

Assessment of Construction Noise and Vibration Effects

Alternative to the Brynderwyn Hills – Brynderwyn Hills section

2 April 2026

Revision A

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Glossary of Acronyms and Abbreviations

The glossary of acronyms and abbreviations tables in Volumes A and B of the Substantive Application applies to this report and should be referred to in addition to the acronyms and abbreviations below.

Abbreviation / Acronym	Term
NZS 6803	New Zealand Standard 6803:1999 Acoustics – Construction Noise
AS 2187	Australian Standard AS 2187: Part 2:2006 Explosives – Storage and Use – Use of Explosives
BS 5228-2	British Standard 5228-2: 2009 ‘Code of practice for noise and vibration control on construction and open sites’
dB	Decibel
DIN 4150-3	German Industry Norm DIN 4150-3 (2016) ‘Structural vibration – Part 3 Effects of vibration on structures’
ppv	<u>Peak Particle Velocity</u> For Peak Particle Velocity (PPV) is the measure of the vibration aptitude, zero to maximum. Used for building structural damage assessment.
Schedules	Schedules to the CNVMP

Glossary of Defined Terms

The glossary of defined terms tables in Volumes A and B of the Substantive Application applies to this report and should be referred to in addition to the defined terms below.

Term	Meaning
A-weighting	The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.
dBA	The unit of sound level which has its frequency characteristics modified by a filter (A-weighted) so as to more closely approximate the frequency bias of the human ear.
L _{Aeq} (t)	The equivalent continuous (time-averaged) A-weighted sound level. This is commonly referred to as the average noise level.
L _{AFmax}	The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.
Sensitive Site	Relates to blasting. Defined in AS 2187.2-2006: a sensitive site includes houses and low rise residential buildings, theatres, schools, and other similar buildings occupied by people.
(t)	The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.

1. Introduction

1.1. Purpose and scope of this report

This report provides an assessment of the actual and potential construction noise and vibration effects associated with the construction of the Brynderwyn Hills section of the Alternative to the Brynderwyn Hills project (the Project).

This assessment forms part of a suite of technical assessments prepared for NZTA to inform the Substantive Application under the Fast-track Approvals Act 2024 (FTAA) for the Project. This report should be read in conjunction with Volume A of the Substantive Application.

The scope of this assessment includes the following:

- The **methodology** applied to preparing the assessment.
- A description of the **existing environment**.
- **Assessment** of the actual and potential **construction noise and vibration effects** generated by the Project.
- **Conclusion** on the significance of effects.
- **Recommended mitigation and conditions** to manage and mitigate adverse effects.

1.2. Qualifications and Experience

My name is Siiri Wilkening. I am an acoustics consultant, and a Director of Marshall Day Acoustics Ltd (MDA). MDA is a specialist acoustics consultancy of about 100 professional acoustics consultants, founded in 1981, with offices in New Zealand, Australia, Hong Kong/China, and France. I have worked at MDA for 27 years.

I hold a Master's degree in Engineering (Land Improvement and Environmental Protection) (University of Rostock, Germany). I have nearly 30 years' experience as an acoustics consultant and am a Fellow of the Acoustical Society of New Zealand. I am also a member of the Resource Management Law Association and the Institute of Directors (New Zealand).

My experience relevant to this Application includes:

- I was the expert witness on many Roads of National Significance, including State Highway 1 (SH1) East West Link, SH1 Northern Corridor Improvements, State Highway 16 Waterview Connections, SH1 MacKays to Peka Peka (Kāpiti Expressway) and SH1 Puhoi to Warkworth, all of which were designated through Boards of Inquiry. For each of these projects, my role involved all aspects of acoustics, noise and vibration effects from construction and traffic and (where relevant) underwater effects, and I presented expert evidence at the hearings.
- The SH1 Southern Corridor Improvements (Manukau to Papakura and Papakura to Drury), which involves considerable challenges due to high population density close to the road. The widening of the Southern Motorway, the busiest state highway in New Zealand, will affect a large number of people, both during construction and following completion. I am the lead acoustical consultant on these projects and am responsible for all works relating to noise and vibration effects, which includes ambient noise level surveys, computer noise modelling, extensive meetings and engagement with residents and Council, noise mitigation design and the formulation of noise management plans. Various stages of the Project were consented through a mixture of conventional Council hearings and the Covid Fast Track process. I appeared as expert witness at the hearings and prepared the assessments for the Fast Track process.
- I was engaged as principal acoustic consultant of the Te Tupu Ngātahi Supporting Growth Alliance, with a programme providing for the planning and consenting of transport infrastructure (active modes, rapid transit and roading) for the growth areas surrounding Auckland, with projects extending from Warkworth in the north, to Drury and Pukekohe in the south, to Huapai in the West. My role was to provide oversight and peer reviews of the assessments. The role changed to include the assessment

of the noise and vibration effects on a number of the projects (Takanini Level Crossings, North (Strategic), North West (Strategic), Pukekohe, and Airport to Botany Rapid Transit), which involved everything from contributing to route selection to assessment and expert witness appearance at several of the combined Council hearings.

