TE TUPU NGĀTAHI
SUPPORTING GROWTH

Warkworth Assessment of Construction Noise and Vibration Effects

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Version 1.0

WAKA KOTAHI NZ TRANSPORT AGENCY

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Table of Contents

Appendices

Table of Figures

Table of Tables

Glossary of Defined Terms and Acronyms

Acronym/Term	Description
AEE	Assessment of Effects on the Environment report
AT	Auckland Transport
AUP:OP	Auckland Unitary Plan: Operative in Part
CEMP	Construction Environmental Management Plan
CNVMP	Construction Noise and Vibration Monitoring Plan
FUZ	Future Urban Zone
HAIL	Hazardous Activities and Industries List
HNZPT / Heritage NZ	Heritage New Zealand Pouhere Taonga
NOR	Notice of Requirement
NOR 1	Northern Public Transport Interchange + Park and Ride and Western Link - North
NOR 2	Woodcocks Road Upgrade (Western Section)
NOR 3	State Highway 1 Upgrade (Southern Section)
NOR 4	Matakana Road Upgrade
NOR 5	Sandspit Road Upgrade
NOR 6	Western Link - South
NOR 7	Sandspit Link
NOR 8	Wider Western Link (Northern Section)
NZ	New Zealand
RMA	Resource Management Act 1991
SH1	State Highway 1
Te Tupu Ngātahi	Te Tupu Ngātahi Supporting Growth Alliance
Waka Kotahi	Waka Kotahi New Zealand Transport Agency
L_{Aeq}	The equivalent continues A-weighted sound pressure level
dB	Unit of measurement of sound

1 Executive Summary

Overview

The Warkworth Assessment Package is a network of planned transport infrastructure with the purpose of responding to planned future growth in the Warkworth growth areas. The transport network is made of eight NoRs including new corridors, existing road upgrades, and a public transport interchange with park and ride.

Table 1-1. Warkworth Assessment Package – NOR and Project Overview

Notice	Project
NOR 1	**Northern Public Transport Interchange + Park and Ride and Western Link - North**
NOR 2	**Woodcocks Road Upgrade (Western Section)**
NOR 3	**State Highway 1 Upgrade – South**
NOR 4	**Matakana Road Upgrade**
NOR 5	**Sandspit Road Upgrade**
NOR 6	**Western Link - South**
NOR 7	**Sandspit Link**
NOR 8	**Wider Western Link – North**

Methodology

Construction noise levels have been assessed using the method recommended in NZS 6803 in accordance with the Auckland Unitary Plan Operative in Part (AUP:OP). As construction of each Project is expected to last for more than 20 weeks, the “long-duration” noise limits are applicable.

Noisy activities will typically be carried out between 7am – 6pm on weekdays. Night-time and weekend works will be limited and only occur for critical activities.

Construction vibration levels have been assessed against the requirements of the AUP:OP, which refer to the criteria in DIN 4150-3:1999 for the avoidance of cosmetic building damage. The AUP:OP also details amenity criteria, which should act as a trigger for consultation if predicted to be exceeded.

Construction noise setback distances and vibration emission radii have been determined (based on assumptions of construction activities and equipment) for each of the NOR sections. The construction boundary was assumed to be the edge of the earthworks boundary. Affected receivers have been identified using construction noise setback distances and vibration emission radii. The construction noise setback distances and vibration emission radii were used to determine where any potential construction noise and vibration exceedances of the relevant criteria could occur. It should also be noted that the emission radii are conservative and vibration levels measured on site tend to be much lower than those predicted at the NOR stage of a project.

Potential effects of construction noise and vibration have then been assessed and construction management and mitigation measures identified where appropriate. To avoid and/or minimise exceedances of the Project construction noise and vibration criteria, Best Practicable Option (BPO) mitigation and management measures should be utilised.

Assessment of effects

NOR 1 – Northern Public Transport Hub and Park and Ride and Western Link North (Northern Section)

The proposed site for the Northern Public Transport Hub is located adjacent to the intersection of State Highway 1 and the proposed new Western Link - North (Northern Section), with few dwellings nearby. The noise environment is dominated by road traffic noise from vehicles using State Highway 1.

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 40m from the alignment. With mitigation in place, as set out in Section 7.2, noise levels are predicted to comply with the daytime noise criteria at all existing receivers.

No existing dwellings or commercial structures are predicted to receive vibration levels that exceed the Category B criteria, even if high vibration generating equipment, such as the roller compactor, are used on the construction boundary at the closest position to the receivers.

Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the Construction Noise and Vibration Management Plan (CNVMP) and Schedules.

NOR 2 – Woodcocks Road Upgrade

Woodcocks Road (western section) runs through a rural and residential environment. The land adjacent to Woodcocks Road is predominantly Future Urban Zone (FUZ) on both sides of the existing corridor with a small area of Residential zoned land to the east of Mason Heights.

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 3m away. With mitigation in place, as set out in Section 7.2, noise levels of up to 85 dB L_{Aeq} could occur intermittently at the closest receivers, if high noise generating activities occur on the construction boundary. At this level effects are likely to include loss of concentration, annoyance, and a reduction in speech intelligibility.

Operation of construction equipment will be intermittent in nature. Construction will be linear so as the equipment moves away from the receiver noise levels will reduce. The worst-case situations, where mitigated noise levels could reach 85 dB L_{Aeq} at the closest receivers, are not expected to be frequent, due to the setback distances to the majority of the proposed works and the use of equipment with lower source noise levels for large portions of the works. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

Vibration levels could exceed the Category B criteria at one existing dwelling prior to mitigation being implemented, if high vibration generating equipment such as the roller compactor is used on the construction boundary at the closest position to the receiver. Without mitigation, at this receiver there is potential for cosmetic damage to the building (such as cracking) and annoyance from perception of

vibration. Mitigation such as the use of non-vibratory compaction equipment within 8m of buildings is recommended to avoid potential cosmetic damage. Vibration can typically be tolerated inside buildings if it occurs intermittently during the day, is of limited duration and where there is effective prior engagement.

Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

NOR 3 – State Highway 1

State Highway 1 is an existing busy motorway with commercial buildings and residential dwellings along the road corridor. The noise environment is dominated by road traffic noise from vehicles on State Highway 1.

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 3m away. With mitigation in place, as set out in Section 7.2, noise levels of up to 85 dB L_{Aeq} could occur intermittently at the closest receivers, if high noise generating activities occur on the construction boundary. At this level effects are likely to include loss of concentration, annoyance, and a reduction in speech intelligibility.

Operation of construction equipment will be intermittent in nature. Construction will be linear so as the equipment moves away from the receiver noise levels will reduce. The worst-case situations, where mitigated noise levels could reach 85 dB L_{Aeq} at the closest receivers, are not expected to be frequent, due to the setback distances to the majority of the proposed works and the use of equipment with lower source noise levels for large portions of the works. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

Vibration levels could exceed the Category B criteria at 12 existing dwellings prior to mitigation being implemented, if high vibration generating equipment such as the roller compactor is used on the construction boundary at the closest position to the receivers. Without mitigation, at these receivers there is potential for cosmetic damage to buildings (such as cracking) and annoyance from perception of vibration. Mitigation such as the use of non-vibratory compaction equipment within 8m of buildings is recommended to avoid potential cosmetic damage. Vibration can typically be tolerated inside buildings if it occurs intermittently during the day, is of limited duration and where there is effective prior engagement.

Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

NOR 4 – Matakana Road Upgrade

Matakana Road is located within a rural and residential area with some dwellings located close to the road corridor. The noise environment is dominated by road traffic noise from vehicles on Matakana Road.

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 3m away. With mitigation in place, as set out in Section 7.2, noise levels of up to 85 dB L_{Aeq} could occur intermittently at the closest receivers, if high noise generating activities occur on the construction boundary. At this level effects are likely to include loss of concentration, annoyance, and a reduction in speech intelligibility.

Operation of construction equipment will be intermittent in nature. Construction will be linear so as the equipment moves away from the receiver noise levels will reduce. The worst-case situations, where mitigated noise levels could reach 85 dB L_{Aeq} at the closest receivers, are not expected to be frequent, due to the setback distances to the majority of the proposed works and the use of equipment with lower source noise levels for large portions of the works. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

Vibration levels could exceed the Category B criteria at nine existing dwellings prior to mitigation being implemented, if high vibration generating equipment such as the roller compactor is used on the construction boundary at the closest position to the receivers. Without mitigation, at these receivers there is potential for cosmetic damage to buildings (such as cracking) and annoyance from perception of vibration. Mitigation such as the use of non-vibratory compaction equipment within 8m of buildings is recommended to avoid potential cosmetic damage. Vibration can typically be tolerated inside buildings if it occurs intermittently during the day, is of limited duration and where there is effective prior engagement.

Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

NOR 5 – Sandspit Road Upgrade

Sandspit Road currently runs through urban and rural environments. In the rural area there are a few dwellings near the road. The noise environment is dominated by road traffic noise from vehicles using the Sandspit Road and the surrounding road network.

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 4m away. With mitigation in place, as set out in Section 7.2, noise levels of up to 83 dB L_{Aeq} could occur intermittently at the closest receivers, if high noise generating activities occur on the construction boundary. At this level effects are likely to include loss of concentration, annoyance, and a reduction in speech intelligibility.

Operation of construction equipment will be intermittent in nature. Construction will be linear so as the equipment moves away from the receiver noise levels will reduce. The worst-case situations, where mitigated noise levels could reach 83 dB L_{Aeq} at the closest receivers, are not expected to be frequent, due to the setback distances to the majority of the proposed works and the use of equipment with lower source noise levels for large portions of the works. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

Vibration levels could exceed the Category B criteria at one existing dwelling prior to mitigation being implemented, if high vibration generating equipment such as the roller compactor is used on the construction boundary at the closest position to the receiver. Without mitigation, at this receiver there is potential for cosmetic damage to the building (such as cracking) and annoyance from perception of vibration. Mitigation such as the use of non-vibratory compaction equipment within 8m of buildings is recommended to avoid potential cosmetic damage. Vibration can typically be tolerated inside buildings if it occurs intermittently during the day, is of limited duration and where there is effective prior engagement.

Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

NOR 6 – Western Link - South

Western Link - South is an existing road with commercial and residential buildings along the road corridor. The noise environment is dominated by road traffic noise from vehicles on the nearby road network.

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 17m away. With mitigation in place, as set out in Section 7.2, noise levels of up to 72 dB L_{Aeq} could occur intermittently at the closest receivers, if high noise generating activities occur on the construction boundary. At this level effects are likely to include loss of concentration, annoyance, and a reduction in speech intelligibility.

Operation of construction equipment will be intermittent in nature. Construction will be linear so as the equipment moves away from the receiver noise levels will reduce. The worst-case situations, where mitigated noise levels could reach 72 dB L_{Aeq} at the closest receivers, are not expected to be frequent, due to the setback distances to the majority of the proposed works and the use of equipment with lower source noise levels for large portions of the works. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

No existing dwellings or commercial structures are predicted to receive vibration levels that exceed the Category B criteria, even if high vibration generating equipment, such as the roller compactor, are used on the construction boundary at the closest position to the receivers.

Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

NOR 7 – Sandspit Link

The proposed Sandspit Link runs through a currently rural environment. In the rural area there are few dwellings near the road. The noise environment is dominated by road traffic noise from vehicles using the Matakana Road and the surrounding road network.

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 15m away. With mitigation in place, as set out in Section 7.2, noise levels of up to 74 dB L_{Aeq} could occur intermittently at the closest receivers, if high noise generating activities occur on the construction boundary. At this level effects are likely to include loss of concentration, annoyance, and a reduction in speech intelligibility.

Operation of construction equipment will be intermittent in nature. Construction will be linear so as the equipment moves away from the receiver noise levels will reduce. The worst-case situations, where mitigated noise levels could reach 74 dB L_{Aeq} at the closest receivers, are not expected to be frequent, due to the setback distances to the majority of the proposed works and the use of equipment with lower source noise levels for large portions of the works. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

No existing dwellings or commercial structures are predicted to receive vibration levels that exceed the Category B criteria, even if high vibration generating equipment, such as the roller compactor, are used on the construction boundary at the closest position to the receivers.

Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

NOR 8 – Wider Western Link – North

The Wider Western Link runs through a predominantly rural area with some residential dwellings located close to the road corridor. The noise environment is dominated by road traffic noise from vehicles on Woodcocks Road.

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 10m away. With mitigation in place, as set out in Section 7.2, noise levels of up to 76 dB L_{Aeq} could occur intermittently at the closest receivers, if high noise generating activities occur on the construction boundary. At this level effects likely to include loss of concentration, annoyance, and a reduction in speech intelligibility.

Operation of construction equipment will be intermittent in nature. Construction will be linear so as the equipment moves away from the receiver noise levels will reduce. The worst-case situations, where mitigated noise levels could reach 76 dB L_{Aeq} at the closest receivers, are not expected to be frequent, due to the setback distances to the majority of the proposed works and the use of equipment with lower source noise levels for large portions of the works. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

No existing dwellings or commercial structures are predicted to receive vibration levels that exceed the Category B criteria, even if high vibration generating equipment, such as the roller compactor, are used on the construction boundary at the closest position to the receivers.

Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

2 Introduction

This Construction Noise and Vibration assessment has been prepared for the Te Tupu Ngātahi Supporting Growth Alliance, Warkworth Package of Notices of Requirement (NoRs) for Auckland Transport (AT) and Waka Kotahi NZ Transport Agency (WK) as requiring authorities under the Resource Management Act 1991 (RMA). The notices are to designate land for future strategic transport corridors as part of Te Tupu Ngātahi Supporting Growth Alliance to enable the future construction, operation and maintenance of transport infrastructure in the Warkworth area of Auckland.

2.1 Warkworth Growth Area

Warkworth is located at the northernmost extent of the Auckland Region, approximately 60km from the Auckland city centre, and 30km north of Orewa. It is identified as a satellite town in the Auckland Unitary Plan: Operative in Part (AUP:OP) and will act as a rural node that serves both the surrounding rural communities as well as connecting to urban Auckland.

