclusion in the CNVMP

GIS@beca.com



**Legend**

- Dwellings to be notified of night works
- Proposed designation
- Construction plan 100m buffer

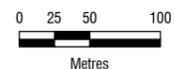
This map contains data derived in part or wholly from sources other than Beca, and therefore, no representations or warranties are made by Beca as to the accuracy or completeness of this information.

Map intended for distribution as a PDF document.  
Scale may be incorrect when printed.

Contains Crown Copyright Data. Crown Copyright Reserved.

**Draft For Caucusing**

Scale 1:5,000 at A3



Revision	Author	Verified	Approved	Date
1	MGR			28/01/2011

Title:

**Dwellings To Be Notified of Night Works**

FOR INTERNAL REVIEW ONLY  
YET TO BE VERIFIED.

Client:  
**NZ Transport Agency (Auckland)**

Project:  
**Waterview Connection Project**



Discipline:  
**GIS**

Drawing No:  
**GIS-3814238-42-1**

Path: P:\3814238\1001\GIS\55\_Workspaces\01\_mxd\110127\_NoisePlan\_v2.mxd

GIS@beca.com



**Legend**

- Dwellings to be notified of night works
- Proposed designation
- Construction plan 100m buffer

This map contains data derived in part or wholly from sources other than Beca, and therefore, no representations or warranties are made by Beca as to the accuracy or completeness of this information.

Map intended for distribution as a PDF document.  
Scale may be incorrect when printed.

Contains Crown Copyright Data. Crown Copyright Reserved.

**Draft For Caucusing**

Scale 1:5,000 at A3



Revision	Author	Verified	Approved	Date
1	MGR			28/01/2011

Title:

**Dwellings To Be Notified of Night Works**

FOR INTERNAL REVIEW ONLY  
YET TO BE VERIFIED.

Client:  
**NZ Transport Agency (Auckland)**

Project:  
**Waterview Connection Project**



Discipline:  
**GIS**

Drawing No:  
**GIS-3814238-42-2**



**Legend**

- Dwellings to be notified of night works
- Proposed designation
- Construction plan 100m buffer

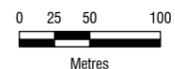
This map contains data derived in part or wholly from sources other than Beca, and therefore, no representations or warranties are made by Beca as to the accuracy or completeness of this information.

Map intended for distribution as a PDF document.  
Scale may be incorrect when printed.

Contains Crown Copyright Data. Crown Copyright Reserved.

**Draft For Caucusing**

Scale 1:5,000 at A3



Revision	Author	Verified	Approved	Date
1	MGR			28/01/2011

Title:

**Dwellings To Be Notified of Night Works**

FOR INTERNAL USE ONLY  
YET TO BE VERIFIED.

Client: NZ Transport Agency (Auckland)

Project: Waterview Connection Project



Discipline: GIS

Drawing No: GIS-3814238-42-3

Path: P:\3814238\100\T01\55\_Workspaces\01\_mxd\110127\_NoisePlan\_v2.mxd

GIS@beca.com



**Legend**

- Dwellings to be notified of night works
- Proposed designation
- Construction plan 100m buffer

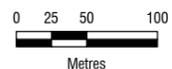
This map contains data derived in part or wholly from sources other than Beca, and therefore, no representations or warranties are made by Beca as to the accuracy or completeness of this information.

Map intended for distribution as a PDF document.  
Scale may be incorrect when printed.

Contains Crown Copyright Data. Crown Copyright Reserved.

**Draft For Caucusing**

Scale 1:5,000 at A3



Revision	Author	Verified	Approved	Date
1	MGR			28/01/2011

Title:

**Dwellings To Be Notified of Night Works**

FOR INTERNAL REVIEW ONLY  
YET TO BE VERIFIED.

Client:  
**NZ Transport Agency (Auckland)**

Project:  
**Waterview Connection Project**



Discipline:  
**GIS**

Drawing No:  
**GIS-3814238-42- 4**

Path: P:\3814238\100\TGI\55\_Workspaces\01\_mxd\110127\_NoisePlan\_v2.mxd

GIS@beca.com



**Legend**

- Dwellings to be notified of night works
- Proposed designation
- Construction plan 100m buffer

This map contains data derived in part or wholly from sources other than Beca, and therefore, no representations or warranties are made by Beca as to the accuracy or completeness of this information.

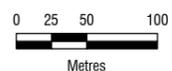
Map intended for distribution as a PDF document.  
Scale may be incorrect when printed.

Contains Crown Copyright Data. Crown Copyright Reserved.

**Draft For Caucusing**

Path: P:\3814238\1001\01\55\_Workspaces\01\_mxd\110127\_NoisePlan\_v2.mxd

Scale 1:5,000 at A3



Revision	Author	Verified	Approved	Date
1	MGR			28/01/2011

Title:

**Dwellings To Be Notified of Night Works**

FOR INTERNAL USE ONLY  
YET TO BE VERIFIED.

Client: NZ Transport Agency (Auckland)

Project: Waterview Connection Project



Discipline: GIS

Drawing No: GIS-3814238-42-5

GIS@beca.com



**Legend**

- Dwellings to be notified of night works
- Proposed designation
- Construction plan 100m buffer

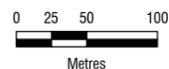
This map contains data derived in part or wholly from sources other than Beca, and therefore, no representations or warranties are made by Beca as to the accuracy or completeness of this information.

Map intended for distribution as a PDF document.  
Scale may be incorrect when printed.

Contains Crown Copyright Data. Crown Copyright Reserved.

Path: P:\3814238\1001\01\55\_Workspaces\01\_mxd\110127\_NoisePlan\_v2.mxd

Scale 1:5,000 at A3



Revision	Author	Verified	Approved	Date
1	MGR			28/01/2011

Title:

**Dwellings To Be Notified of Night Works**

FOR INTERNAL PURPOSES ONLY  
YET TO BE VERIFIED.

Client:  
**NZ Transport Agency (Auckland)**

Project:  
**Waterview Connection Project**



Discipline:  
**GIS**

Drawing No:  
**GIS-3814238-42-6**

GIS@beca.com



- Legend**
- Dwellings to be notified of night works
  - Proposed designation
  - Construction plan 100m buffer

This map contains data derived in part or wholly from sources other than Beca, and therefore, no representations or warranties are made by Beca as to the accuracy or completeness of this information.

Map intended for distribution as a PDF document.  
Scale may be incorrect when printed.

Contains Crown Copyright Data. Crown Copyright Reserved.

**Draft For Caucusing**

Path: P:\3814238\100\T01\55\_Workspaces\01\_mxd\110127\_NoisePlan\_v2.mxd

Scale 1:5,000 at A3

0 25 50 100  
Metres



Revision	Author	Verified	Approved	Date
1	MGR			28/01/2011

**FOR INTERNAL REVIEW ONLY  
YET TO BE VERIFIED.**

**Dwellings To Be Notified of Night Works**

*Client:* NZ Transport Agency (Auckland)

*Project:* Waterview Connection Project



*Discipline:* GIS

*Drawing No:* GIS-3814238-42-7