In addition, I have undertaken a large number of acoustic assessments for a variety of projects ranging from transportation and power generation to educational facilities, residential and commercial subdivisions, mining and plan changes. I have appeared as an expert witness at many Council hearings, before numerous Environment Courts and five Boards of Inquiry. I have also taken part in Environment Court mediation.

1.3. Code of Conduct

Although this Project is not being considered before the Environment Court, I confirm that I have read the Code of Conduct for expert witnesses as contained in Section 9 of the Environment Court Practice Note 2023. I agree to comply with that Code. I am satisfied that the matters which I address in this Construction Noise and Vibration Assessment are within my area of expertise, except where I state that I am relying on information provided by another person or expert. I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

2. Assessment Methodology

2.1. Performance standards

2.1.1. Construction Noise

I have assessed construction noise in accordance with NZS 6803:1999 “Acoustics – Construction Noise” (NZS 6803).¹ The standard applies assessment criteria that apply at 1 metre from the most exposed façade of any building. In summary, the relevant daytime noise criteria are 70 dB L_{Aeq} and 85 dB L_{AFmax}. For any night-time works, the relevant noise criteria are 45 dB L_{Aeq} and 75 dB L_{AFmax}. The 45 dBA criterion means that works would typically need to be remote (potentially up to 900 metres) from any Sensitive Activity in order to be able to comply.

Since the construction of this Project will take longer than 20 weeks in any one location, the long-term duration criteria apply as follows:

Table 1: Construction noise criteria

Time of week	Time period	dB L _{Aeq}	dB L _{AFmax}
Occupied sensitive activities (e.g. dwellings)			
Weekdays	06:30-07:30	55	75
	07:30-18:00	70	85
	18:00-20:00	65	80
	20:00-06:30	45	75
Saturdays	06:30-07:30	45	75
	07:30-18:00	70	85
	18:00-20:00	45	75
	20:00-06:30	45	75
Sundays and public holidays	06:30-07:30	45	75
	07:30-18:00	55	85
	18:00-20:00	45	75
	20:00-06:30	45	75
All other buildings occupied at the time of the works			
All days	07:30-18:00	70	n/a
	18:00-07:30	75	n/a

2.1.2. Construction Vibration

NZTA has developed a framework of vibration assessment criteria for sensitive use buildings. I have assessed construction vibration based on this framework, which references relevant international standards, specifically:

- German Industry Norm DIN 4150-3 (2016) ‘Structural vibration – Part 3 Effects of vibration on structures’ (DIN 4150-3), which addresses protection of buildings from any damage; and
- British Standard 5228-2: 2009 ‘Code of practice for noise and vibration control on construction and open sites’ (BS 5228-2), which takes account of people’s amenity.

The criteria applied progressively, with the aim of protecting people’s amenity as far as practicable and protecting buildings from damage. The Construction vibration criteria on which the majority of this assessment is based is set out in Table 2 below.

¹ The standard is referenced in the Operative Kaipara District Plan - Rule 12.10.15 and the Whangārei District Plan Section NAV-R3.

Table 2: Construction vibration criteria

Receiver	Location	Details	Category A	Category B
Occupied sensitive use buildings	Inside the building	20:00-06:30	0.3mm/s ppv	1mm/s ppv
		06:30-20:00	1mm/s ppv	5mm/s ppv
Other occupied buildings	Inside the building	06:30-20:00	2mm/s ppv	5mm/s ppv
All other buildings	Building foundation	Vibration – transient	5mm/s ppv	BS 5228-2 Table B.2
		Vibration - continuous		BS 5228-2 50% of Table B.2 values

There are a number of services (e.g. gas, water or power) close to the works. Vibration on these services are controlled by DIN 4150-3 which sets guideline values in ppv (refer above) for buried pipework for vibration as shown in Table 3 below.

