

North

Assessment of Construction Noise and Vibration Effects

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Glossary of Defined Terms and Acronyms

Table 1-1: Glossary

Acronym/Term	Description
AEE	Assessment of Effects on the Environment
AC	Auckland Council
AT	Auckland Transport
AUP:OP	Auckland Unitary Plan Operative in Part
BPO	Best Practicable Option
BS	British Standard
CNVMP	Construction Noise and Vibration Management Plan
EWP	Elevated Work Platform
FTN	Frequent Transit Network
FUZ	Future Urban Zone
MDRS	Medium Density Residential Standards
NoR	Notice of Requirement (under the Resource Management Act 1991)
NoR 1	New Rapid Transit Corridor between Albany and Milldale
NoR 2	New Milldale Station and Associated Facilities
NoR 3	New Pine Valley East Station and Associated Facilities
NoR 4	SH1 Improvements Package
NoR 5	New SH1 crossing at Dairy Stream
NoR 6	New Connection between Milldale and Grand Drive
NoR 7	Upgrade to Pine Valley Road
NoR 8	Upgrade to Dairy Flat Highway between Silverdale and Dairy Flat
NoR 9	Upgrade to Dairy Flat Highway between Dairy Flat and Albany
NoR 10	Upgrade to Wainui Road
NoR 11	New connection between Dairy Flat Highway and Wilks Road
NoR 12	Upgrade and Extension to Bawden Road
NoR 13	Upgrade to East Coast Road between Silverdale and Ō Mahurangi Penlink (Redvale) Interchange
NPS:UD	National Policy Statement on Urban Development 2020

Acronym/Term	Description
PPF	Protected Premises and Facilities
RMA	Resource Management Act 1991
RTC	Rapid Transit Corridor
SH1	State Highway 1
Te Tupu Ngātahi	Te Tupu Ngātahi Supporting Growth Programme
THAB	Terrace Housing and Apartment Buildings
Waka Kotahi	Waka Kotahi NZ Transport Agency

Executive Summary

Assessment undertaken

This report assesses the construction noise and vibration from the proposed 13 Notices of Requirement (NoR) against relevant standards and guidelines. Where necessary, we have investigated and recommended mitigation.

NoR1 New Rapid Transit Corridor

Results of assessment and recommended measures

The new RTC traverses land currently used for rural activities and crosses several roads. Existing receivers are located at varying distances from the potential works with the closest existing receiver being less than 9m. If high noise generating activities occur right on the construction boundary, around 200 existing receivers could experience noise levels that exceed the daytime noise criterion without mitigation. Future receivers constructed within 76m of the works could experience noise levels that exceed the 70 dB L_{Aeq} noise criterion during high noise generating activities such as the pavement works, without mitigation implemented.

Existing receivers are predominately residential type structures. Compliance with the Category B criteria is predicted, though the Category A (amenity) criteria may be infringed for some receivers for limited times.

With mitigation in place, as will be set out in the CNVMP, noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works, and the Category B vibration criteria can be complied with.

NoR2 New Milldale Station

Results of assessment and recommended measures

The proposed station is located about halfway down an embankment from the existing residential street level. This means that most works will be well shielded. However, the kiss n ride and bus layover areas are level with the road. Closest existing receivers may be 5m from the potential works. If high noise generating activities occur right on the designation boundary, around 25 existing receivers could experience noise levels that exceed the daytime noise criterion without mitigation. Future receivers constructed within 76m of the works could experience noise levels that exceed the 70 dB L_{Aeq} noise criterion during high noise generating activities such as the pavement works, without mitigation implemented.

Existing receivers are predominately residential type structures. Three existing dwellings may experience vibration levels above 5mm/s PPV without the implementation of mitigation, if the roller compactor is used on the construction boundary in the closest position to them.

With mitigation in place, as will be set out in the CNVMP, noise levels may still exceed the 70 dB L_{Aeq} noise criterion for some construction works. However, the Category B vibration criteria can be complied with using appropriate mitigation and management.

NoR3 New Pine Valley East Station

Results of assessment and recommended measures

The proposed station is located in the FUZ zone and on the edge of the future industrial area, with closest existing receivers at least 44m away. With mitigation in place, compliance with the daytime noise criterion is predicted. Future receivers constructed within 76m of the works could experience noise levels that exceed the 70 dB L_{Aeq} noise criterion during high noise generating activities such as the pavement works, without mitigation implemented.