The Warkworth growth area will be less than 5km north-south and east-west and will make a significant contribution to the future growth of Auckland's population. A 1000ha of currently rural land has been rezoned (FUZ) to support significant business and residential growth. At full build out it is anticipated to provide for approximately 8,200 new dwellings and employment activities that will contribute to 4,600 new jobs across Warkworth. This growth area will be development ready in the stages outlined below:

- **Stage 1** Warkworth North – Business land is already live zoned and remainder to be development ready by 2022.
- **Stage 2** Warkworth South – To be development ready between 2028 – 2032
- **Stage 3** Warkworth Northeast – To be development ready between 2033 – 2037

Furthermore, the Warkworth Structure Plan was adopted by the Council in 2019 and sets out the framework for transforming Warkworth from a rural environment to an urbanised community over the next 15 - 20 years.

It is noted that parts of these areas are experiencing earlier than anticipated growth pressure, with parts of Warkworth South subject to a lodged Private Plan Change, as well as sections of Warkworth Northeast. [1]

The Warkworth Assessment Package will provide route protection for the local arterials, which include walking, cycling and public transport linkages needed to support the expected growth in Warkworth. The Warkworth Package of projects is summarised in Section 3.

This report addresses the construction noise and vibration effects of the Warkworth Package (NOR 1 - NOR 8).

Refer to the Assessment of Effects on the Environment (AEE) for a more detailed project description.

[1] https://www.aucklandcouncil.govt.nz/have-your-say/have-your-say-notified-resource-consent/Pages/resource-consent-public-notice.aspx?itemId=194&src=Search

2.2 Purpose and scope of this Report

This construction noise and vibration assessment forms part of the suite of technical reports prepared to support the AEE for the Warkworth Package. Its purpose is to inform the AEE that accompanies the eight Warkworth Network NORs sought by AT and WK.

This report considers the actual and potential noise effects associated with the construction of the Warkworth Package on the existing and likely future environment as it relates to noise and vibration effects and recommends measures that may be implemented to avoid, remedy and/or mitigate these effects.

The key matters addressed in this report are as follows:

a) Identify and describe the noise and vibration context of the Warkworth Assessment Package area;
b) Identify and describe the actual and potential construction noise and vibration effects of each Project corridor within the Warkworth Assessment Package;
c) Recommend measures as appropriate to avoid, remedy or mitigate actual and potential construction noise and vibration effects (including any conditions/management plan required) for each Project corridor within the Warkworth Assessment Package; and
d) Present an overall conclusion of the level of actual and potential construction noise and vibration effects for each Project corridor within the Warkworth Assessment Package after recommended measures are implemented.

2.3 Report Structure

The report is structured a follows:

a) Overview of the methodology used to undertake the assessment and identification of the assessment criteria and any relevant standards or guidelines;
b) Description of each Project corridor and project features within the Warkworth Assessment Package as it relates to construction noise and vibration;
c) Description of the existing and likely future noise environment;
d) Description of the actual and potential adverse construction noise and vibration effects of construction of each Project;
e) Recommended measures to avoid, remedy or mitigate potential adverse construction noise and vibration effects; and
f) Overall conclusion of the level of potential adverse construction noise and vibration effects of the Project after recommended measures are implemented.

This report should be read alongside the AEE, which contains further details on the history and context of the Warkworth project. The AEE also contains a detailed description of works to be authorised within each NOR, and the typical construction methodologies that will be used to implement this work. These have been reviewed by the author of this report and have been considered as part of this assessment of noise and vibration effects. As such, they are not repeated here. Where a description of an activity is necessary to understand the potential effects, it has been included in this report for clarity.

2.4 Preparation of this Report

The construction methodology and construction drawings for each NOR were reviewed and reference to the AUP:OP, NZS 6803 and DIN 4150 was made (these documents are discussed further below).

A site visit was conducted on 21st February 2023.

Ambient noise measurements were carried out at:

- 153 Woodcocks Avenue
- 10 Georgetti Way
- 171 Matakana Road

3 Warkworth Package Overview

The Warkworth package is a network of planned transport infrastructure with the purpose of responding to planned future growth in the Warkworth growth areas. The transport network is made of eight NoRs including public transport interchanges, existing road upgrades, and new corridors.

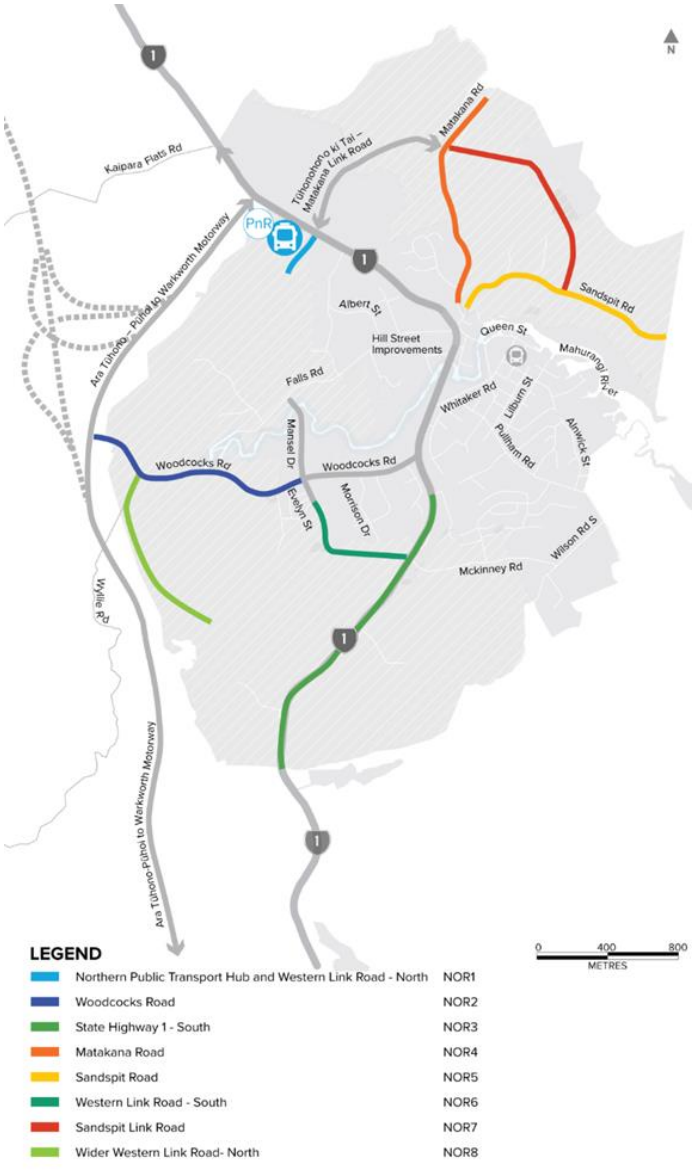
An overview of the Warkworth NOR package is set out in Table 3-1 and shown in Figure 3-1.

Table 3-1. Warkworth NOR Package

Corridor	NOR	Description	Requiring Authority
Northern Public Transport Hub and Western Link – North	1	New northern public transport hub and associated facilities including a park and ride at the corner of State Highway 1 (SH1) and the new Western Link – North. New urban arterial cross-section with active mode facilities between the intersection of SH1 and Te Honohono ki Tai (Matakana Link Road) to the proposed bridge crossing, enabling a connection for development in the Warkworth Northern Precinct as provided for in the Warkworth North Precinct.	Auckland Transport
Woodcocks Road - West	2	Upgrade of the existing Woodcocks Road corridor between Mansel Drive and Ara Tūhono (Puhoi to Warkworth) to an urban arterial cross-section with active mode facilities.	Auckland Transport
State Highway 1 – South Upgrade	3	Upgrade of the existing SH1 corridor between Fairwater Road and the southern Rural Urban Boundary to an urban arterial cross-section with active mode facilities.	Auckland Transport
Matakana Road Upgrade	4	Upgrade of the existing Matakana Road corridor between the Hill Street intersection and the northern Rural Urban Boundary to an urban arterial cross-section with active mode facilities.	Auckland Transport
Sandspit Road Upgrade	5	Upgrade of the existing Sandspit Road corridor between the Hill Street intersection and the eastern Rural Urban Boundary to an urban arterial cross-section with active mode facilities.	Auckland Transport

Corridor	NOR	Description	Requiring Authority
Western Link – South	6	New urban arterial cross-section with active mode facilities between the intersection of SH1 and McKinney Road and Evelyn Street.	Auckland Transport
Sandspit Link	7	New urban arterial cross-section with active mode facilities between the intersection of Matakana Road and Te Honohono ki Tai (Matakana Link Road) and Sandspit Road.	Auckland Transport
Wider Western Link – North	8	New urban arterial cross-section with active mode facilities between Woodcocks Road and the Mahurangi River.	Auckland Transport

Figure 3-1. Warkworth NOR package Overview



4 Existing Ambient Noise Environment

In order to establish existing baseline noise levels in the Warkworth area, site surveys were undertaken to measure the existing noise environment.

4.1 Noise Monitoring Procedure

Noise survey equipment, meteorological conditions, data analysis and results are described below. The noise monitoring was undertaken in general accordance with the relevant requirements of NZS 6801, 6802 and 6806. This meant the results could adequately inform both the operational and construction noise assessments.

Measurements were undertaken at the following three locations:

- 153 Woodcocks Avenue
- 10 Georgetti Way
- 171 Matakana Road

These locations were selected to represent an existing environment that is unlikely to change significantly up until the design year, and where road traffic is currently the controlling noise source. The measurement positions were chosen to avoid extraneous factors which could have influenced the sound levels, where practicable. Measurement and calibration details required by NZS 6801 are held on file.

The unattended noise monitoring results can be found in Appendix C. Forms summarising the noise monitoring at each location are provided in Appendix D. Monitoring was undertaken for one week.

4.2 Meteorological Conditions

During the surveys, meteorological data was obtained from Auckland, Warkworth Ews (17838) weather station operated by NIWA. This is the closest station where data was available at an hourly resolution or less.

The meteorological data from this weather station was used to identify periods when conditions were likely to have been outside the meteorological restrictions given in NZS 6801, and therefore data measured during these periods has been excluded from the noise analysis.

4.3 Data Analysis

Road traffic was the dominant noise source at all measurement locations. There is a natural variation in the noise environment throughout the day, and often variations for the weekends. Each day's data was analysed, and abnormal events were excluded. A summary of the measured noise levels at each location for each day is presented in Table 4-1.

The $L_{Aeq(24h)}$ was calculated for each day where there was sufficient data after unsatisfactory meteorological conditions and abnormal events were excluded. This meant that data for the 12th and 13th of February were excluded due to rain.

Note that data was not recorded at 153 Woodcocks Avenue and 171 Matakana Road on the 16th of February since the batteries ran out of power for those sound level meters on that day.

Table 4-1 Summary of measured noise levels

Date	Noise Level, dB $L_{Aeq(24h)}$		
	153 Woodcocks Avenue	10 Georgetti Way	171 Matakana Road
09/02/2023	59	40	49
10/02/2023	59	43	51
11/02/2023	58	50	55
14/02/2023	59	50	57
15/02/2023	58	45	53
16/02/2023	-	43	-

The average $L_{Aeq(24h)}$ for the unattended measurement at each location was:

- 153 Woodcocks Road: 59 dB $L_{Aeq(24h)}$
- 10 Georgetti Way: 47 dB $L_{Aeq(24h)}$
- 171 Matakana Road: 54 dB $L_{Aeq(24h)}$

5 Assessment Criteria

5.1 Construction Noise

The following guidelines and standards have been reviewed for the assessment of construction noise:

- AUP:OP, specifically rule E25.6.27, relating to construction noise in all zones except the City Centre and Metropolitan Centre zones, and E25.6.29 relating to construction noise in the road corridor
- NZS 6803:1999 Acoustics – Construction Noise

Table 5-1 and Table 5-2 below set out the recommended construction noise criteria. These criteria align with the long duration (more than 20 weeks) noise criteria of NZS 6803 and largely reflect the AUP:OP criteria.

Table 5-1 Construction noise criteria for occupied sensitive receivers

Day of the week	Time period	Maximum noise level >20 weeks	
		dB L_{Aeq}	dB L_{Amax}
Weekdays	**6:30 – 7:30**	55	75
	7:30 – 18:00	70	85
	18:00 – 20:00	65	80
	20:00 – 06:30	45	75
Saturdays	**6:30 – 7:30**	45	75
	7:30 – 18:00	70	85
	18:00 – 20:00	45	75
	20:00 – 06:30	45	75
Sunday and public holidays	**6:30 – 7:30**	45	75
	7:30 – 18:00	55	85
	18:00 – 20:00	45	75
	20:00 – 06:30	45	75

Table 5-2 Construction noise criteria for all other occupied receivers

Time period	Maximum noise level >20 weeks dB L_{Aeq}
07:30 – 18:00	70
18:00 – 07:30	75

Exemptions to these levels are provided in Rule E25.6.29 (2) and E25.6.29 (3) where noise levels specified do not apply for planned works in the road between the hours of 10pm and 7am where:

- The number of nights where the noise generated by the works exceeds the relevant noise levels at any one receiver exceeds the relevant noise levels for 3 nights or less; and
- The works cannot practicably be carried out during the day or because the road controlling authority requires this work to be night-time; or
- Because of the nature of the works the noise produced cannot practicably be made to comply with the relevant noise levels.

Under E25.6.29(3) noise levels specified (as replicated above in Table 5-1) do not apply for planned works in the road between the hours of 7am and 10pm where:

- The number of days where the noise generated by the works exceeds the relevant noise levels at any one receiver is 10 days or less; or
- Because of the nature of the works and the proximity of receivers the noise generated cannot be practicably made to comply with the relevant noise levels.

If situations fall under the exemption rules, then a copy of the works access permit issued by Auckland Transport will be provided to the Council five days prior to work commencing; or a construction noise and vibration management plan will be provided to the Council no less than five days prior to the works commencing in accordance with the applicable provisions of Standard E25.6.29(5).

5.2 Construction Vibration

The main objective of controlling construction vibration is to avoid vibration-related damage to buildings, structures, and services, in the vicinity of the works. Any adverse effects of construction vibration on human comfort would typically only be experienced for short durations, for most types of construction work.

It should be noted that the level of vibration perceived by humans, and the level of vibration that is likely to result in annoyance for some people, are magnitudes lower than the level of vibration capable of damaging structures. This means that vibration levels which readily comply with the building damage criteria will likely cause annoyance and adverse reaction from building occupants who mistakenly believe that their building is sustaining damage.