Table 3: Construction vibration criteria for underground pipework

Line	Pipe material	Guideline value for short term vibration criteria ppv in mm/s at the pipe	Guideline value for long term vibration criteria ppv in mm/s at the pipe
1	Steel, welded	100	50
2	Vitrified clay, concrete, reinforced concrete, prestressed concrete, metal (with or without flange)	80	40
3	Masonry, plastics	50	25

2.1.3. Blasting

Noise from explosives is normally described as “airblast” or blasting noise. Blasting noise is caused by ground vibration, air movement around the rock face being blasted and air pressure venting from the holes that are drilled in the face.

NZS 6803 references Australian Standard AS 2187: Part 2:2006 Explosives – Storage and Use – Use of Explosives (AS 2187), and in Section 8.1.4 states that:

Noise from use of explosives is also a special case. The adoption of good blasting practices will reduce the inherent and associated impulsive noise and vibration. Practices should conform with the provisions of documents such as AS 2187: Part 2, provided that the airblast noise limit shall be a peak sound level of 120 dBC measured at a suitable location as specified in 6.2.

AS2187-2 contains Table J4.5(A) which recommends the following criteria for blasting noise (reproduced as Table 4 below). I have assessed air blast against these criteria.

Table 4: Airblast and blast vibration criteria

Category	Type of blasting operations	Peak component particle velocity (PPV)	Peak sound pressure level (dBL)
Sensitive site (e.g. dwellings)	Operations lasting longer than 12 months or more than 20 blasts	5 mm/s for 95% blasts per year, 10 mm/s maximum unless agreement is reached with the occupier that a higher limit may apply	115 dBL for 95% blasts per year, 120 dBL maximum unless agreement is reached with the occupier that a higher limit may apply
Occupied non-sensitive sites	All blasting	25 mm/s maximum unless agreement is reached with occupier that a higher limit may apply.	125 dBL maximum unless agreement is reached with occupier that a higher limit may apply.

2.2. Assumptions

This assessment of construction noise and vibration effects is based on assumptions about construction activities and equipment that will form part of the Project, particularly given parts of the Project are expected to be implemented sometime in the future. I have based this assessment on the indicative construction methodology set out in Section C4.3. of Volume A of this Application, and on similar construction projects I have worked on. I consider the equipment and tasks on which I have based this assessment are representative of similar projects, therefore forming a reasonable assumption for the purposes of assessment.

I have assumed that all existing buildings inside the Proposed Designation will be removed and have therefore not assessed construction noise and vibration effects on them.

Where no sensitive receivers are in the vicinity of works (e.g. within 900 metres over flat ground), night-time works may be undertaken without adversely affecting dwellings and would therefore be less restricted in timing. In addition, night-time works may be required for specific activities such as bridge installations, interchange works, utility relocations, or pavement works. Any construction activity that impacts the existing state highways — including SH1, State Highway 12, and local road interfaces — is likely to be undertaken at night to minimise disruption to traffic and ensure safety. Overall, though, I have assumed that works will predominantly be undertaken during daytime.

2.3. Alignment changes within the Proposed Designation

The Indicative Alignment within the Proposed Designation represents a possible alignment which has been developed for assessment purposes and to illustrate what the Project's final design might look like, and the effects generated by its construction. The alignment that gets built including the design and placement of bridges, culverts, stormwater systems, soil disposal areas and landscaping, will be refined and confirmed during the detailed design stage. This assessment has therefore anticipated impacts within the Proposed Designation, rather than just in the vicinity of the Indicative Alignment. The proposed conditions establish outcome-based criteria that will ensure effects on the environment are adequately avoided, remedied or mitigated, regardless of the final design and construction methodology for the Project. As such, should the final alignment within the Proposed Designation change, the effects assessment, proposed mitigation and recommendations outlined in this report would remain appropriate.

2.4. Safe distances to achieve compliance with the construction performance criteria

2.4.1. Construction noise

I have predicted indicative construction noise “compliance distances” outside which compliance with the relevant daytime noise criteria outlined in Section 2.1.1 can be achieved, based on the activity noise levels for certain construction activities. Activity noise levels take account of a variety of equipment that may be used, its spatial distribution and a time component (e.g. if some activities are only operating for 50% of the time).

I have determined the following indicative compliance distances from the highest noise activities anticipated for the Project:

Earthworks:	85 metres
Rock excavation:	120 metres
Bored piling (e.g. bridge construction):	65 metres
Impact piling (e.g. bridges):	90 metres
Rock crushing:	90 metres

Other activities would have smaller radii and therefore would already be addressed through the above activities.