Existing receivers are predominately residential type structures. Compliance with the Category A criteria is predicted during daytime.

With mitigation in place, as will be set out in the CNVMP, noise levels may still exceed the 70 dB L_{Aeq} noise criterion for some construction works. However, the Category B vibration criteria can be complied with using appropriate mitigation and management.

NoR4 SH1 Improvements

Results of assessment and recommended measures

The SH1 upgrades and construction of the active mode beside SH1 are generally at a sufficient distance from the closest houses to not result in adverse noise or vibration effects. However, the closest existing receivers are less than 3m from the designation boundary. Should high noise generating activities occur right on the designation boundary, over 200 existing receivers could experience noise levels that exceed the daytime noise criterion without mitigation. Even with mitigation in place, the most affected houses could still intermittently receive noise levels of up to 80 dB L_{Aeq} . We note that the existing receivers may not be present at the time of construction, particularly considering this Project is located partly within the FUZ. Future receivers constructed within 76m of the works could experience noise levels (prior to mitigation) that exceed the 70 dB L_{Aeq} noise criterion during high noise generating activities such as the pavement works.

Existing receivers are predominately residential type structures. More than 40 existing dwellings may experience vibration levels above 5mm/s PPV, if no mitigation is implemented. This would occur if the roller compactor is used on the designation boundary closest to these dwellings.

NoR5 New SH1 crossing at Dairy Stream

The SH1 crossing is a new arterial connecting Top Road on the west to East Coast Road on the east. The crossing will be located approximately 1.2 km south of the Wilks Road. The alignment is located within the FUZ. The closest existing receivers are approximately 13m away. With mitigation in place, noise levels are predicted to comply with the daytime noise criteria at all existing receivers.

Compliance with the Category B vibration criteria is predicted at all existing receivers.

NoR6 New Connection between Milldale and Grand Drive

The arterial is an upgrade and extension of Upper Orewa Road. The alignment is located within the FUZ. The closest receivers are approximately 12m away. With mitigation in place, noise levels are predicted to comply with the daytime noise criteria at all existing receivers.

Compliance with the Category B vibration criteria is predicted at all existing receivers.

NoR7 Pine Valley Road Upgrade

The arterial is an upgrade of the existing Pine Valley Road from the edge of the FUZ to the newly constructed Argent Lane. The alignment is located within the FUZ. The closest receivers are approximately 28m. With mitigation in place, noise levels are predicted to comply with the daytime noise criteria at all existing receivers.

Compliance with the Category B vibration criteria is predicted at all existing receivers.

NoR8 Dairy Flat Highway Upgrade

The arterial is an upgrade of the existing Highway between Silverdale interchange and Durey Road at the rural urban boundary in Dairy Flat. The alignment is predominantly in the FUZ but also extends into the rural urban boundary. The closest existing receivers are approximately 3m away from the construction boundary. With mitigation in place, the most affected receivers could still receive intermittent noise levels up to 85 dB L_{Aeq} when works are immediately adjacent. However, due to the setback distances to most of the proposed works and the use of equipment with lower source noise levels for large portions of the works, mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

Four existing dwellings may experience vibration levels above 5mm/s PPV, exceeding the daytime Category B criterion, if the roller compactor is used on the construction boundary in the closest position to them. Mitigation, such as the use of non-vibratory compaction equipment within 8m of buildings, is recommended to avoid potential cosmetic damage.

NoR9 Dairy Flat Highway Upgrade

The arterial is an upgrade of the existing Dairy Flat Highway between Durey Road and Albany Village. The alignment is located within a rural zone and FUZ. The closest existing receivers are approximately 2m away from the construction boundary. With mitigation in place, the most affected receivers could still receive intermittent noise levels up to 85 dB L_{Aeq} when works are immediately adjacent. However, due to the setback distances to most of the proposed works and the use of equipment with lower source noise levels for large portions of the works, mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

Five existing dwellings may experience vibration levels above 5mm/s PPV, exceeding the daytime Category B criterion, if the roller compactor is used on the construction boundary in the closest position to them. Mitigation, such as the use of non-vibratory compaction equipment within 8m of buildings, is recommended to avoid potential cosmetic damage.