The following guidelines and standards have been reviewed for the assessment of construction vibration:

- AUP:OP rule E25.6.30 relating to construction vibration, amenity and avoidance of any damage to buildings
- German Standard DIN4150-3 (1999) Structural vibration – Part 3 Effects of vibration on structures
- British Standard (BS) 5228-2: 2009 “Code of practice for noise and vibration control on construction and open sites”

Rule E25.6.30 of the AUP:OP relates to construction vibration and contains criteria for both building damage and amenity. The building vibration criteria are based on the German Standard DIN 4150-3:1999 "Structural Vibration - Part 3: Effects of Vibration on Structures". This Standard is conservative and designed to avoid all (including cosmetic) damage to buildings. Significantly higher limits would be applied if damage to structural foundations was the only consideration.

The amenity criteria act as trigger levels for consultation and communication.

Table 5-3 below shows the recommended vibration criteria for all NoRs. These criteria are based on the AUP:OP.

Table 5-3 Construction vibration criteria

Vibration Level	Effect	Category A	Category B
Occupied activities sensitive to noise	Night-time 2000h – 0630	0.3mm/s ppv	2mm/s ppv
	Daytime 0630h – 2000h	2mm/s ppv	5mm/s ppv
Other occupied buildings	Daytime 0630h – 200h.	2mm/s ppv	5mm/s ppv
All other buildings	All other times	Tables 1 and 3 of DIN4150-3:1999	

The two category criteria are to facilitate a progressive management response to the increasing risks and effects during construction.

Category A sets the criteria for the amenity effects where vibrations may be perceived by occupants within a building and is an indicator of when communication and consultations should be initiated to manage effects. The Category A criteria aims to avoid annoyance of building occupants.

If the Category A criteria cannot be practicably achieved, the focus shifts to avoiding building damage rather than avoiding annoyance by applying the Category B criteria. Building damage is unlikely to occur if the Category B criteria are complied with. If predictions indicate that the Category B criteria may be exceeded, building condition surveys must be carried out prior to works commencing and vibration monitoring must be carried out during the works. This allows an assessment of and response to any effects.

6 Assessment Methodology

A consistent approach has been adopted for the whole Warkworth Package as set out in this section. It has been assumed that no concurrent project works will occur across the multiple areas where receivers may be subjected to impacts from more than one designation. Any receivers that may be impacted by more than one Project would be reassessed closer to the time of construction. Buildings within the current proposed designation footprint will be removed, as confirmed by the Project Team, and are not assessed.

Construction noise setback distances and vibration emission radii have been determined based on assumptions of construction activities and equipment for each of the NORs.

The construction boundary is assumed to be the earthworks boundary. Affected receivers have been identified using construction noise setback distances and vibration emission radii. The construction noise setback distances and vibration emission radii were used to determine where any potential construction noise and vibration exceedances of the relevant criteria could occur. Potential effects of construction noise and vibration have then been assessed and construction management and mitigation measures identified where appropriate. Where practicable the, BPO mitigation and management measures should be utilised.

This report proposes a framework for construction noise and vibration management such that the most effective and practicable methods for mitigation will be planned and implemented, taking into account the extent of predicted effects. At the core of this framework is the CNVMP in Section 7.2.1 which will be developed prior to commencement of construction and updated as necessary throughout the duration of construction.

6.1 Construction Methodology

An indicative construction methodology has been provided by the project team to inform the assessment of each of the NoRs.

The outline is based on a generic construction project and has not taken into consideration any project specific scope of works, constraints or staging requirements that may be applicable for each project. The indicative construction programme assumes a linear construction sequence.

The construction methodology for the projects is as follows:

6.1.1 Site establishment

- Site access construction;
- Tree removal and vegetation clearance;
- Remove footpath, streetlights, grass verge berm;
- Property/ building modification or demolition, including fencing, driveways and gates;
- Install environmental controls e.g. silt fencing, sediment retention ponds;
- Implement traffic management to establish the construction zones;
- Service protection works; and
- Construct access tracks/ haul roads (if any).

6.1.2 Advance works

- Relocation of utilities/services; and
- Major earthworks including the following:
    - Ground improvements, undercuts, embankment foundations;
    - Cut and fill works along the alignment to formation level, including preload if required; and
    - Remove preload upon settlement completion, and subgrade preparation.

6.1.3 Main works

- Minor earthworks (cut and fill);
- Remove verge and prepare subgrade formation;
- Construct new longitudinal drainage facilities;
- Construct new pavement, widening works in available areas;
- Move traffic to newly constructed pavement areas and continue with the remaining widening works;
- Pavement reconstruction or reconfiguration of existing road furniture;
- Complete tie in works, footpaths, cycleways, lighting and landscaping;
- Construct permanent stormwater wetlands;
- Construct new culverts including rip rap and headwalls;
- Install road safety barriers (if any); and
- Bridge construction works as follows:
    - Construct abutments;
    - Piling, pier, and headstock construction;
    - Install bridge beams and decking;
    - Install settlement slabs;
    - Retaining wall construction (if any);
    - Accommodation works; and
    - Install signage and lighting.

6.1.4 Finishing works and demobilisation

- Final road surfacing and road markings;
- Commission traffic signals (if any);
- Finishing works e.g. landscaping, street furniture, fencing and outstanding accommodation works;
- Move traffic to the final road configuration; and
- Practical completion and de-establishment.

6.1.5 Plant and Equipment

Table 6-1 provides an indicative list of plant and equipment which may be required for construction across each designation.

Table 6-1 Indicative construction equipment

Construction	Construction Activity
Typical across all works	• Site facility • Light Vehicles • Hiab truck • Trucks
Earthworks	• 20-30T Excavator • Roller Compactor • Water Cart • Tippers • Stabilizers
Drainage	• 20T Excavator • Trench Shields • Tandem Tipper • Loader • Plate compactor • Trucks • Water cart
Pavement Construction	• Grader • Water Cart • Smooth Drum Roller • Vibratory Roller • Tandem Tippers • Kerbing Machine • Concrete Truck • Plate compactor • Paver • Excavators
Bridge construction	• Concrete truck • Excavator • Tip trucks • Cranes • Delivery trucks • Pilling Rig • Concrete Pump • Elevated Work Platform

6.2 Construction Noise

Construction phases for each of the Projects are expected to occur for a minimum of 24 months. Predictions have been assessed against the noise criteria for greater than 20 weeks “long-duration” under NZS6803:1999 as presented in Table 5-1. It is expected that the majority of the works will be carried out between 7am – 6pm Monday to Saturday. There may be extended hours during summer earthworks season (e.g. 6am to 8pm, Monday to Sunday), there is also the possibility of night works for critical activities (culvert construction and road surfacing).

Various construction activities and pieces of equipment will act as noise sources on site during construction works. An indicative construction equipment list has been provided by the project team to assess the noise and vibration effects. Given construction will occur in the future, the current methodology may not be inclusive of all equipment used nearer the time of construction. Equipment tables will need to be updated to reflect selection at the development of the management plan.

A minimum set back distance from receivers to comply with day-time noise criterion of 70 dB L_{Aeq} without mitigation has been calculated.

6.2.1 Equipment Noise Levels

Table 6-2 details the sound power levels from the likely significant noise sources and the various receiver setback distances required to achieve compliance with the 70 dB L_{Aeq} day-time noise criterion without mitigation. The noise data has been taken from British Standard 5228-1:2009 “Code of practice for noise and vibration control on construction and open sites”, manufacturers data or the AECOM database of noise measurements. Equipment selection at detailed design stage may include equipment with different sound power levels than those presented. The equipment list should be reassessed nearer the time at production of the CNVMP.

Table 6-2 Construction Equipment Sound levels and indicative compliance distance

Equipment	Sound power level (dB L_{wA})	Free field noise level at varying distances (dB L_{Aeq})				Minimum Setback distance to comply with day-time criteria without mitigation, metres
		5 m	10 m	20 m	50 m	
30T excavator	105	86	80	73	66	30
20T excavator	99	80	74	67	60	13
Roller compactor	101	82	76	69	62	20
Tipper Truck	107	88	82	75	68	36
Loader	105	86	80	73	66	30
Vibratory Plate Compactor	110	91	85	78	71	45

Equipment	Sound power level (dB L_{wA})	Free field noise level at varying distances (dB L_{Aeq})				Minimum Setback distance to comply with day-time criteria without mitigation, metres
		5 m	10 m	20 m	50 m	
Smooth Drum Roller	103	84	78	71	64	25
Paver	103	84	78	71	64	25
Grader	99	80	74	67	60	13
Bridge Construction Only						
Concrete Truck	107	88	82	75	68	36
Cranes	99	80	74	67	60	13
Concrete Pump	103	81	75	69	61	17
Bored Pilling Rig	111	89	83	77	69	49

Table 6-3 details the sound power levels for key construction activities, combining the equipment sound power levels detailed in Table 6-2 where multiple items of equipment may be operating simultaneously. Table 6-3 also details the minimum setback distance at which compliance can be achieved for each activity.

Table 6-3 Activity Sound Power Levels and Compliance Distance

Construction Type	Activity Sound Power Level (dB L_{wA})	Minimum set back distance from receivers to comply with day-time limit (70 dB L_{Aeq}) without mitigation, metres
Typical across all works	110	48 m
Earthworks	111	49 m
Drainage works	113	55 m
Pavement Construction	115	76 m
Bridge Construction	113	55 m

6.3 Construction Vibration

Vibration generation and propagation is highly site specific. The generation of vibration is dependent on the local site geology, the equipment being used, the nature of the works, and even the operator.

To account for the inaccuracy in the prediction of vibration, the likely worst-case vibration has been calculated based on the equipment and hard ground geology.

Vibration from a source transmits in a spherical pattern and reduces with distance. There will be a particular distance from each source at which the vibration level equals the relevant vibration criteria. This distance is called the 'emission radius'. The vibration criteria and emission radii for high vibration generating equipment are detailed in Table 6-4.

Table 6-4 Vibration sources and indicative emission radii

Equipment	Night-time Occupied Buildings (0.3 mm/s)	Daytime Occupied Buildings (2 mm/s)	DIN 4150 emission radii		
			Historic and Sensitive (2.5 mm/s)	Residential (5 mm/s)	Commercial (10 mm/s)
Roller Compactor	140m	21m	17m	8m	4m
Bored Pilling Rig	17m	4m	2m	1m	1m
Excavator	80m	12m	10m	6m	2m
Tipper Truck	16m	2m	2m	1m	0m
Vibratory Plate Compactor	20m	3m	2m	1m	1m

We recommend that vibration measurements are undertaken at specific locations as identified through the CNVMP and schedules at the commencement of construction activities to establish vibration propagation site laws for vibration generating equipment. This approach will confirm the emission radii used in this assessment and ensure the applicable criteria are complied with. It has been found on other major construction projects, that the measured vibration levels for a particular activity are much lower than those predicted during the assessment stage.

7 Warkworth Construction Effects

7.1 Overview of Construction Effects

Potential construction noise and vibration effects are summarised in this section.

7.1.1 Construction noise

Table 7-1 gives examples of the potential effects on receivers at different noise levels based on NZS6803 with most exposed façades providing a 20 dB reduction. Depending on the construction of the house, facades may provide up to a 25 – 30 dB reduction, therefore assumptions and effects provided below are based on a conservative approach.

Table 7-1 Potential construction noise effects on receivers

External Noise Level	Potential Daytime Effects Outdoors	Corresponding Internal Noise Level	Potential Daytime Effects Indoors
65 dB L_{Aeq}	Conversation becomes strained, particularly over longer distances	45 dB L_{Aeq}	Noise levels would be noticeable but unlikely to interfere with residential or office daily activities.
65 to 70 dB L_{Aeq}	People would not want to spend any length of time outside, except when unavoidable through workplace requirements	45 to 50 dB L_{Aeq}	Concentration would start to be affected. TV and telephone conversations would begin to be affected.
70 to 75 dB L_{Aeq}	Businesses that involve substantial outdoor use (for example garden centres) would experience considerable disruption.	50 to 55 dB L_{Aeq}	Phone conversations would become difficult. Personal conversations would need slightly raised voices. Office work can generally continue, but 55 dB is considered by the experts to be a tipping point for offices. For residential activity, TV and radio sound levels would need to be raised.
75 to 80 dB L_{Aeq}	Some people may choose protection for long periods of exposure. Conversation would be very difficult, even with raised voices.	55 to 60 dB L_{Aeq}	Continuing office work would be extremely difficult and become unproductive. In a residential context, people would actively seek respite.

External Noise Level	Potential Daytime Effects Outdoors	Corresponding Internal Noise Level	Potential Daytime Effects Indoors
80 to 90 dB L_{Aeq}	Hearing protection would be required for prolonged exposure (8 hours at 85 dB) to prevent hearing loss.	60 to 70 dB L_{Aeq}	Untenable for both office and residential environments. Unlikely to be tolerated for any extent of time.

With effective management of construction activities, which includes consultation and communication with affected parties and scheduling noisy works during the daytime rather than night-time period, noise levels can be controlled for each of the Projects so that the effects on the nearest residential receivers are reduced.

Barriers will not be effective at all locations, particularly where receivers are more than one storey. Where barriers are not going to be effective, the use of enclosures or local screening of equipment should be considered and implemented, where practicable.

If noisy activities must take place during the night-time, and screening or other mitigation measures do not provide sufficient attenuation to meet the night-time noise criteria or are not practicable, it may be necessary to offer temporary relocation to affected residents. Temporary relocation should be considered on a case-by-case basis and as a last resort.

7.1.2 Construction vibration

The vibration effects associated with construction of the Projects are considered in terms of human response and building damage. However, in our experience the main concern for building occupants during construction is damage to the building itself.

Humans can generally perceive vibrations at a much lower level than when building damage is likely to occur. The adverse effects of construction vibration on building occupants may be significant in some buildings adjacent to the areas of works. Adverse effects may range from annoyance to loss of amenity or inability to carry out work. Vibration effects will reduce with distance from the source, and the level of vibration transmission into a building will depend on a number of factors, such as the foundation type and building construction.

Potential effects and human perception of the vibration levels found within the AUP:OP and DIN criteria have been combined below and adopted for this assessment.

Table 7-2 Potential vibration effects on human perception summary against AUP:OP/DIN criteria

Vibration level (mm/s PPV)	Potential effects Indoors
0.14 mm/s	The threshold of perception for stationary people. Just perceptible in particularly sensitive environments.
0.3 mm/s	Can be just perceptible during normal residential activities, particularly for more sensitive receivers. Levels above may wake most people from their sleep.