2.4.2. Construction vibration

I have determined “compliance distances” from certain construction activities, outside which compliance with the vibration criteria outlined in Section 2.1.2 can be achieved. These compliance distances are based on vibration measurements for high vibration sources. In addition, I have applied a 100% safety margin to ensure that my predicted vibration levels relating to the building protection criteria (daytime Category B) are conservative and reduce any residual risk of infringements.

I have determined the following indicative compliance distances to comply with the amenity (1 mm/s ppv) and building protection (5 mm/s ppv) criteria respectively, for the highest vibration generating activities:

Table 5: Safe distances for different vibration inducing activities

Equipment	Activity (potentially)	Compliance distance	
		Category A daytime (1 mm/s ppv)	Category B daytime (5 mm/s ppv)
Vibratory roller compaction Large Medium	Road compaction	40 metres 30 metres	15 metres 10 metres
Impact piling	Retaining walls/bridges	40 metres	15 metres
Sheet piling	Culverts	45 metres	10 metres

For buried pipework, the vibration criteria are significantly higher than for above ground buildings (refer Section 2.1.2). The indicative safe distances for the highest vibration inducing activity (sheet piling) are very small, being approximately 1 metre or less.

At such small distances, the certainty of prediction is diminished. Therefore, I recommend that measurements must be undertaken when high vibration activities are undertaken within 3 metres of buried pipework to reduce risk to the Project and the pipework.

2.4.3. Blasting

Blasting will be managed by a blast specialist. Based on work undertaken on the SH1 Puhoi to Warkworth project. This charge weight would result in the following approximate safe distances to comply with the blasting criteria:

Vibration to comply with 5 mm/s ppv	80 metres
Airblast to comply with 120 dBL	160 metres

3. Assessment of Effects

As a general preface to this section, the Proposed Designation area is wide, and the Indicative Alignment is located such that a significant buffer between the main construction work and sensitive receivers is provided. However, I understand that the alignment may change within the Proposed Designation. If this is the case, the safe distances set out in Section 2.4 will be used to determine potential effects on any buildings that exist and are occupied during construction.

As noted in Section 2.2 above, I have assumed that all buildings inside the Proposed Designation will be removed during construction. Accordingly, only 40 dwellings that are outside, but within 120 metres of, the Proposed Designation have been assessed as they are within the largest “safe distance” identified in Section 2.4.1. I have assumed that other buildings are not commonly frequented, e.g. sheds, garages and similar buildings, and have not assessed them further.

3.1. Construction Noise

3.1.1. Road construction works

There are 40 dwellings within the largest safe distances for construction noise set out in Section 2.4.1 (i.e. 120 metres) to the Proposed Designation. The closest dwelling to highly likely hear works is 89A The Braigh, Waipu, which is approximately 10 metres from the Proposed Designation, and 55 metres from the Indicative Alignment. Works to construct the Indicative Alignment in this location involve the construction of the new interim tie-in at Waipū. Other dwellings within safe distances from the Proposed Designation are shown indicatively in Figure 1 and Figure 2 overleaf.