NoR10 Wainui Road Upgrade

The arterial is an upgrade of the existing Wainui Road between Lysnar Road and the roundabout just south of the Gull service station adjacent SH1. The alignment is predominantly located in the FUZ. The closest existing receivers are approximately 9m away from the construction boundary. With mitigation in place, the most affected receivers could still receive intermittent noise levels up to 75 dB L_{Aeq} when works are immediately adjacent. However, due to the setback distances to most of the proposed works and the use of equipment with lower source noise levels for large portions of the works, mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

Compliance with the Category B vibration criteria is predicted at all existing receivers.

NoR11 New Connection between Dairy Flat highway and Wilks Road

The arterial is a New Link Road connecting Dairy Flat Highway (at the Kahikatea Flat Road intersection) to Wilks Road. The alignment is predominantly located in the FUZ and residential zone. The closest existing receivers are approximately 7m away from the construction boundary. With mitigation in place, the most affected receivers could still receive intermittent noise levels of up to 79 dB L_{Aeq} when works are immediately adjacent. However, due to the setback distances to most of the proposed works and the use of equipment with lower source noise levels for large portions of the works, mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

Compliance with the Category B vibration criteria is predicted at all existing receivers.

NoR12 Upgrade and Extension to Bawden Road

The arterial is an upgrade and extension of the existing Bawden Road. The alignment is located in the FUZ. The closest receivers are located approximately 9m away from the construction boundary. With mitigation in place, the most affected receivers could still receive intermittent noise levels of up to 75 dB L_{Aeq} when works are immediately adjacent. However, due to the setback distances to most of the proposed works and the use of equipment with lower source noise levels for large portions of the works, mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

Compliance with the Category B vibration criteria is predicted at all existing receivers.

NoR13 East Coast Road Upgrade

The arterial is an upgrade to East Coast Road between Hibiscus Coast Highway and the Penlink interface (just north of where East Coast Road intersects with Bawden Road). The alignment is located throughout the rural, business and FUZ. The closest receivers are located approximately 3m away from the construction boundary. With mitigation in place, the most affected receivers could still receive intermittent noise levels of up to 85 dB L_{Aeq} when works are immediately adjacent. However, due to the setback distances to most of the proposed works and the use of equipment with lower source noise levels for large portions of the works, mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

30 existing dwellings and one commercial receiver may experience vibration levels above the daytime Category B criteria, if the roller compactor is used on the construction boundary in the closest position to them. Mitigation, such as the use of non-vibratory compaction equipment within 8m of buildings, is recommended to avoid potential cosmetic damage.

Conclusion

Construction noise and vibration can be mitigated and managed through the CNVMP to generally comply with the applicable noise and vibration criteria across all NoRs. Exceedances of the criteria could occur intermittently over a short duration if high noise or vibration generating equipment are used adjacent to occupied buildings. Any future buildings will need to be assessed at the time of construction and mitigation and management determined through the CNVMP. 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.

1 Introduction

This construction noise and vibration assessment has been prepared for Te Tupu Ngātahi Supporting Growth Alliance, North Auckland Projects to support 13 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 and two rapid transit corridor stations to enable the future construction, operation and maintenance of transport infrastructure in the North area of Auckland. The North area extends from Albany to Ōrewa and via the growth areas of Dairy Flat, Silverdale West, Wainui East, and Redvale (refer Figure 2-1). The North Projects are summarised in section 2.

This report addresses the construction noise and vibration effects of the North Projects identified in section 2.

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

1.1 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 North Projects. Its purpose is to inform the AEE that accompanies the North NoRs for AT and WK.

This report considers the actual and potential effects associated with the construction of the North Projects on the existing and likely future environment as they relate 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:

1. Identify and describe the noise and vibration context of the North Projects area;
2. Identify and describe the actual and potential construction noise and vibration effects of each Project corridor;
3. 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; and
4. Present an overall conclusion of the level of actual and potential construction noise and vibration effects for each Project corridor after recommended measures are implemented.

1.2 Report Structure

The report is structured as follows:

- a) Project overview with a summary of the North Projects in section 2;
- b) Overview of the methodology used to undertake the assessment and identification of the assessment criteria and any relevant standards or guidelines in sections 3 and 4;
- c) Identification and description of the existing and likely future noise environment in section 5;
- d) Description of the actual and potential adverse construction noise and vibration effects of the Projects, including recommended measures to avoid or mitigate potential adverse effects, in section 6;

- e) Overall conclusion of the level of potential adverse construction noise and vibration effects of the Projects after recommended measures are implemented in section 7.