Vibration level (mm/s PPV)	Potential effects Indoors
	This is the AUP:OP limit for construction vibration generated at night-time for sensitive receivers.
1 mm/s	Is typically tolerable with prior notification. Complaint or adverse reaction is likely in office or residential environments, particularly if there is no prior warning. What people actually feel would be subject to the source but could include a steady vibration from sources such as vibratory compaction, or a small jolt such as from the movement of a large digger either of which could rattle crockery and glassware. Sleep disturbance would be almost certain for most people.
2 mm/s	Vibration would clearly be felt. However, it can typically be tolerated in indoor environments such as offices, houses and retail if it occurs intermittently during the day and where there is effective prior engagement. Effects experienced would be somewhere between levels of 1 and 5 mm/s. This is the AUP:OP limit for large construction projects generating vibration.
5 mm/s	Unlikely to be tolerable in a workplace. Highly unsettling for both workplaces and dwellings. If exposure is prolonged, some people may want to leave the building Computer screens would shake and items could fall off shelves if they are not level. This is the threshold below which no cosmetic damage will occur in the DIN standard.
10 mm/s	Likely to be intolerable for anything other than a very brief exposure.

The AUP:OP sets the criteria for amenity at 0.3mm/s for night time and 2 mm/s during the day. Based on the worst-case source of a roller compactor, any receiver within a 21m radius of the construction area may experience vibration of 2 mm/s inside their property. Whilst at this level building damage is highly unlikely to occur, human perception may result in slight concerns but can generally be tolerated if activity occurs intermittently and with prior notice.

At 0.3 mm/s the emission radii could be up to 140m from construction areas, and at this level people could feel slight vibrations especially during the night-time, which may cause sleep disturbance. High vibratory activities should therefore be avoided, where practicable, during the night-time and careful management of the type of equipment used at night should be included within the CNVMP (refer Section 7.2.1).

Construction vibration effects generally have a short timeframe, typically a few days at a time. The use of high vibratory equipment, such as a roller compactor, should be managed through a CNVMP to limit potential vibration effects, and alternative equipment with lower vibratory effect should be used where practicable.

7.2 Recommended Measures to Avoid, Remedy or Mitigate Construction Effects

7.2.1 Construction Noise and Vibration Management Plan

Implementing noise management and mitigation measures via a CNVMP is the most effective way to control construction noise and vibration impacts. The objective of the CNVMP should provide a framework for the development and implementation of best practicable options to avoid, remedy or mitigate the adverse effects on receivers of noise and vibration resulting from construction. Section E25.6.29(5) of the AUP:OP sets out the minimum level of information that must be provided in a CNVMP. Accordingly, as a minimum, we recommend that the CNVMP should include the following content:

- Description of the works and anticipated equipment/processes;
- Hours of operation, including times and days when construction activities would occur;
- The construction noise and vibration standards for the Project;
- Identification of receivers where noise and vibration standards apply;
- Management and mitigation options, including alternative strategies adopting the BPO where full compliance with the relevant noise and/or vibration standards cannot be achieved;
- Methods and frequency for monitoring and reporting on construction noise and vibration, including:
    - Updating the predicted noise and vibration levels based on the final methodology and construction activities;
    - Confirming which buildings will be included in a pre and post building condition survey;
    - Identifying appropriate monitoring locations for receivers of construction noise and vibration;
    - Procedures to respond to complaints received on construction noise and vibration, including methods to monitor and identify noise and vibration sources;
    - Procedure for responding to monitored exceedances; and
    - Procedures for monitoring construction noise and vibration and reporting to the Auckland Council Consent Monitoring officer.
- Procedures for maintaining contact with stakeholders, notifying of proposed construction activities, the period of construction activities, and handling noise and vibration complaints;
- Contact details of the site supervisor or Project manager and the Requiring Authority's Project Liaison Person (phone, postal address, email address);
- Procedures for the regular training of the operators of construction equipment to minimise noise and vibration as well as expected construction site behaviours for all workers;
- Identification of areas where compliance with the noise and/or vibration standards will not be practicable and where a Site Specific Construction Noise and/or Vibration Management Schedule will be required;
- Procedures for how remedial works will be undertaken, should they be required as a result of the building condition surveys; and
- Procedures and timing of reviews of the CNVMP.

7.2.2 Schedules

In addition to a CNVMP, it may be necessary to produce Site Specific or Activity Specific Construction Noise and Vibration Management Schedules ("Schedules") where noise and/or vibration limits are predicted to be exceeded for a more sustained period or by a large margin. A schedule to the CNVMP provides a specific assessment of an activity and/or location and should include details such as:

- Activity location, start and finish dates;
- The nearest neighbours to the activity;
- A location plan;
- Predicted noise/vibration levels and BPO mitigation for the activity and/or location;
- Communication and consultation with the affected neighbours;
- Location, times and type of monitoring; and
- Any pre-condition survey of buildings predicted to receive vibration levels approaching the Category B vibration limits, which document their current condition and any existing damage.

7.2.3 Noise mitigation measures

A hierarchy of mitigation measures will be adopted through the CNVMP and Schedules (where produced), as follows:

- Managing times of activities to avoid night works and other sensitive times;
- Selecting equipment and methodologies to restrict noise;
- Liaising with neighbours so they can work around specific activities;
- Using screening/enclosures/barriers; and
- Offering neighbours temporary relocation.

By following this hierarchy, the BPO for mitigation will be implemented, whilst avoiding undue disruption to the community. In particular, temporary relocation of neighbours can cause significant inconvenience and should only be offered where other options have been exhausted and noise levels still require mitigation.

Some activities are likely to be set back a considerable distance from the nearest receivers and require very little or no mitigation to achieve compliance with the relevant Project noise limits. Alternative methodologies, such as careful equipment selection and use of noise barriers or localised screening (e.g. for concrete cutting) may be suitable management and mitigation measures and should be implemented where they are practicable and effective.

7.2.4 Vibration mitigation

Similarly to noise, a hierarchy of vibration mitigation measures will be adopted through the CNVMP and Schedules (where produced) as follows:

- Managing times of activities to avoid night works and other sensitive times (communicated through community liaison);
- Operating vibration generating equipment as far from sensitive sites as possible;
- Liaising with neighbours so they can work around specific activities;
- Selecting equipment and methodologies to minimise vibration;
- Offering neighbours temporary relocation; and

- In specific situations, a cut-off trench may be used as a vibration barrier if located close to the source.

In general, there are less options available to mitigate vibration propagation and insulate receiver buildings, compared to noise. Mitigation will therefore focus on scheduling of activities, effective communication with neighbours, and selection of appropriate equipment and methods, where practicable.

Appropriate vibration mitigation measures for each activity will be listed in the CNVMP and Schedules (where produced).

7.2.5 Building Condition Survey

A detailed building precondition survey should be undertaken by a suitably qualified engineer prior to the start of construction at all buildings where the daytime Category B criteria may be exceeded. The survey shall include, but not be limited to, the following:

- Determination of building classification: commercial, industrial, residential or a historic or sensitive structure;
- Determination of building specific vibration damage risk thresholds; and
- Recording (including photographs) the major features of the buildings including location, type, construction (including foundation type), age and present condition, including existing levels of any aesthetic damage or structural damage.

A post-construction condition survey of the same buildings shall be conducted when construction is completed, and any damage shown to have been caused by the Project construction rectified by the Project Team.

7.2.6 Night Works

Night works have the potential to cause the greatest disturbance to residents and should be avoided where possible. However, it is possible that night works will be required during the construction period for critical activities. Before night works are programmed, it is important to determine if there are alternative options that would avoid working at night and, if so, whether those options are technically and practicably feasible.

Where there are no practicable alternative options to night works, it may be necessary to implement enhanced noise and vibration management measures, but this will depend on the location of the worksite and the proposed activities.

When work must be carried out at night, it may be necessary to:

- Increase the frequency of communications with stakeholders;
- Carry out regular noise and vibration monitoring to confirm noise and vibration levels; or
- Offer temporary relocation to neighbours if unreasonable noise and/or vibration levels cannot be avoided.

8 NOR 1 – Northern Public Transport Hub and Western Link – North

8.1 Overview and Description of Works

The Northern PT Hub is located adjacent to the intersection of State Highway 1 and the proposed new Western Link - North (Northern Section). This project involves:

- Construction of a PT Hub
- Park and Ride facilities with 228 car park spaces attached to the PT Hub
- Construction of the new Western Link - North, a four-lane urban arterial with cycle lanes and footpaths on both sides

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

8.1.1 Noise Environment

The proposed site for the Northern Public Transport Hub is located adjacent to the intersection of State Highway 1 and the proposed new Western Link - North (Northern Section), with few dwellings nearby. The noise environment is dominated by road traffic noise from vehicles using State Highway 1.

The land adjacent to the proposed Western Link - North (Northern Section) is live zoned as set out in the Warkworth North Precinct Plan. The proposed site for the Northern Public Transport Hub is currently FUZ but will likely be re-zoned to Light Industry or Business Zone. This zoning would likely result in an increase in ambient noise levels.

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

8.2 Assessment of Construction Noise and Vibration

8.2.1 Construction Noise Effects

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 40m away. High noise generating activities may not occur right on the construction boundary but if they do, one existing property could experience unmitigated noise levels that exceed the daytime noise criterion. Details of all properties where the criteria could be exceeded are provided in Appendix A.

With mitigation in place, as set out in Section 7.2, noise levels are predicted to comply with the daytime noise criteria at all existing receivers.

Future receivers constructed within 76m of the works could experience unmitigated noise levels that exceed the 70 dB L_{Aeq} noise criterion during high noise generating activities such as the pavement works.

Operation of construction equipment will be intermittent in nature. Construction will be linear along the road alignment so as the equipment moves away from the receiver noise levels will reduce.

If a critical activity has to be carried out during the night-time in close proximity to residential receivers, consultation and mitigation measures will be essential. The use of noisy equipment should be avoided where practicable to prevent sleep disturbance. Any night-time works are likely to be limited in duration and will be managed through the CNVMP (as per section 7.2.1) and a Schedule (as per section 7.2.2).

8.2.2 Construction Vibration Effects

Existing receivers near the Northern Public Transport Hub are predominantly residential type structures. No existing buildings are predicted to experience vibration levels above the Category B vibration criteria (5mm/s PPV for residential structures), even if the roller compactor is used on the construction boundary in the closest position to them.

The Category B criterion would be met at future residential structures that are 8m or more from the proposed works and commercial structures that are 4m or more from the proposed works.

No existing receivers are predicted to experience vibration levels above the daytime Category A vibration amenity criteria.

The daytime Category A vibration criteria could be exceeded in future buildings if they are occupied during the works and within 21 m of the roller compactor or within the emission radii identified for the other vibration generating equipment in Table 6-3. The effect on receivers would be subject to their respective proximity to the works but could include steady vibration from the roller compactor or a small jolt from a digger which could rattle crockery and glassware. The Category A criteria should be used as a trigger to initiate consultations with affected parties to manage effects.

Vibration can typically be tolerated inside buildings if it occurs intermittently during the day, is of limited duration and where there is effective prior engagement.

High vibration generating activities should not occur during the night-time in close proximity to residential receivers to avoid sleep disturbance, unless it is a critical activity and there is no alternative.

It should also be noted that the emission radii are conservative and vibration levels measured on site tend to be much lower than those predicted in the early stages of a project.

8.3 Conclusions

The predicted construction noise and vibration levels are based on indicative information to support this NoR, as set out in Section 6, and any conclusions in this assessment should be confirmed during the detailed design stage, taking account of the receivers as they exist at the time of construction.

Construction noise and vibration can be mitigated and managed, utilising the measures set out in Section 7.2, to comply with the applicable limits at existing receivers. Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

A CNVMP is the most effective way to avoid, remedy or mitigate construction noise and vibration effects on receivers.

9 NOR 2 – Woodcocks Road (Western Section)

9.1 Overview and description of works

Woodcocks Road (western section) is an existing arterial extending from the interchange with Ara Tūhono in the west to the Mansel Drive intersection in the east. It is proposed to upgrade the existing corridor to a two-lane urban arterial with cycling and walking facilities on both sides of the corridor.

The proposed upgrade will provide a key east-west connection for all modes between existing SH1 and the western growth area in Warkworth. Additionally, the corridor connects to key future north-south links including the Wider Western Link Round and Western Link - South. The upgrade will also improve active mode user safety along the corridor.

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

9.1.1 Noise Environment

Woodcocks Road (western section) runs through a rural and residential environment. The land adjacent to Woodcocks Road is predominantly zoned FUZ on both sides of the existing corridor with a small area of Residential zoned land to the east of Mason Heights.

The noise environment is dominated by road traffic noise from vehicles on Woodcocks Road.

The Warkworth Structure Plan indicates that the area surrounding Woodcocks Road is likely to be zoned as Residential. This zoning would likely result in an increase in ambient noise levels as the area urbanises.

9.2 Assessment of Construction Noise and Vibration Effects

9.2.1 Construction Noise Effects

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 3m. High noise generating activities may not occur right on the construction boundary but if they do, 25 existing receivers could experience unmitigated noise levels that exceed the daytime noise criterion. Details of all properties where the criteria could be exceeded are provided in Appendix A.

With mitigation in place, as set out in Section 7.2, noise levels of up to 85 dB L_{Aeq} could still occur intermittently at the closest receivers, if high noise generating activities occur on the construction boundary. At this level effects likely to include loss of concentration, annoyance, and a reduction in speech intelligibility. We note that the existing receivers may not be present at the time of construction.

Future receivers constructed within 76m of the works could experience unmitigated noise levels that exceed the 70 dB L_{Aeq} noise criterion during high noise generating activities such as the pavement works.

Operation of construction equipment will be intermittent in nature. Construction will be linear so as the equipment moves away from the receiver noise levels will reduce. The worst-case situations, where mitigated noise levels could reach 85 dB L_{Aeq} at the closest receivers, are not expected to be frequent,

due to the setback distances to the majority of the proposed works and the use of equipment with lower source noise levels for large portions of the works. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

If a critical activity has to be carried out during the night-time in close proximity to residential receivers, consultation and mitigation measures will be essential. The use of noisy equipment should be avoided, where practicable, to prevent sleep disturbance. Any night-time works are likely to be limited in duration and will be managed through the CNVMP (as per Section 7.2.1) and a Schedule (as per Section 7.2.2).