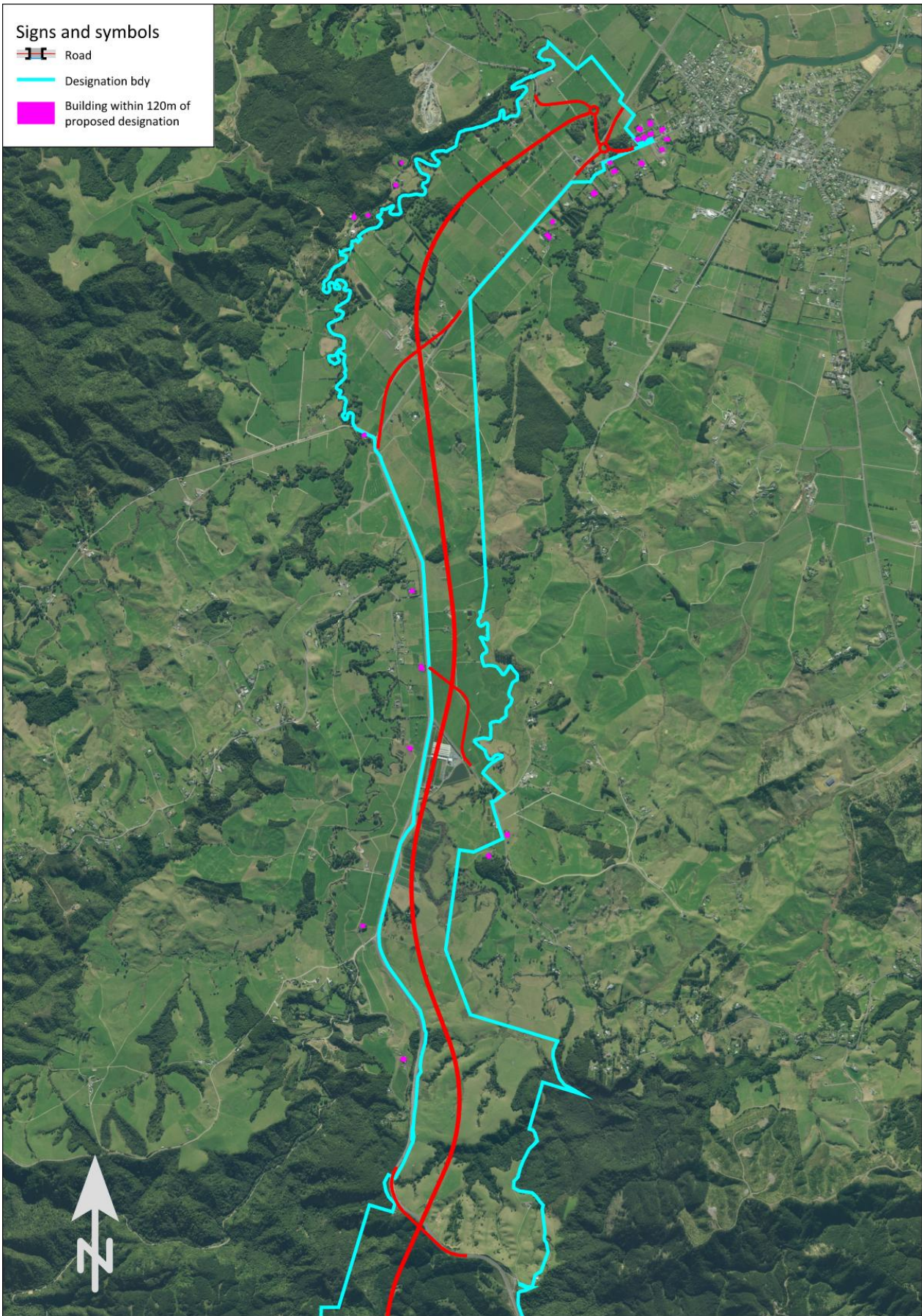


Figure 1: Sector 1 - Sensitive dwellings within 120 m safe distance for construction noise