This report should be read alongside the AEE, which contains further details on the history and context of the Project. The AEE also contains a detailed description of works to be authorised for the North Projects as a whole and each NoR, and indicative typical construction methodologies that will be used to implement this work. These have been reviewed by the authors of this report and have been considered as part of this assessment of construction noise and vibration effects. As such, they are not repeated here, unless a description of an activity is necessary to understand the potential effects, then it has been included in this report for clarity.

2 North Projects Overview

An overview of the North Projects is provided in Figure 2-1 below, with a brief summary of the North Projects provided in Table 2-1.

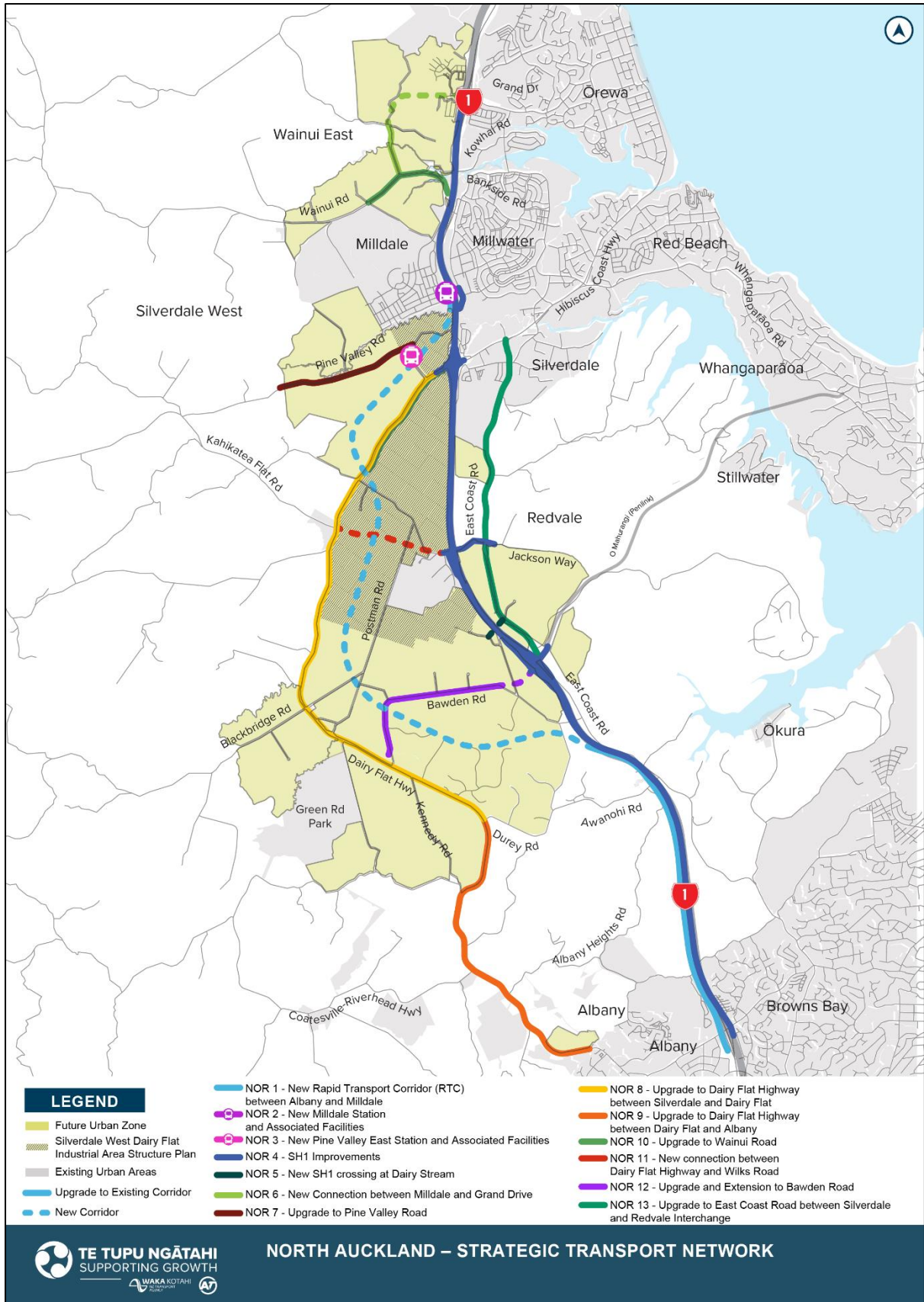


Figure 2-1 Map showing the location of each Project within the North growth area

Table 2-1 North Projects Summary

NoR	Project	Description	Requiring Authority
1	New Rapid Transit Corridor (RTC) between Albany and Milldale, including new walking and cycling path between Bawden Road and Dairy Flat Highway	<ul style="list-style-type: none"> • A 16km-long RTC corridor for public transport and active mode purposes • An 80km/hr operating speed (other than around stations) • Walking and cycling facilities along some of its length from Bawden Road to the point where the RTC crosses Dairy Flat Highway • Grade separated crossings at intersections with other key transport corridors. • The NoR will overlap with the existing motorway designation and SH1 improvements project over some of the length (between Albany and around Bawden Road) 	WK
2	New Milldale Station and Associated Facilities	<ul style="list-style-type: none"> • A new rapid transit station and associated facilities, including: • Station building with associated station facilities • Cycle and shared mobility device parking provision • Local bus layover and stop provision • Taxi and ride share drop-off facilities • 	WK
3	New Pine Valley East Station and Associated Facilities	<ul style="list-style-type: none"> • A new rapid transit station and associated facilities, including: • Station building with associated station facilities on structure over New Pine Valley Road with associated stairs and lift towers • Cycle and shared mobility device parking provision • Local bus layover and stop provision • Layover facilities for bus based RTC mode • Taxi and ride share drop-off facilities • Park and ride facility (up to 500 car parking spaces) • Upgrade to Old Pine Valley Road along station frontage. • 	WK