9.2.2 Construction Vibration Effects

Existing receivers near Woodcocks Road are predominately residential type structures. One existing dwelling may experience vibration levels above 5mm/s PPV, exceeding the daytime Category B criterion, if the roller compactor is used on the designation boundary in the closest position to the receiver. No commercial receivers are predicted to exceed the 10mm/s PPV daytime criteria. The addresses of receivers where the Category B criteria may be exceeded are listed in Appendix B. Once the compactor is 8m away from the dwellings the Category B criterion will be met. The Category B criteria would be met at future residential structures that are 8m or more from the proposed works and commercial structures that are 4m or more from the proposed works.

Without mitigation, at these receivers there is potential for cosmetic damage to buildings (such as cracking) and annoyance from perception of vibration. Mitigation such as the use of non-vibratory compaction equipment within 8m of buildings is recommended to avoid potential cosmetic damage.

The daytime Category A vibration amenity criteria could be exceeded in existing or future buildings if they are occupied during the works and within 21 m of the roller compactor or within the emission radii identified for the other vibration generating equipment in Table 6-4. The effect on receivers would be subject to their respective proximity to the works but could include steady vibration from the roller compactor or a small jolt from a digger which could rattle crockery and glassware.

Vibration can typically be tolerated inside buildings if it occurs intermittently during the day, is of limited duration and where there is effective prior engagement.

High vibration generating activities should not occur during the night-time in close proximity to residential receivers to avoid sleep disturbance, unless it is a critical activity and there is no alternative.

It should also be noted that the emission radii are conservative and vibration levels measured on site tend to be much lower than those predicted at the NOR stage of a project.

9.3 Conclusions

The predicted construction noise and vibration levels are based on indicative information provided by the Project team, as set out in Section 6, and any conclusions in this assessment should be confirmed during the detailed design stage, taking account of the receivers as they exist at the time of construction.

Construction noise and vibration can be mitigated and managed, utilising the measures set out in Section 7.2, to generally comply with the applicable limits as defined in the AUP:OP. Exceedances of

the criteria could occur intermittently over a short duration if high noise or vibration generating equipment are used near occupied buildings. Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

A CNVMP is the most effective way to avoid, remedy or mitigate construction noise and vibration effects on receivers.

10 NOR 3 – State Highway 1 Upgrade – South

10.1 Overview and description of works

The section of SH1 within NOR 3 extends from the Northern Gateway Toll Road in the south to its intersection with Auckland Road in the northeast, with the extents of the proposed upgrade from the FUZ boundary in the south to its intersection with Fairwater Road in the north. The SH1 (southern section) upgrade involves the urbanisation of the corridor to a two-lane urban arterial with cycle lanes and footpaths on both sides of the entire corridor length.

The proposed upgrade will provide a key north-south connection through Warkworth and with the provision of dedicated walking and cycling facilities will become the primary north-south active mode corridor in Warkworth.

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

10.1.1 Noise Environment

The land on both sides of the southern section of the alignment is zoned FUZ. The northern section of the alignment is predominantly zoned as Residential – Single House Zone and to the east of the corridor as Business – Local Centre Zone.

State Highway 1 is an existing busy road with commercial buildings and residential dwellings along the road corridor. The noise environment is dominated by road traffic noise from vehicles on State Highway 1.

It is anticipated that the noise environment in the future will change as a result of the opening of Ara Tuhono (Puhoi to Warkworth). When Ara Tuhono opens, SH1 will become an arterial road and it is anticipated that the majority of traffic passing through Warkworth will use the new corridor.

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

10.2 Assessment of Construction Noise and Vibration Effects

10.2.1 Construction Noise Effects

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 3m from the designation. High noise generating activities may not occur right on the construction boundary but if they do, 91 existing receivers could experience unmitigated noise levels that exceed the daytime noise criterion. Details of all properties where the criteria could be exceeded are provided in Appendix A.

With mitigation in place, as set out in Section 7.2, noise levels of up to 85 dB L_{Aeq} could still occur intermittently at the closest receivers, if high noise generating activities occur on the construction boundary. At this level effects likely to include loss of concentration, annoyance, and a reduction in speech intelligibility. We note that the existing receivers may not be present at the time of construction.

Future receivers constructed within 76m of the works could experience unmitigated noise levels that exceed the 70 dB L_{Aeq} noise criterion during high noise generating activities such as the pavement works.

Operation of construction equipment will be intermittent in nature. Construction will be linear so as the equipment moves away from the receiver noise levels will reduce. The worst-case situations, where mitigated noise levels could reach 85 dB L_{Aeq} at the closest receivers, are not expected to be frequent, due to the setback distances to the majority of the proposed works and the use of equipment with lower source noise levels for large portions of the works. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

If a critical activity has to be carried out during the night-time in close proximity to residential receivers, consultation and mitigation measures will be essential. The use of noisy equipment should be avoided, where practicable, to prevent sleep disturbance. Any night-time works are likely to be limited in duration and will be managed through the CNVMP (as per Section 7.2.1) and a Schedule (as per Section 7.2.2).

10.2.2 Construction Vibration Effects

Existing receivers near State Highway 1 are a mix of residential and commercial type structures. 12 existing dwellings may experience vibration levels above 5mm/s PPV, exceeding the Category B criterion, if the roller compactor is used on the construction boundary in the closest position. No commercial receivers are predicted to exceed the 10mm/s PPV daytime criterion. The addresses of receivers where the Category B criteria may be exceeded are listed in Appendix B. Once the compactor is 8m away from the dwellings the Category B criterion will be met. The Category B criteria would be met at future residential structures that are 8m or more from the proposed works and commercial structures that are 4m or more from the proposed works.

Without mitigation, at these receivers there is potential for cosmetic damage to buildings (such as cracking) and annoyance from perception of vibration. Mitigation such as the use of non-vibratory compaction equipment within 8m of buildings is recommended to avoid potential cosmetic damage.

The daytime Category A vibration amenity criteria could be exceeded in existing or future PPFs if they are occupied during the works and within 21 m of the roller compactor or within the emission radii identified for the other vibration generating equipment in Table 6-4. The effect on receivers would be subject to their respective proximity to the works but could include steady vibration from the roller compactor or a small jolt from a digger which could rattle crockery and glassware.

Vibration can typically be tolerated inside buildings if it occurs intermittently during the day, is of limited duration and where there is effective prior engagement.

High vibration generating activities should not occur during the night-time in close proximity to residential receivers to avoid sleep disturbance, unless it is a critical activity and there is no alternative.

It should also be noted that the emission radii are conservative and vibration levels measured on site tend to be much lower than those predicted at the NOR stage of a project.

10.3 Conclusion

The predicted construction noise and vibration levels are based on indicative information provided by the Project team, as set out in Section 6, and any conclusions in this assessment should be confirmed during the detailed design stage, taking account of the receivers as they exist at the time of construction.

Construction noise and vibration can be mitigated and managed, utilising the measures set out in Section 7.2, to generally comply with the applicable limits as defined in the AUP:OP. Exceedances of the criteria could occur intermittently over a short duration if high noise or vibration generating equipment are used near occupied buildings. Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

A CNVMP is the most effective way to avoid, remedy or mitigate construction noise and vibration effects on receivers.

11 NOR 4 – Matakana Road Upgrade

11.1 Overview and description of works

Matakana Road is an existing arterial connecting the growth area of Warkworth and the towns of Matakana and Omaha. This project extends from the tie in with the Hill Street intersection upgrade project in the south to the FUZ boundary in the north, and it is intersected by the Te Honohono ki Tai (Matakana Link Road) project at its mid-point.

It is proposed to upgrade Matakana Road to a two-lane urban arterial with cycle lanes and footpaths on both sides.

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

11.1.1 Noise Environment

The existing Matakana Road corridor runs through predominantly residential land uses. The eastern extent of Matakana Road is zoned as FUZ. The western and north-western sections of the corridor are comprised of residential land uses (Residential – Single House Zone, Mixed Housing Suburban Zone, and Mixed Housing Urban Zone).

The Warkworth Structure Plan indicates that the FUZ surrounding Matakana Road is likely to be zoned as Residential in the future. This zoning would likely result in an increase in ambient noise levels as the area urbanises.

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

11.2 Assessment of Construction Noise and Vibration Effects

11.2.1 Construction Noise Effects

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver at 3m. High noise generating activities may not occur right on the construction boundary, but if they do, 53 existing properties could experience unmitigated noise levels that exceed the daytime noise criterion. Details of all properties where the criteria could be exceeded are provided in Appendix A.

With mitigation in place as set out in Section 7.2, noise levels of up to 85 dB L_{Aeq} could still occur intermittently at the closest receivers, if high noise generating activities occur on the construction boundary. At this level effects likely to include loss of concentration, annoyance, and a reduction in speech intelligibility.

Future receivers constructed within 76m of the works could experience unmitigated noise levels that exceed the 70 dB L_{Aeq} noise criterion during high noise generating activities such as the pavement works.

Operation of construction equipment will be intermittent in nature. Construction will be linear so as the equipment moves away from the receiver noise levels will reduce. The worst-case situations, where mitigated noise levels could reach 85 dB L_{Aeq} at the closest receivers, are not expected to be frequent,

due to the setback distances to the majority of the proposed works and the use of equipment with lower source noise levels for large portions of the works. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

If a critical activity has to be carried out during the night-time in close proximity to residential receivers, consultation and mitigation measures will be essential. The use of noisy equipment should be avoided where practicable to prevent sleep disturbance. Any night-time works are likely to be limited in duration and will be managed through the CNVMP and a Schedule.

11.2.2 Construction Vibration Effects

Existing receivers near Matakana Road are predominantly residential type structures. Nine existing dwellings may experience vibration levels above 5mm/s PPV exceeding the Category B criterion, if the roller compactor is used on the construction boundary in the closest position to them. Once the compactor is 8m away from the dwellings the Category B criterion will be met. No commercial receivers are predicted to exceed the Category B criterion. The Category B criteria would be met at future residential structures that are 8m or more from the proposed works and commercial structures that are 4m or more from the proposed works.

Without mitigation, at these receivers there is potential for cosmetic damage to buildings (such as cracking) and annoyance from perception of vibration. Mitigation such as the use of non-vibratory compaction equipment within 8m of buildings is recommended to avoid potential cosmetic damage.

The Category A vibration amenity criteria could be exceeded in existing or future buildings if they are occupied during the works and within 21 m of the roller compactor or within the emission radii identified for the other vibration generating equipment in Table 6-4. The effect on receivers would be subject to their respective proximity to the works but could include steady vibration from the roller compactor or a small jolt from a digger which could rattle crockery and glassware.

Vibration can typically be tolerated inside buildings if it occurs intermittently during the day, is of limited duration and where there is effective prior engagement.

High vibration generating activities should not occur during the night-time in close proximity to residential receivers to avoid sleep disturbance, unless it is a critical activity and there is no alternative.

It should also be noted that the emission radii are conservative and vibration levels measured on site tend to be much lower than those predicted in the early stages of a project.

11.3 Conclusions

The predicted construction noise and vibration levels are based on indicative information to support this NoR, as set out in Section 6, and any conclusions in this assessment should be confirmed during the detailed design stage, taking account of the receivers as they exist at the time of construction.

Construction noise and vibration can be mitigated and managed, utilising the measures set out in Section 7.2, to generally comply with the applicable limits as defined in the AUP:OP. Exceedances of the criteria could occur intermittently over a short duration if high noise or vibration generating equipment are used near occupied buildings. Where an exceedance is predicted at any receiver that

exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

A CNVMP is the most effective way to avoid, remedy or mitigate construction noise and vibration effects on receivers.

12 NOR 5 – Sandspit Road Upgrade

12.1 Overview and description of works

Sandspit Road is an existing arterial providing east-west connection between the Warkworth growth area and the towns of Sandspit and Snells Beach. This project extends from the tie in with the Hill Street intersection upgrade Project in the west and to the eastern FUZ boundary.

It is proposed to upgrade Sandspit Road to a two-lane urban arterial with cycle lanes and footpaths on both sides. The proposed upgrade will improve accessibility for active mode users to social and economic opportunities around the Warkworth growth area and contribute to improved safety outcomes along the corridor.

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

12.1.1 Noise Environment

Sandspit Road currently runs through urban and rural environments. In the rural area there are a few dwellings near the road. The noise environment is dominated by road traffic noise from vehicles using Sandspit Road and the surrounding road network.

The land on both sides of the corridor is zoned as FUZ. There is a high likelihood of urban development in the FUZ to the north of the corridor. This is signalled in the Warkworth Structure Plan as land use change to Residential – Single House Zone. An increase in ambient noise levels is expected as the area urbanises.

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

12.2 Assessment of Construction Noise and Vibration Effects

12.2.1 Construction Noise Effects

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 4m away. High noise generating activities may not occur right on the construction boundary but if they do, 17 existing properties could experience unmitigated noise levels that exceed the daytime noise criterion. Details of all properties where the criteria could be exceeded are provided in Appendix A.

With mitigation in place as set out in Section 7.2, noise levels of up to 83 dB L_{Aeq} could still occur intermittently at the closest receivers, if high noise generating activities occur on the construction boundary. At this level effects likely to include loss of concentration, annoyance, and a reduction in speech intelligibility. We note that the existing receivers on FUZ zoned land may not be present at the time of construction.

Future receivers constructed within 76m of the works could experience unmitigated noise levels that exceed the 70 dB L_{Aeq} noise criterion during high noise generating activities such as the pavement works.

Operation of construction equipment will be intermittent in nature. Construction will be linear so as the equipment moves away from the receiver noise levels will reduce. The worst-case situations, where mitigated noise levels could reach 83 dB L_{Aeq} at the closest receivers, are not expected to be frequent, due to the setback distances to the majority of the proposed works and the use of equipment with lower source noise levels for large portions of the works. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

If a critical activity has to be carried out during the night-time in close proximity to residential receivers, consultation and mitigation measures will be essential. The use of noisy equipment should be avoided where practicable to prevent sleep disturbance. Any night-time works are likely to be limited in duration and will be managed through the CNVMP and a Schedule.

12.2.2 Construction Vibration Effects

Existing receivers near Sandspit Road are predominantly residential type structures. One existing dwellings may experience vibration levels above 5mm/s PPV, exceeding the Category B criterion for residential structures, if the roller compactor is used on the construction boundary in the closest position to them. No commercial receivers are predicted to exceed the Category B criterion. Once the compactor is 8m away from the dwellings the Category B criterion will be met. The Category B criteria would be met at future residential structures that are 8m or more from the proposed works and commercial structures that are 4m or more from the proposed works.