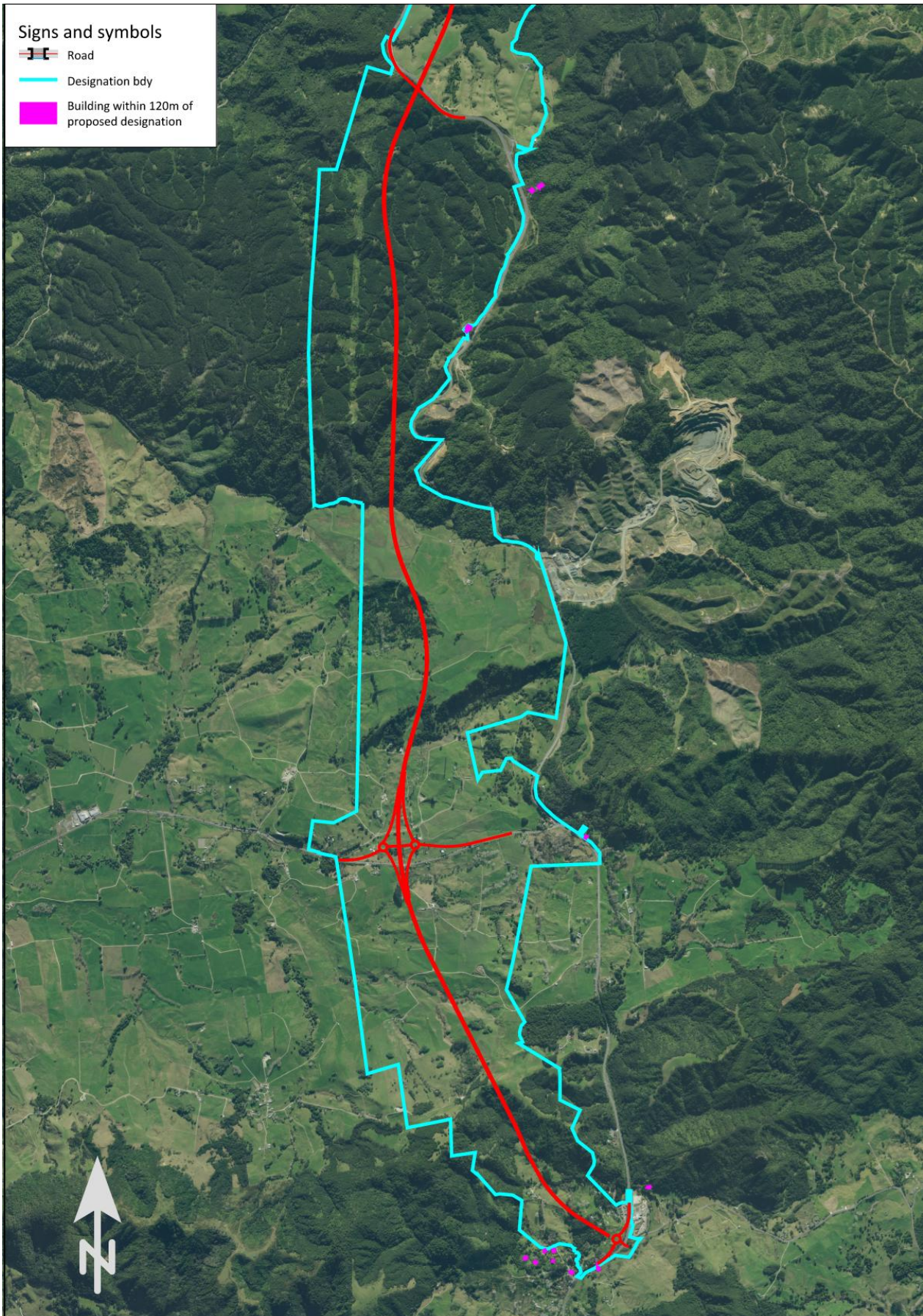


Figure 2: Sectors 2 to 4 - Sensitive dwellings within 120 m safe distance for construction noise

For these dwellings, I predict that there is a chance of the daytime noise criteria being infringed by up to 5 decibels, should works occur within the safe distance. However, it is highly unlikely that rock excavation would occur immediately in the vicinity of the Proposed Designation boundary. It is more likely that works will be at a reasonable distance from the Proposed Designation boundary to allow for earthworks and alignment shape appropriate for the 110 km/h speed limit.

In any event, any infringements would occur only for brief periods of days or, at most, weeks over the entire construction duration of approximately six years.

All other dwellings are more than 120 metres from the Proposed Designation boundary and therefore would receive noise levels that are compliant with the relevant noise criteria.

Overall, I consider that construction noise can be managed to be at a reasonable level. While audible at times, particularly when works are close by, for most of the construction duration construction noise would not be at a level that interrupts normal daytime activities.

3.1.2. Spoil sites

Beside the main road works (involving the road formation, cuts and fills and bridges/over and under passes), there are a number of spoil sites within the Proposed Designation. These sites extend further away from the Indicative Alignment and will likely involve the use of earthmoving equipment such as dozers, trucks and excavators. Therefore, I have used the earthworks noise level predictions as representative values to assess potential noise effects, with a safe distance of approximately 85 metres.

Generally, the spoil sites necessary to construct the Indicative Alignment are gullies that are being filled in with surplus spoil. This means that the sites are often somewhat shielded from houses in the vicinity as the works occur from the bottom of the gully working up. The closest fill site proposed is about 50 metres from 4800 SH1, in the Brynderwyn Hills. This dwelling appears to be most affected by fill activity given its elevation above the fill site and lack of intervening terrain. Any sensitive activity within 85 metres of a fill or spoil site may receive noise levels that infringe the criteria.

With the currently identified fill and spoil sites for the Indicative Alignment (except that in the vicinity of 4800 SH1), exceedances are unlikely given their location in gullies and behind ridges, and I predict that the noise levels will comply with the relevant daytime noise criteria for the currently identified fill and spoil sites. Should other sites move if the Indicative Alignment changes, an 85 metre buffer will be needed to any sensitive activity to achieve compliance, or alternative mitigation implemented such as the use of barriers or similar.

For the fill site close to 4800 SH1, alternative mitigation would need to be implemented such as:

- Working towards the site, keeping a soil bund between the workspace and the dwelling;
- A 3 metre barrier being installed inside the designation along the embankment top to the west of the sensitive receiver; and/or
- Low noise equipment being used when works are closest to the sensitive receiver.

These mitigation measures will be anchored in the Construction Noise and Vibration Management Plan (CNVMP) (refer Section 4.2).