4	SH1 Improvements (alteration to designations 6761, 6760, 6759, 6751)	<ul style="list-style-type: none"> • Widening the SH1 carriageway from two lanes to three lanes in each direction from the Lonely Track Road overbridge to the Silverdale interchange • Upgraded Ō Mahurangi Penlink (Redvale) Interchange (upgrading this proposed interchange to add north facing ramps) • New Wilks Road interchange (south facing ramps only) • Silverdale interchange upgrade for east-west capacity • New walking and cycling path along SH1 - an approximately 16 km long active mode corridor along one side of SH1 from Albany to Grand Drive (starts on east of SH1 at Ōteha Valley Road, crosses to west of SH1 around 	WK

NoR	Project	Description	Requiring Authority
		<p>Bawden Road and then back to east around Silverdale interchange.)</p> <ul style="list-style-type: none"> • Silverdale to Highgate active mode connection -connection from the strategic active mode corridor at Silverdale to Highgate Parkway • Wainui interchange upgrade for active modes – new bridge for active modes across SH1 	
5	New SH1 crossing at Dairy Stream	<ul style="list-style-type: none"> • A new two-lane urban arterial connection and SH1 motorway overbridge between Top Road and East Coast Road near Huruhuru (Dairy Stream) • Active mode facilities on both sides of the carriageway • The overbridge would cross six lanes of motorway, a two-lane link road to the motorway service centre and the new walking and cycling path on SH1 (refer to NoR 4 above) 	AT
6	New Connection between Milldale and Grand Drive	<ul style="list-style-type: none"> • A new two-lane urban arterial with separated walking and cycling facilities on both sides between Wainui Road (Milldale) and the western edge of the Ara Hills development in Ōrewa. This will connect through to Grand Drive at SH1 via a new 30m road corridor to be vested by the Ara Hills developer. 	AT
7	Upgrade to Pine Valley Road	<ul style="list-style-type: none"> • An upgrade to Pine Valley Road (FUZ section) between Poynter Lane and Argent Lane to a two-lane urban arterial with separated walking and cycling facilities on both sides 	AT
8	Upgrade to Dairy Flat Highway between Silverdale and Dairy Flat	<ul style="list-style-type: none"> • An upgrade to a 4-lane urban arterial on sections where FUZ land is located both sides of the road (between Silverdale interchange and Wilks Road and between Richards Road and Durey Road), with separated walking and cycling paths on both sides of the corridor • Upgrade to a 2-lane rural arterial between Wilks Road and Richards Road – with a swale on the west and separated walking and cycling on the east • Upgraded bridge over Huruhuru (Dairy Stream) 	AT
9	Upgrade to Dairy Flat Highway between Dairy Flat and Albany	<ul style="list-style-type: none"> • An upgrade to Dairy Flat Highway between Dairy Flat and Albany for active mode and safety improvements including a central wire rope barrier and wide barriers. • The widened Road corridor will retain two lanes (one in each direction) and will also retain crawler lanes as currently located • Cycle path added on the western side of the carriageway between Durey Road and the Coatesville Riverhead Highway Roundabout and then on the eastern side between the Roundabout and Te Wharau (Albany Village) 	AT