Without mitigation, at these receivers there is potential for cosmetic damage to buildings (such as cracking) and annoyance from perception of vibration. Mitigation such as the use of non-vibratory compaction equipment within 8m of buildings is recommended to avoid potential cosmetic damage.

The daytime Category A vibration amenity criteria could be exceeded in existing or future buildings if they are occupied during the works and within 21 m of the roller compactor or within the emission radii identified for the other vibration generating equipment in Table 6-4. The effect on receivers would be subject to their respective proximity to the works but could include steady vibration from the roller compactor or a small jolt from a digger which could rattle crockery and glassware.

Vibration can typically be tolerated inside buildings if it occurs intermittently during the day, is of limited duration and where there is effective prior engagement.

High vibration generating activities should not occur during the night-time in close proximity to residential receivers to avoid sleep disturbance, unless it is a critical activity and there is no alternative.

It should also be noted that the emission radii are conservative and vibration levels measured on site tend to be much lower than those predicted in the early stages of a project.

12.3 Conclusions

The predicted construction noise and vibration levels are based on indicative information to support this NoR, as set out in Section 6, and any conclusions in this assessment should be confirmed during the detailed design stage, taking account of the receivers as they exist at the time of construction.

Construction noise and vibration can be mitigated and managed, utilising the measures set out in Section 7.2, to generally comply with the applicable limits as defined in the AUP:OP. Exceedances of

the criteria could occur intermittently over a short duration if high noise or vibration generating equipment are used near occupied buildings. Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

A CNVMP is the most effective way to avoid, remedy or mitigate construction noise and vibration effects on receivers.

13 NOR 6 – Western Link - South

13.1 Overview and description of works

The New Western Link - South is located at the end of Evelyn Street in the north to SH1 in the south and runs through existing greenfield land. The New Western Link - South Project involves the construction of a new two-lane urban arterial with walking and cycling facilities on both sides and upgrading the intersection with McKinney Road

The new corridor will provide key north-south connection in the Warkworth network. The purpose of the Western Link is to enable development in west Warkworth and provide access to FUZ land and industrial areas while taking pressure off the existing SH1 and Hill Street intersection.

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

13.1.1 Noise Environment

The majority of land adjacent to the new Western Link - South is currently zoned as FUZ. There is a small area zoned as Business – Light Industry Zone, some of which is currently undeveloped.

The Warkworth Structure Plan indicates that the area to the South and West of the Wider Western Link is likely to be zoned as Residential. This zoning plus full development of the Business – Light Industry Zone would likely result in an increase in ambient noise levels as the area urbanises.

The noise environment is dominated by road traffic noise from vehicles on the nearby road network.

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

13.2 Assessment of Construction Noise and Vibration Effects

13.2.1 Construction Noise Effects

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 17m from the designation. High noise generating activities may not occur right on the construction boundary but if they do, 29 existing receivers could experience unmitigated noise levels that exceed the daytime noise criterion. Details of all properties where criteria could be exceeded are provided in Appendix A.

With mitigation in place as set out in Section 7.2, noise levels of up to 72 dB L_{Aeq} could still occur intermittently at the closest receivers, if high noise generating activities occur on the construction boundary. At this level effects likely to include loss of concentration, annoyance, and a reduction in speech intelligibility. We note that the existing receivers on FUZ zoned land may not be present at the time of construction.

Future receivers constructed within 76m of the works could experience unmitigated noise levels that exceed the 70 dB L_{Aeq} noise criterion during high noise generating activities such as the pavement works.

Operation of construction equipment will be intermittent in nature. Construction will be linear so as the equipment moves away from the receiver noise levels will reduce. The worst-case situations, where mitigated noise levels could reach 72 dB L_{Aeq} at the closest receivers, are not expected to be frequent, due to the setback distances to the majority of the proposed works and the use of equipment with lower source noise levels for large portions of the works. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

If a critical activity has to be carried out during the night-time in close proximity to residential receivers, consultation and mitigation measures will be essential. The use of noisy equipment should be avoided where practicable to prevent sleep disturbance. Any night-time works are likely to be limited in duration and will be managed through the CNVMP and a Schedule.

13.2.2 Construction Vibration Effects

Existing receivers near the Western Link - South are a mix of residential and commercial type structures. No existing buildings are predicted to experience vibration levels above the Category B vibration criteria (5mm/s PPV for residential structures), even if the roller compactor is used on the construction boundary in the closest position to them.

The Category B criteria would be met at future residential structures that are 8m or more from the proposed works and commercial structures that are 4m or more from the proposed works.

The Category A vibration amenity criteria could be exceeded in existing or future buildings if they are occupied during the works and within 21 m of the roller compactor or within the emission radii identified for the other vibration generating equipment in Table 6-4. The effect on receivers would be subject to their respective proximity to the works but could include steady vibration from the roller compactor or a small jolt from a digger which could rattle crockery and glassware.

Vibration can typically be tolerated inside buildings if it occurs intermittently during the day, is of limited duration and where there is effective prior engagement.

High vibration generating activities should not occur during the night-time in close proximity to residential receivers to avoid sleep disturbance, unless it is a critical activity and there is no alternative.

It should also be noted that the emission radii are conservative and vibration levels measured on site tend to be much lower than those predicted in the early stages of a project.

13.3 Conclusions

The predicted construction noise and vibration levels are based on indicative information to support this NoR, as set out in Section 6, and any conclusions in this assessment should be confirmed during the detailed design stage, taking account of the receivers as they exist at the time of construction.

Construction noise and vibration can be mitigated and managed, utilising the measures set out in Section 7.2, to generally comply with the applicable limits as defined in the AUP:OP. Exceedances of the criteria could occur intermittently over a short duration if high noise or vibration generating equipment are used near occupied buildings. Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

A CNVMP is the most effective way to avoid, remedy or mitigate construction noise and vibration effects on receivers.

14 NOR 7 – Sandspit Link

14.1 Overview and description of works

Sandspit Link is a proposed new road with the purpose of providing strategic east-west movements to Matakana and Kowhai Coasts and providing local access to the northern growth area. The corridor extends from Matakana Road in the north-west and connects to Sandspit Road in the southeast. The alignment provides a resilient alternative to SH1 and Hill Street Intersection whilst improving dual accessibility between the northern growth area and Warkworth.

The Sandspit Link Project involves the construction of a two-lane urban arterial with cycle lanes and footpaths on both sides and a new intersection at the connection with Sandspit Road.

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

14.1.1 Noise Environment

The proposed Sandspit Link runs through a currently rural environment. In the rural area there are few dwellings near existing roads. The noise environment is dominated by road traffic noise from vehicles using the Matakana Road and the surrounding road network as well as noise associated with the nearby quarry.

Sandspit Link is zoned as FUZ on both sides of the alignment. To the northeast of the alignment is an existing Special Purpose – Quarry Zone.

The Warkworth Structural Plan indicates that the land surrounding the proposed Sandspit Link is likely to be zoned Residential. This zoning would likely result in an increase in ambient noise levels as the area urbanises.

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

14.2 Assessment of Construction Noise and Vibration Effects

14.2.1 Construction Noise Effects

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 15m. High noise generating activities may not occur right on the construction boundary but if they do, 5 existing properties could experience unmitigated noise levels that exceed the daytime noise criterion. Details of all properties where the criteria could be exceeded are provided in Appendix A

With mitigation in place as set out in Section 7.2, noise levels of up to 74 dB L_{Aeq} could still occur intermittently at the closest receivers, if high noise generating activities occur on the construction boundary. At this level effects likely to include loss of concentration, annoyance, and a reduction in speech intelligibility. We note that the existing receivers on FUZ zoned land may not be present at the time of construction.

Future receivers constructed within 76m of the works could experience unmitigated noise levels that exceed the 70 dB L_{Aeq} noise criterion during high noise generating activities such as the pavement works.

Operation of construction equipment will be intermittent in nature. Construction will be linear so as the equipment moves away from the receiver noise levels will reduce. The worst-case situations, where mitigated noise levels could reach 74 dB L_{Aeq} at the closest receivers, are not expected to be frequent, due to the setback distances to the majority of the proposed works and the use of equipment with lower source noise levels for large portions of the works. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

If a critical activity has to be carried out during the night-time in close proximity to residential receivers, consultation and mitigation measures will be essential. The use of noisy equipment should be avoided where practicable to prevent sleep disturbance. Any night-time works are likely to be limited in duration and will be managed through the CNVMP and a Schedule.

14.2.2 Construction Vibration Effects

Existing receivers near the proposed Sandspit Link are a mix of residential and commercial type structures. No existing buildings are predicted to experience vibration levels above the Category B vibration criteria (5mm/s PPV for residential structures), even if the roller compactor is used on the construction boundary in the closest position to them.

The Category B criteria would be met at future residential structures that are 8m or more from the proposed works and commercial structures that are 4m or more from the proposed works.

The Category A vibration amenity criteria could be exceeded in existing or future buildings if they are occupied during the works and within 21 m of the roller compactor or within the emission radii identified for the other vibration generating equipment in Table 6-4. The effect on receivers would be subject to their respective proximity to the works but could include steady vibration from the roller compactor or a small jolt from a digger which could rattle crockery and glassware.

Vibration can typically be tolerated inside buildings if it occurs intermittently during the day, is of limited duration and where there is effective prior engagement.

High vibration generating activities should not occur during the night-time in close proximity to residential receivers to avoid sleep disturbance, unless it is a critical activity and there is no alternative.

It should also be noted that the emission radii are conservative and vibration levels measured on site tend to be much lower than those predicted in the early stages of a project.

14.3 Conclusions

The predicted construction noise and vibration levels are based on indicative information to support this NOR, as set out in Section 6, and any conclusions in this assessment should be confirmed during the detailed design stage, taking account of the receivers as they exist at the time of construction.

Construction noise and vibration can be mitigated and managed, utilising the measures set out in Section 7.2, to generally comply with the applicable limits as defined in the AUP:OP. Exceedances of the criteria could occur intermittently over a short duration if high noise or vibration generating

equipment are used near occupied buildings. Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

A CNVMP is the most effective way to avoid, remedy or mitigate construction noise and vibration effects on receivers.

15 NOR 8 – Wider Western Link – North

15.1 Overview and description of works

The Wider Western Link is a proposed new arterial extending from Woodcocks Road in the north to SH1 in the south. The extent of the proposed new Wider Western Link (northern section) is from Woodcocks Road in the north to the midway point of the Warkworth South FUZ and is inclusive of the Mahurangi River.

The Wider Western Link (northern section) project involves the construction of a two-lane urban arterial with walking and cycling facilities on both sides. The corridor connects the Southern Interchange to Woodcocks Road and SH1 and, provides access into the southern FUZ where access will otherwise be difficult due to topography and streams.

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

15.1.1 Noise Environment

The Wider Western Link runs through a predominantly rural area with some residential dwellings located close to the road corridor. The noise environment is dominated by road traffic noise from vehicles on Woodcocks Road.

The Warkworth Structural Plan indicates that the area surrounding the Wider Western Link is likely to be zoned as Heavy Industry Zone and Residential Zones. This zoning would likely result in an increase in ambient noise levels as the area urbanises compared to the current rural nature.

15.2 Assessment of Construction Noise and Vibration Effects

15.2.1 Construction Noise Effects

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 10m. High noise generating activities may not occur right on the construction boundary, but if they do, 4 existing properties could experience unmitigated noise levels that exceed the daytime noise criterion. Details of all properties where the criteria could be exceeded are provided in Appendix A.

With mitigation in place as set out in Section 7.2, noise levels of up to 76 dB L_{Aeq} could still occur intermittently at the closest receivers, if high noise generating activities occur on the construction boundary. At this level effects likely to include loss of concentration, annoyance, and a reduction in speech intelligibility. We note that the existing receivers on FUZ zoned land may not be present at the time of construction.

Future receivers constructed within 76m of the works could experience unmitigated noise levels that exceed the 70 dB L_{Aeq} noise criterion during high noise generating activities such as the pavement works.

Operation of construction equipment will be intermittent in nature. Construction will be linear so as the equipment moves away from the receiver noise levels will reduce. The worst-case situations, where

mitigated noise levels could reach 76 dB L_{Aeq} at the closest receivers, are not expected to be frequent, due to the setback distances to the majority of the proposed works and the use of equipment with lower source noise levels for large portions of the works. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

If a critical activity has to be carried out during the night-time in close proximity to residential receivers, consultation and mitigation measures will be essential. The use of noisy equipment should be avoided where practicable to prevent sleep disturbance. Any night-time works are likely to be limited in duration and will be managed through the CNVMP and a Schedule.

15.2.2 Construction Vibration Effects

Existing receivers near Wider Western Link are predominantly residential type structures. No existing buildings are predicted to experience vibration levels above the Category B vibration criteria (5mm/s PPV for residential structures), even if the roller compactor is used on the construction boundary in the closest position to them.

The Category B criteria would be met at future residential structures that are 8m or more from the proposed works and commercial structures that are 4m or more from the proposed works.

The daytime Category A vibration amenity criteria could be exceeded in existing or future buildings if they are occupied during the works and within 21 m of the roller compactor or within the emission radii identified for the other vibration generating equipment in Table 6-4. The effect on receivers would be subject to their respective proximity to the works but could include steady vibration from the roller compactor or a small jolt from a digger which could rattle crockery and glassware.

Vibration can typically be tolerated inside buildings if it occurs intermittently during the day, is of limited duration and where there is effective prior engagement.

High vibration generating activities should not occur during the night-time in close proximity to residential receivers to avoid sleep disturbance, unless it is a critical activity and there is no alternative.

It should also be noted that the emission radii are conservative and vibration levels measured on site tend to be much lower than those predicted in the early stages of a project.

15.3 Conclusions

The predicted construction noise and vibration levels are based on indicative information to support this NoR, as set out in Section 6, and any conclusions in this assessment should be confirmed during the detailed design stage, taking account of the receivers as they exist at the time of construction.

Construction noise and vibration can be mitigated and managed, utilising the measures set out in Section 7.2, to generally comply with the applicable limits as defined in the AUP:OP. Exceedances of the criteria could occur intermittently over a short duration if high noise or vibration generating equipment are used near occupied buildings. Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

A CNVMP is the most effective way to avoid, remedy or mitigate construction noise and vibration effects on receivers.