3.1.3. Rock crushing

I understand that excavated rock may be crushed on site. A mobile crusher would be placed in a location within the Proposed Designation. Any excavated rock would be crushed, and material placed either in a fill site or transported off site for alternative use.

Mobile rock crushers are high noise generating equipment and will need to be carefully placed. The minimum buffer to a sensitive activity must be 90 metres in order to achieve compliance with the relevant daytime noise criteria. Crushing should be restricted to daytime only, where practicable. Crushing should be avoided during the night-time, unless the crusher has been located such that it is well shielded and compliance with the 45 dB L_{Aeq} night-time noise criterion can be achieved.

3.1.4. Summary – Construction Noise

While I predict that the construction noise criteria will be complied with at virtually all sensitive activities, this does not mean that construction noise will be inaudible. For any sensitive activity within 250 to 400 metres of any works (where there is no terrain screening between the works and the house), construction noise will likely be audible at times. In my opinion, this is not unreasonable and expected from time to time. Noise levels will be low enough to not result in adverse effects.

Noise levels can be mitigated further using common measures such as choice of equipment and methodology, shielding and communication. These measures are discussed further in Section 0.

3.2. Construction Vibration

3.2.1. Effects on buildings

As discussed above, most buildings are at a significant distance from the Proposed Designation and would therefore receive construction vibration levels that are compliant with the various Category A and Category B vibration criteria of Table 2. Only at The Braigh are dwellings sufficiently close to the Proposed Designation boundary to potentially receive vibration levels that may infringe the amenity criterion during road compaction, with three dwellings within 15 metres of the Proposed Designation boundary, but at least 30 metres from the Indicative Alignment.

Compaction would only occur for a very limited time, likely one or two days only in any one location, and vibration levels would be up to 2 mm/s ppv at distances of about 15-20 metres from the compaction works. Even when works are closest, the building protection criterion (i.e. 5 mm/s ppv) will be readily complied with. I do not consider there is any risk of cosmetic building damage to any dwelling from the proposed Project works.

All other buildings will be outside the safe distance and receive vibration levels that are well below the 1 mm/s ppv amenity criterion. The large distances from works to buildings means that, in most instances, vibration will not be felt by occupants.

3.2.2. Effects on pipes

The Project will be constructed in the vicinity of existing services. While most will be well beyond the safe distance of 1 metre, a First Gas pipeline will be crossed by the construction works at approximately CH24400.

I understand that the most likely pipe material is steel. However, as noted earlier, the safe distance is generally around 1 metre from any pipe. Any vibration inducing construction within 3 metres of the pipe should be monitored to ensure no damage to the pipe, and to reduce the risk to the Project.

3.2.3. Summary – Construction vibration

While I predict that the construction vibration criteria for the protection of buildings will be complied with at all sensitive buildings, this does not mean that construction vibration will not be perceived. For any houses within 40 to 60 metres of high vibration daytime works, construction vibration will likely be perceptible at times. At night-time, this distance would increase to about 250 metres. In my opinion, feeling vibration during daytime is not unreasonable and expected from time to time. Vibration levels will be low enough to not result in adverse effects. I do not consider there is any risk of cosmetic building damage to any dwelling from the proposed Project works.

Vibration levels can be mitigated further using common measures such as choice of equipment and methodology, monitoring and communication. These measures are discussed further in Section 4.

3.3. Blasting

I am currently not aware where blasting may be undertaken along the alignment. This will be determined when works progress on the detailed design alignment at a later stage. However, given the width of the Proposed Designation and the fact that there are very few buildings within 160 metres of the Indicative Alignment, I consider that any blasting can be designed and undertaken to readily comply with the

relevant noise and vibration criteria. Should the Indicative Alignment move closer to the Proposed Designation boundary, blasting should be restricted to areas where there are no buildings within 160 metres from the blast site, or the blast design should be carried out to ensure the relevant building damage criteria are complied with.

Even when compliance with the relevant noise and vibration criteria is achieved, people may be concerned or disturbed by blasts, and management as discussed below is recommended.

4. Recommended Mitigation

4.1. Best practice general mitigation and management measures

The most effective way to control construction noise is through good on-site management and communication between managers, staff and affected receivers. We have included recommended measures in this report, based on the assumed construction equipment and methodologies.

Good noise and vibration management is essential in reducing adverse effects as far as practicable, irrespective of the low number of dwellings potentially affected or if noise levels may already be compliant with the relevant criteria.