NoR	Project	Description	Requiring Authority
10	Upgrade to Wainui Road	<ul style="list-style-type: none"> • Upgrade to Wainui Road to a 2-lane urban arterial between Lysnar Road and the new Argent Lane • Separate, dedicated, walking and cycling facilities on both sides of the carriageway • Upgraded bridge over Waterloo Creek (tributary to Ōrewa River) 	AT
11	New connection between Dairy Flat Highway and Wilks Road	<ul style="list-style-type: none"> • Segment 1 (Kahikatea Flat Road to Postman Road Segment) will feature a 2-lane urban arterial (24 m wide corridor) with separated walking and cycling facilities on both sides. • Segment 2 (Postman Road to SH1) features a 4-lane urban arterial (30 m wide corridor) with separated cycling and walking facilities, two lanes of general traffic and two-lanes where priority may given to freight traffic. 	AT
12	Upgrade and Extension to Bawden Road	<ul style="list-style-type: none"> • Upgrade and extension to Bawden Road. This will include a 30m four-lane road corridor with walking and cycling facilities on both sides. Two lanes for general traffic and two lanes for a frequent transit network (likely bus lanes). • Road intersects with the RTC. The road is likely to go under the RTC (grade separated crossing). 	AT
13	Upgrade to East Coast Road between Silverdale and Ō Mahurangi Penlink (Redvale) Interchange	<ul style="list-style-type: none"> • Upgrade to the footpath on the west side and new footpath on east side between Hibiscus Coast Highway and Silverwater Drive. • Segment 1 (from Silverwater Drive to Newman Road) features a two-lane urban arterial upgrade (24 m) with separated walking and cycling facilities on both sides. • Segment 2 (from Newman Road to Jackson Way, where one or both sides is rural) has a shared path to the west only, with no works to the existing carriageway and no swales. • Segment 3 (from Jackson Way to the end of the FUZ) features a 24 m wide cross section with walking and cycling facilities on both sides. 	AT

3 Assessment Criteria

3.1 Construction Noise

3.1.1 Criteria

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
- Waka Kotahi’s “State Highway Construction and Maintenance Noise and Vibration Guide” (**Guide**), V1.1, August 2019.

The North Projects include both AT and Waka Kotahi projects. Although the Guide is a Waka Kotahi document, we recommend that the requirements of it are also applied to AT projects, which is a similar approach to other Te Tupu Ngātahi Supporting Growth Alliance projects. The Guide takes account of the intended application of NZS 6803 criteria and provides a solid management structure to achieve the best practicable outcome for construction noise. The Guide and AUP:OP contain the same construction noise criteria.

Table 3-1 and Table 3-2 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 the Guide, and largely reflect the AUP:OP criteria.

Table 3-1 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

Day of the week	Time period	Maximum noise level >20 weeks	
		dB L _{Aeq}	dB L _{Amax}
	20:00 – 06:30	45	75

Table 3-2 Construction noise criteria for all other occupied receivers

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

3.1.2 Exceedance of criteria

During construction some activities will likely occur close to buildings. In some instances, there is the potential for noise levels to exceed the recommended construction noise standards. For most large-scale construction projects, exceedances of the construction noise standards for brief periods of time are common, and management will ensure that effects are reasonable.

NZS 6803 anticipates that at times construction noise cannot be made to comply with the recommended criteria. Statements such as “*construction noise from any site should not generally exceed the numerical noise limits*”¹ suggest that intermittent exceedances are not unreasonable, as long as the Best Practicable Option (BPO) has been applied to the management and mitigation of that construction noise.

The AUP:OP in its Objectives and Policies also appropriately anticipates exceedances from construction noise and states:

“(4) Construction activities that cannot meet the noise and vibration standards are enabled while controlling duration, frequency and timing to manage adverse effects.”

and

“(10) Avoid, remedy or mitigate the adverse effects of noise and vibration from construction, maintenance and demolition activities while having regard to:

[...]

The practicability of complying with permitted noise and vibration standards.”

Whether the duration of a construction activity that exceeds the standards can be considered reasonable, depends on site specific circumstances, and may vary from site to site and activity to activity. For instance, where daytime noise standards are exceeded for several days, but neighbouring residents are not at home, no one would be affected and therefore mitigation may not be required beyond communication with the residents.