16 Conclusions

An assessment of the construction noise and vibration effects due to the Warkworth Package has been undertaken for the Projects considering a worst case scenario. The predicted noise and vibration levels and effects are based on indicative information as provided by the Project team and any assessment conclusions should be confirmed during the detailed design stage, taking account of the final equipment selections, methodology and receivers as they exist at the time of construction.

Construction noise and vibration can be mitigated and managed, utilising the measures set out in Section 7.2, to comply with the applicable limits for the majority of the works. Exceedances of the criteria could occur intermittently across all NoRs, if high noise or vibration generating equipment is used near occupied buildings. The most impacted receivers are located within 10m of the construction boundary.

Night works will be limited to critical activities that cannot be carried out at any other time.

A CNVMP will be prepared prior to construction commencing in accordance with Section 7.2.1 of this report. The CNVMP will provide a framework for the development and implementation of best practicable options to avoid, remedy or mitigate the adverse effects of construction noise and vibration on receivers that exist at the time of construction. Communication and consultation will occur with the affected receivers and Schedules will be prepared if required.

Elevated noise levels should be avoided and mitigated where possible to reduce the likelihood of adverse effects such as loss of concentration, annoyance and sleep disturbance (for night works).

Whilst vibration levels at the daytime Category A criterion of 2mm/s PPV can generally be tolerated if activity occurs intermittently and with prior notice, communication and consultation will be the key management measure to avoid annoyance and concern. Where vibration levels are predicted to exceed the Category B criteria, and where the construction methodology cannot be changed to reduce vibration levels, building condition surveys are recommended.

Overall, construction noise and vibration can be controlled for all NORs to reasonable levels with the implementation of appropriate mitigation and management measures.

1 Appendix A: Receivers Exceeding Construction Noise Criteria

NoR 1

Address	Building Type/Structure
42 State Highway 1	Residential

NoR 2

Address	Building Type/Structure
314 Woodcocks Road	Residential
127A Woodcocks Road	Residential
346 Woodcocks Road	Residential
286 Woodcocks Road	Residential
1 Mason Heights	Residential
371 Woodcocks Road	Residential
2 Mason Heights	Residential
314A Woodcocks Road	Residential
372 Woodcocks Road	Residential
12 Oliver Street	Residential
8 Oliver Street	Residential
10 Oliver Street	Residential
3 Mason Heights	Residential
20 Oliver Street	Residential
4 Oliver Street	Residential
6 Oliver Street	Residential
18 Oliver Street	Residential
16 Oliver Street	Residential
14 Oliver Street	Residential
6 Evelyn Street	Residential
87 Woodcocks Road	Residential
326 Falls Road	Residential
5 Evelyn Street	Residential
317 Woodcocks Road	Residential
153 Woodcocks Road	Residential

NoR 3

Address	Building Type/Structure
1/18 Wech Drive	Residential
8E McKinney Road	Residential
1659 State Highway 1	Residential
8 Toovey Road	Commercial
9 McKinney Road	Residential
8F McKinney Road	Residential
27B Campbell Drive	Residential
1723 State Highway 1	Residential
43 Auckland Road	Commercial
6 McKinney Road	Residential
24 Wickens Place	Residential
33 Campbell Drive	Residential
22 Wickens Place	Residential
1/6 Wech Drive	Residential
17 Wech Drive	Residential
13 Wickens Place	Residential
25 Campbell Drive	Residential
15 Wech Drive	Residential
14 Wech Drive	Residential
67 Auckland Road	Commercial
1794 State Highway 1	Commercial
11 Wickens Place	Resiential
11 Wech Drive	Resiential
12 Wech Drive	Resiential
37 Campbell Drive	Resiential
7 McKinney Road	Resiential
35 Campbell Drive	Resiential
1848 State Highway 1	Resiential
16 Wech Drive	Resiential
7 Wech Drive	Resiential
23 Campbell Drive	Resiential
19 Wech Drive	Resiential
22 Wech Drive	Resiential
21 Campbell Drive	Resiential
1673 State Highway 1	Resiential
1/1 Fairwater Road	Commercial
8A Wech Drive	Residential
21 Wickens Place	Residential
1 Wech Drive	Commercial
21 Wech Drive	Resiential
1728 State Highway 1	Resiential
23 Wickens Place	Resiential
2/18 Wech Drive	Resiential
20 Wickens Place	Resiential
9 Wickens Place	Resiential
4 Wech Drive	Resiential
3/4 Fairwater Road	Commercial
5 Wech Drive	Residential
27 Campbell Drive	Residential
1/4 Fairwater Road	Residential
19 Campbell Drive	Residential
25 Wickens Place	Residential
3 Wech Drive	Residential
1773 State Highway 1	Residential
19 Wickens Place	Residential
31 Campbell Drive	Residential
2/6 Wech Drive	Residential
18 Wickens Place	Residential
17 Wickens Place	Residential
9 Wech Drive	Residential
39 Campbell Drive	Residential
8D McKinney Road	Residential
12A Wech Drive	Residential
20 Wech Drive	Residential
17A Wech Drive	Residential
4A Wech Drive	Residential
17 Campbell Drive	Residential
8B McKinney Road	Residential
29 Campbell Drive	Residential
7 Wickens Place	Residential
16 Wickens Place	Residential
1829 State Highway 1	Residential
3/6 Wech Drive	Residential
3/6 Fairwater Road	Commercial
5 Wickens Place	Residential
3 Wickens Place	Residential
1695A Valerie Cl	Residential
1684 State Highway 1	Residential
41 Campbell Drive	Residential
15 Campbell Drive	Residential
1695B Valerie Cl	Residential
14 Wickens Place	Residential
7A Wech Drive	Residential
3B Wech Drive	Residential
8 Wech Drive	Residential
7 Toovey Road	Residential
43 Campbell Drive	Residential
3/9 Fairwater Road	Commercial
8C McKinney Road	Residential
12 Wickens Place	Residential
20 Campbell Drive	Residential

NoR 4

Address	Building Type/Structure
130 Matakana Road	Residential
1 Melwood Drive	Residential
19 Northwood Close	Residential
98 Matakana Road	Residential
160 Matakana Road	Residential
190 Matakana Road	Residential
303 Matakana Road	Residential
170 Matakana Road	Residential
299 Matakana Road	Residential
304 Matakana Road	Residential
297 Matakana Road	Residential
165 Matakana Road	Residential
223 Matakana Road	Residential
2 Melwood Drive	Residential
4 Clayden Road	Residential
2 Clayden Road	Residential
76 Matakana Road	Residential
301 Matakana Road	Residential
120 Matakana Road	Residential
59 Northwood Close	Residential
3 Matakana Road	Residential
211 Matakana Road	Residential
4 Melwood Drive	Residential
23 Northwood Close	Residential
5 Matakana Road	Residential
3 Melwood Drive	Residential
57 Northwood Close	Residential
293 Matakana Road	Residential
140 Matakana Road	Residential
185 Matakana Road	Residential
245 Matakana Road	Residential
41 Northwood Close	Residential
17 Northwood Close	Residential
39 Northwood Close	Residential
295 Matakana Road	Residential
33 Northwood Close	Residential
6 Clayden Road	Residential
49 Matakana Road	Residential
31 Northwood Close	Residential
171 Matakana Road	Residential
45 Northwood Close	Residential
43 Northwood Close	Residential
25 Northwood Close	Residential
15 Northwood Close	Residential
37 Northwood Close	Residential
47 Northwood Close	Residential
2 Millstream Place	Residential
35 Northwood Close	Residential
55 Northwood Close	Residential
61 Northwood Close	Residential
6 Millstream Place	Residential
29 Northwood Close	Residential
40 Clayden Road	Residential

NoR 5

Address	Building Type/Structure
4 Millstream Place	Residential
209 Sandspit Road	Residential
6 Millstream Place	Residential
108 Sandspit Road	Residential
384 Sandspit Road	Residential
10 Millstream Place	Residential
1 Millstream Place	Residential
3 Millstream Place	Residential
8 Millstream Place	Residential
137 Sandspit Road	Residential
5 Millstream Place	Residential
12 Millstream Place	Residential
7 Millstream Place	Residential
14 Millstream Place	Residential
9 Millstream Place	Residential
146 Sandspit Road	Residential
109 Sandspit Road	Residential

NoR 6

Address	Building Type/Structure
2 Jamie Lane	Residential
4 Jamie Lane	Residential
6 Jamie Lane	Residential
1 Christopher Lane	Residential
10 Georgetti Way	Residential
3 Christopher Lane	Residential
73 Woodcocks Road	Commercial
3 Dunningham Street	Residential
9 Dunningham Street	Residential
5 Dunningham Street	Residential
8 Jamie Lane	Residential
7 Dunningham Street	Residential
5 Christopher Lane	Residential
1 McKinney Road	Residential
10 Jamie Lane	Residential
8 Georgetti Way	Residential
7 Christopher Lane	Residential
22 Wech Drive	Residential
3 McKinney Road	Residential
77 Morrison Drive	Commercial
12 Jamie Lane	Residential
9 Christopher Lane	Residential
6 Georgetti Way	Residential
2 Christopher Lane	Residential
4 Christopher Lane	Residential
1848 State Highway 1	Residential
21 Wech Drive	Residential
13 Christopher Lane	Residential
6 Christopher Lane	Residential

NoR 7

Address	Building Type/Structure
195 Sandspit Road	Residential
137 Sandspit Road	Residential
169 Sandspit Road	Residential
179 Sandspit Road	Residential
209 Sandspit Road	Residential

NoR 8

Address	Building Type/Structure
346 Woodcocks Road	Residential
12 Wyllie Road	Residential
314A Woodcocks Road	Residential
123 Valerie Close	Residential

2 Appendix B: Receivers Exceeding Construction Vibration Criteria

NoR 2

Address	Building Type/Structure
314 Woodcocks Road	Residential

NoR 3

Address	Building Type/Structure
1/18 Wech Drive	Residential
8E McKinney Road	Residential
1659 State Highway 1	Residential
9 McKinney Road	Residential
8F McKinney Road	Residential
27B Campbell Drive	Residential
1723 State Highway 1	Residential
6 McKinney Road	Residential
24 Wickens Place	Residential
33 Campbell Drive	Residential
22 Wickens Place	Residential
1/6 Wech Drive	Residential