Mitigation and management generally involves:

- Communication and consultation
- Staff training
- Equipment selection
- Timing of works
- Noise barriers
- Alternative mitigation options in exceptional circumstances (e.g. offers of temporary relocation)

All of these measures will be set out in a CNVMP. Where infringements of the noise or vibration criteria are predicted even with the generally mitigation measures implemented as set out in the CNVMP, Schedules to the CNVMP (Schedules) would be prepared.

4.2. Construction Noise and Vibration Management Plan

All appropriate mitigation and management are generally set out in a CNVMP, which would be used to manage works on site and sets out how the construction contractor interacts with the neighbouring affected parties.

The CNVMP should also include information set out in NZS 6803 in Section 8 and Annex E:

- Summary of noise and vibration standards;
- Summary of assessments/predictions;
- General construction practices, management and mitigation that will be used for the Project;
- Noise management and mitigation measures specific to activities and/or receiving environments, particularly for high noise and/or vibration activities, and all night-time works;
- Monitoring and reporting requirements;
- Procedures for handling complaints; and
- Procedures for review of the CNVMP throughout the works.

The CNVMP will need to be prepared when a contractor has been engaged and more details are known about the works (e.g. methodology, equipment, timing etc).

4.3. Schedules to the CNVMP

In addition, Schedules are a useful tool in determining how the noise and vibration effects from specific activities or in specific areas will be managed and potentially affected parties communicated with. Schedules would generally be prepared where there is a high risk of exceeding the noise and/or vibration standards.

The Schedules are specific to the activity or receiver they relate to, and would therefore contain detailed information on communication, management and mitigation specific to a certain task or area.

The following information would normally be included in a Schedule:

- The activity start and finish dates;
- The nearest neighbours to the activity;
- A location plan;
- The activity equipment and methodology;
- Predicted noise/vibration levels
- Recommended Best Practicable Option (BPO) mitigation;
- Documented communication and consultation with affected persons;
- Monitoring details; and
- Any pre-activity building condition survey for any buildings predicted to receive vibration levels exceeding the Category A criteria and receiving noise levels towards the Category B criteria.

They would be attached to the CNVMP, providing additional information that would sit alongside the general management and mitigation options within the CNVMP.

4.4. Specific mitigation recommended in this assessment

Any noise or vibration effects will be managed through a CNVMP and Schedules as required.

Commonly, noise levels can be mitigated by providing temporary noise barriers, timing of works to occur when people are typically not at home, using lower noise and well-maintained equipment, and good site management to avoid unnecessary noise generation. Residual effects will be managed with proactive communication and engagement with affected parties, on-site staff training to raise awareness of neighbour sensitivities and undertaking noise surveys to verify predictions.

Vibration effects can be reduced if the construction methodology avoids high vibration inducing activities (e.g. using bored piling rather than impact or vibro piling) or choosing smaller equipment (e.g. choosing a 6-8T vibro roller rather than a 10-12T vibro roller). Engagement with potentially affected building occupants is important to avoid concern about vibration being felt without warning.

Where high vibration works are proposed within 3 metres of pipes, I have recommended vibration surveys to ensure vibration levels are monitored and can remain within the relevant criteria. This enables construction methodologies to be adjusted should the measured vibration levels exceed relevant criteria.

If blasting is undertaken, I recommend that a prior notification system is established that notifies people within a certain radius via text or email of impending blasts. I also recommend that, except in emergencies, a blast window is established and kept to, e.g. Monday to Friday 10am to 3pm, with weekly prior notice, so that residents in the vicinity have certainty about blast effects.

5. Conclusion

The Project can be constructed to generally comply with the relevant noise, vibration and blast criteria recommended. The Indicative Alignment is at sufficient distances that all sensitive buildings would receive compliant noise and vibration levels. There is the potential for a small number of dwellings to receive intermittent non-compliant noise levels and vibration levels above the amenity criterion, where works are closest. In addition, the proposed fill area in the Brynderwyn Hills next to 4800 SH1 is only 50 metres from the dwelling, which means that noise levels are predicted to exceed the daytime noise criteria unless mitigation is implemented.

Given that the Indicative Alignment may change within the Proposed Designation, I have provided indicative safe distances from construction activities to sensitive receivers to show where compliance can be achieved. I have recommended mitigation and management measures, particularly a CNVMP and Schedules, which will ensure proactive management of any adverse noise or vibration effects.

Overall, with the above mitigation measures in place, I consider that the Project can be constructed generating reasonable noise and vibration levels. While construction noise and vibration are higher than day-to-day noise and vibration levels and will likely be heard and felt by people closest to the works, this is not unreasonable given the limited duration of the works.