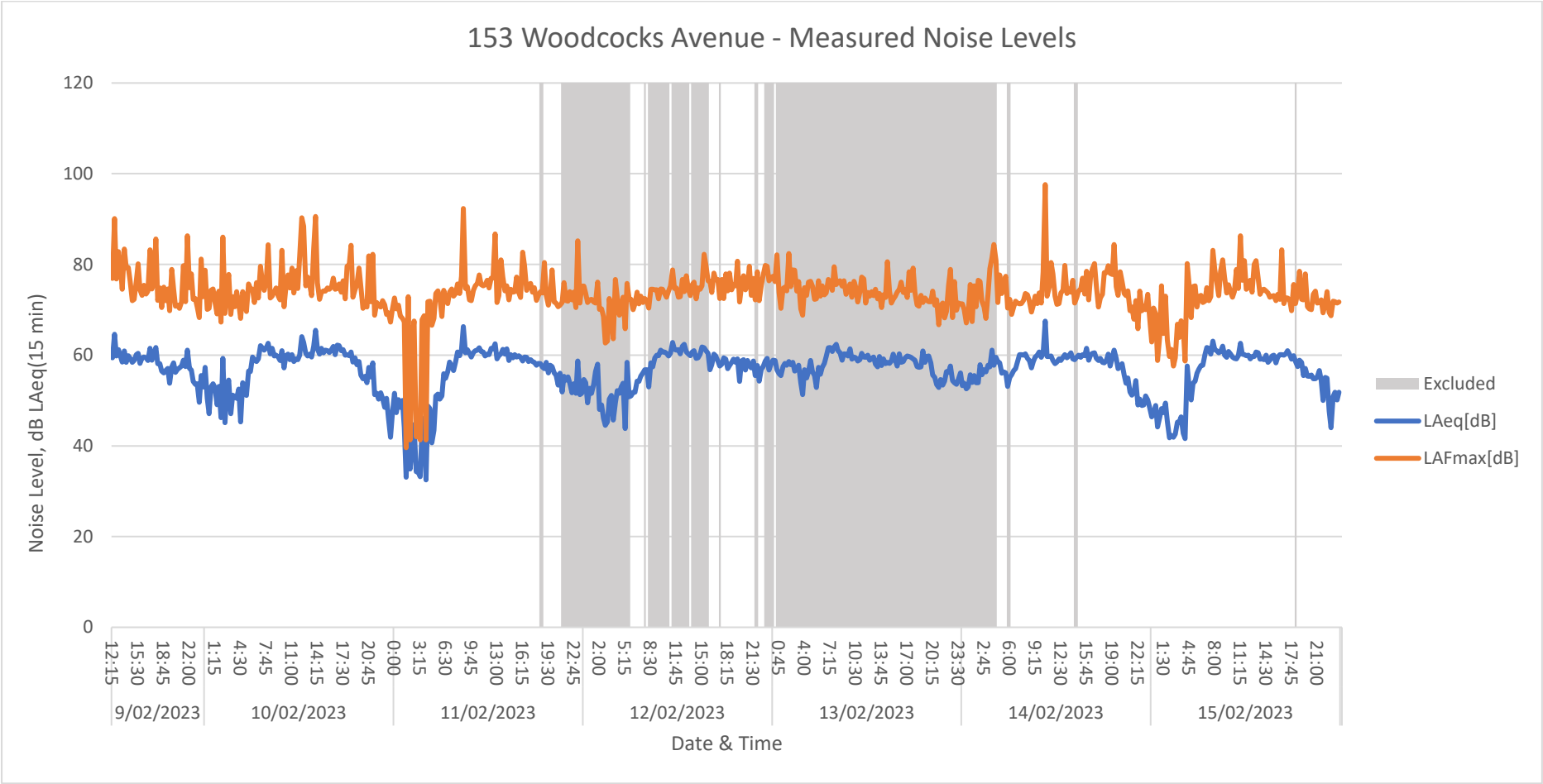
NoR 4

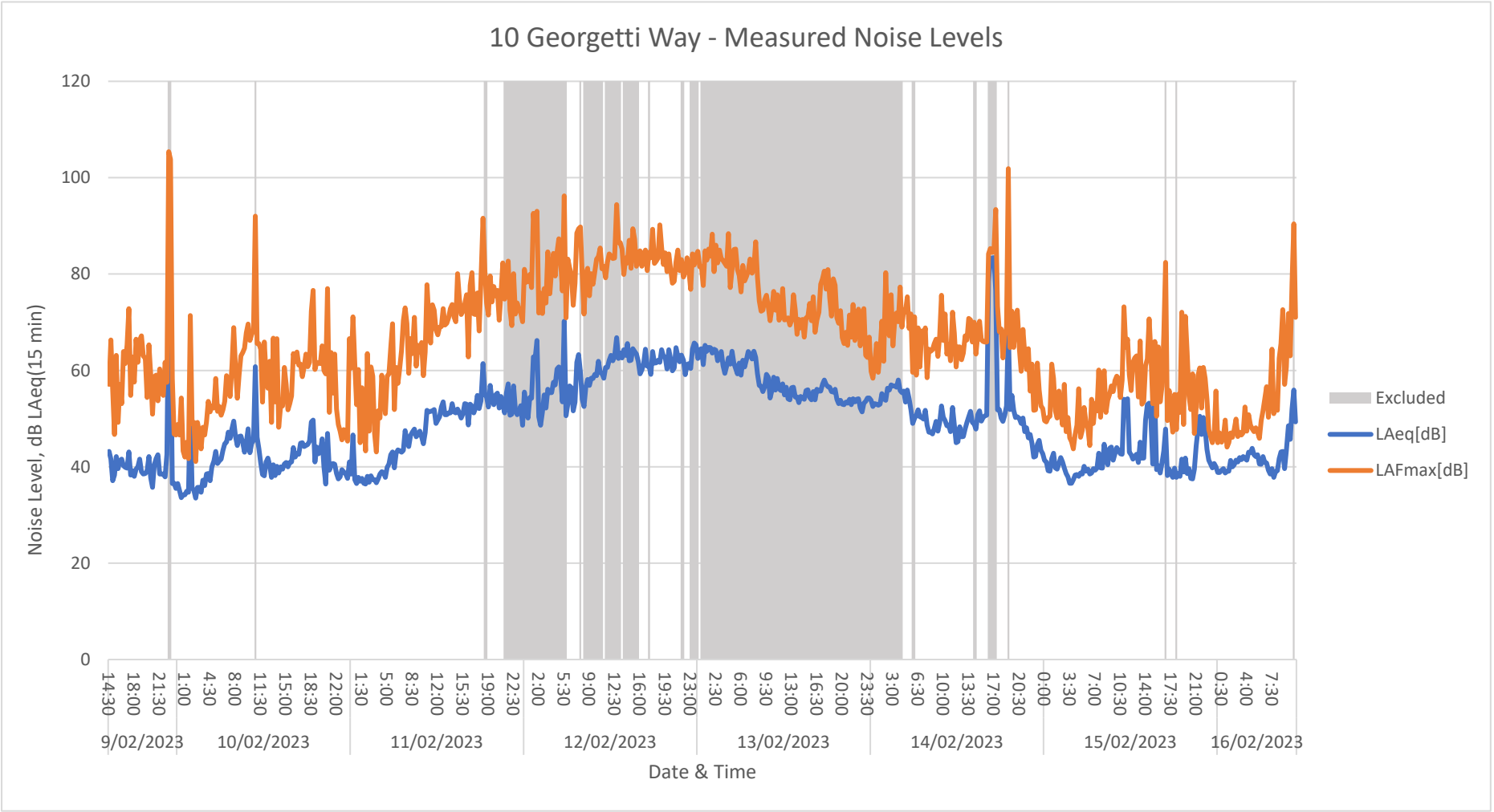
Address	Building Type/Structure
130 Matakana Road	Residential
1 Melwood Drive	Residential
19 Northwood Close	Residential
98 Matakana Road	Residential
160 Matakana Road	Residential
190 Matakana Road	Residential
303 Matakana Road	Residential
170 Matakana Road	Residential
299 Matakana Road	Residential

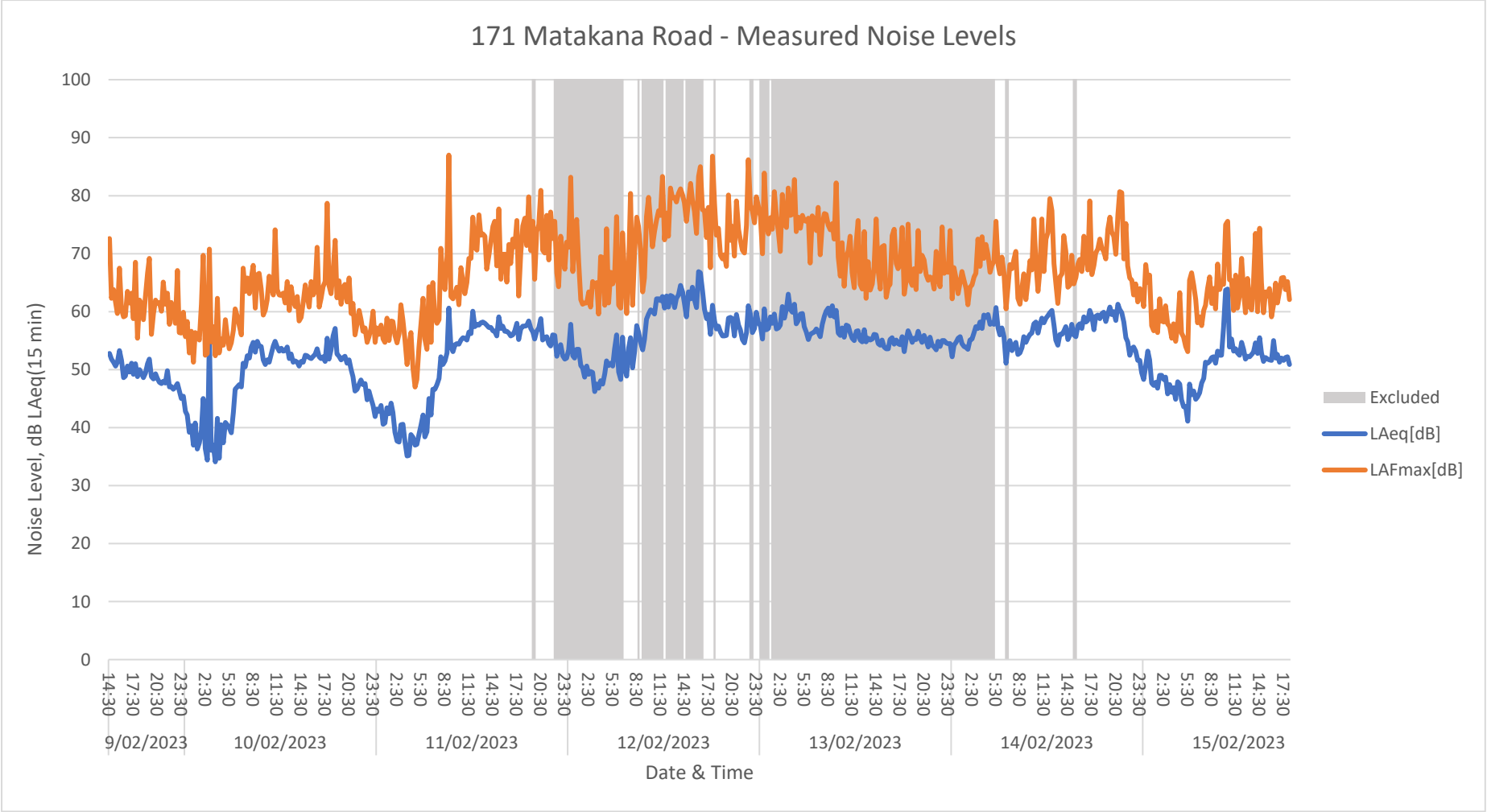
NoR 5

Address	Building Type/Structure
4 Millstream Place	Residential

3 Appendix C: Unattended Noise Monitoring Results


153 Woodcocks Avenue - Measured Noise Levels
Noise Level, dB LAeq(15 min)
120
100
80
60
40
20
0
12:15
15:30
18:45
22:00
1:15
4:30
7:45
11:00
14:15
17:30
20:45
0:00
3:15
6:30
9:45
13:00
16:15
19:30
22:45
2:00
5:15
8:30
11:45
15:00
18:15
21:30
0:45
4:00
7:15
10:30
13:45
17:00
20:15
23:30
2:45
6:00
9:15
12:30
15:45
19:00
22:15
1:30
4:45
8:00
11:15
14:30
17:45
21:00
9/02/2023
10/02/2023
11/02/2023
12/02/2023
13/02/2023
14/02/2023
15/02/2023
Date & Time
Excluded
LAeq[dB]
LAFmax[dB]


10 Georgetti Way - Measured Noise Levels
Noise Level, dB LAeq(15 min)
120
100
80
60
40
20
0
14:30
18:00
21:30
1:00
4:30
8:00
11:30
15:00
18:30
22:00
1:30
5:00
8:30
12:00
15:30
19:00
22:30
2:00
5:30
9:00
12:30
16:00
19:30
23:00
2:30
6:00
9:30
13:00
16:30
20:00
23:30
3:00
6:30
10:00
13:30
17:00
20:30
0:00
3:30
7:00
10:30
14:00
17:30
21:00
0:30
4:00
7:30
9/02/2023
10/02/2023
11/02/2023
12/02/2023
13/02/2023
14/02/2023
15/02/2023
16/02/2023
Date & Time
Excluded
LAeq[dB]
LAFmax[dB]


171 Matakana Road - Measured Noise Levels
Noise Level, dB LAeq(15 min)
100
90
80
70
60
50
40
30
20
10
0
14:30
17:30
20:30
23:30
2:30
5:30
8:30
11:30
14:30
17:30
20:30
23:30
2:30
5:30
8:30
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17:30
9/02/2023
10/02/2023
11/02/2023
12/02/2023
13/02/2023
14/02/2023
15/02/2023
Date & Time
Excluded
LAeq[dB]
LAFmax[dB]

4 Appendix D: Noise Monitoring Forms

NOISE MONITORING FORM – 10 Georgetti Way				
Summary				
Project name	Supporting Growth Alliance			
Project number	60558831			
Date / time	09/02/2023, 14:30pm			
Engineer(s)	Dhulkifl Ahmed			
Location (NZTM2000)	X	1747792	Y	5969208
Equipment				
Manufacturer	Rion			
Type	NL-52			
Serial number	00898330			
Date of last calibration	29/11/2021			
Calibration drift pre/post	N/A			
Noise Environment				
Which assessment method is applicable? *I.e. NZS 6802:2008 Simple / Detailed or other.*	Simple			
General description of measured noise: specific and residual levels including comments on k_1 adjustment and contamination	Dominant noise source: Road noise from Georgetti Way			
Any special audible characteristics (tonality, impulsivity etc.) and comment on k_2 adjustment	N/A			
Meteorological Conditions				
Wind speed and direction at microphone	3.6			
Wind speed and direction at dominant source(s)	3.6			
Precipitation	0			
Fog	N/A			
Temperature	18.6			
Humidity	43%			
Percentage cloud cover	60%			
Site Conditions				
Microphone height	1.5m			
Distance to dominant noise source(s)	8m			
Height of noise source(s)	Ground level			
Distance from any reflective surfaces	1.5m			
Intervening topography	N/A			
Hard, mixed or soft ground	Mixed			
Barriers between source(s) and microphone	N/A			
General comments and sketches				

Photo A: View toward the source

Photo B:

NOISE MONITORING FORM – 171 Matakana Road				
Summary				
Project name	Supporting Growth Alliance			
Project number	60558831			
Date / time	09/02/2023, 13:30pm			
Engineer(s)	Dhulkifl Ahmed			
Location (NZTM2000)	X	1748825	Y	5971672
Equipment				
Manufacturer	01dB			
Type	Cube			
Serial number	00898331			
Date of last calibration	29/11/2021			
Calibration drift pre/post	N/A			
Noise Environment				
Which assessment method is applicable? *I.e. NZS 6802:2008 Simple / Detailed or other.*	Simple			
General description of measured noise: specific and residual levels including comments on k_1 adjustment and contamination	Dominant noise source: Road noise from Matakana Rd, foliage, and insect noise from surrounding area			
Any special audible characteristics (tonality, impulsivity etc.) and comment on k_2 adjustment	N/A			
Meteorological Conditions				
Wind speed and direction at microphone	3.1 m/s			
Wind speed and direction at dominant source(s)	3.1 m/s			
Precipitation	0			
Fog	N/A			
Temperature	19.5			
Humidity	38			
Percentage cloud cover	60%			
Site Conditions				
Microphone height	1.5m			
Distance to dominant noise source(s)	30m			
Height of noise source(s)	Ground level			
Distance from any reflective surfaces	1.5m			
Intervening topography	Slight hill between noise source and receiver			
Hard, mixed or soft ground	Mixed			
Barriers between source(s) and microphone	N/A			
General comments and sketches				

Photo A: View toward the source

NOISE MONITORING FORM – 153 Woodcocks Road				
Summary				
Project name	Supporting Growth Alliance			
Project number	60558831			
Date / time	09/02/2023, 12:15pm			
Engineer(s)	Dhulkifl Ahmed			
Location (NZTM2000)	X	1747278	Y	5969508
Equipment				
Manufacturer	Rion			
Type	NL-52			
Serial number	00898331			
Date of last calibration	29/11/2021			
Calibration drift pre/post	N/A			
Noise Environment				
Which assessment method is applicable? *I.e. NZS 6802:2008 Simple / Detailed or other.*	Simple			
General description of measured noise: specific and residual levels including comments on k_1 adjustment and contamination	Dominant noise source: Road noise from Woodcocks Ave			
Any special audible characteristics (tonality, impulsivity etc.) and comment on k_2 adjustment	N/A			
Meteorological Conditions				
Wind speed and direction at microphone	3.2 m/s			
Wind speed and direction at dominant source(s)	3.2 m/s			
Precipitation	0			
Fog	N/A			
Temperature	19.2			
Humidity	42%			
Percentage cloud cover	60%			
Site Conditions				
Microphone height	1.5m			
Distance to dominant noise source(s)	10m			
Height of noise source(s)	Ground level			
Distance from any reflective surfaces	1.5m			
Intervening topography	Foliage between source and receiver			
Hard, mixed or soft ground	Mixed			
Barriers between source(s) and microphone	N/A			
General comments and sketches				

Photo A: View toward the source