If night-time works occur, this would likely only happen for a few nights in any one location. In that instance, this may be acceptable if residents have been informed and a clear timeframe has been

¹ NZS 6803:1999 Acoustics – Construction Noise, Section 7.1.2.

provided. However, if night-time works are expected to be ongoing for several consecutive nights, and at a noise level that affects residents' ability to sleep, then alternative strategies may need to be implemented, such as offering temporary relocation for those affected residents.

3.2 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”
- Waka Kotahi’s “State Highway Construction and Maintenance Noise and Vibration Guide” (**Guide**), V1.1, August 2019.

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. The amenity criteria set out in the AUP:OP are slightly less stringent than those set out in the Waka Kotahi Guide (2mm/s PPV vs 1 mm/s PPV).

Table 3-3 below shows the recommended vibration criteria for all NoRs which are sought by AT (NoRs 5 to 13). These criteria are based on the AUP:OP.

Table 3-4 below shows the recommended vibration criteria for all NoRs which are sought by Waka Kotahi (NoRs 1 to 4). These criteria are based on the Guide with the more stringent amenity criteria for occupied buildings.

Table 3-3: AT vibration limits at all buildings

Receiver	Details	Category A	Category B
Occupied activities sensitive to noise	Night-time 2000h-0630h	0.3 mm/s PPV	2mm/s PPV
	Daytime 0630h-2000h	2mm/s PPV	5mm/s PPV
Other occupied buildings	Daytime 0630h-2000h	2mm/s PPV	5mm/s PPV
All other buildings	At all times	Tables 1 and 3 of DIN4150-3:1999	

Table 3-4: Waka Kotahi vibration limits at all buildings

Receiver	Location	Details	Category A	Category B
Occupied PPFs*	Inside the building	Night-time 2000h-0630h	0.3 mm/s PPV	1mm/s PPV
		Daytime 0630h-2000h	1mm/s PPV	5mm/s PPV
Other occupied buildings	Inside the building	Daytime 0630h-2000h	2mm/s PPV	5mm/s PPV
All other buildings	Building foundation	Vibration – transient	5mm/s PPV	BS 5228-2 Table B.2
		Vibration – continuous		BS 5228-2 50% of Table B.2 values

* Protected Premises and Facilities

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 aim 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.

4 Assessment Methodology

A consistent approach has been adopted for the North Projects 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 as part of the Construction Noise and Vibration Management Plan (CNVMP) preparation. Any buildings within the proposed designation footprint are assumed to 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 edge of the proposed alignment. 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. 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.

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 Construction Noise and Vibration Management Plan (CNVMP) in Section 6.3.1, which will be developed prior to commencement of construction, and updated as necessary throughout the duration of construction.

4.1 Construction methodology

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

The outline is based on a generic transport 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 indicative construction methodology for the projects is as follows:

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;
- Establishment of site compounds and construction areas
- Service protection works; and

- Construct access tracks/ haul roads (if any).

Early works

- Site/ ground investigations.
- Relocation of utilities services; and
- Temporary works establishment, e.g. road diversion, closures, minor improvements.

Main works

- Topsoil stripping and earthworks (cut and fill) to formation level.
- Construct new drainage and culvert facilities.
- Bridge construction works (if any) as follows:
 - Construct substructure including foundations, piles, piers and abutments.
 - Construct superstructure including bridge beams and deck construction.
 - Complete bridge finishing works, approaches, barriers, landscaping.
 - Retaining wall construction (if any).
- Construct new pavement and widening works in available areas.
- Move traffic to newly constructed pavement areas and continue with the remaining widening works.
- Construct lane reconfiguration, including pavement reconstruction and/or rehabilitation
- Complete tie in works, footpaths, cycleways, lighting and landscaping.
- Construct permanent stormwater wetlands.
- Install road safety barriers and other traffic services facilities (traffic signals, pedestrian crossing, islands).
 - Install signage and street lighting.

Finishing works and demobilisation

- Final road surfacing/ resurfacing and road markings.
- Commission new services, including traffic signals (if any).
- Finishing works e.g. landscaping, street furniture, fencing and outstanding accommodation works.
- Move traffic to the final road configuration.
- Contractor to demobilise from site.

4.2 Dwellings to be removed

We have assumed that all existing buildings inside the designation areas will be removed or will not represent a dwelling (e.g. buildings may be repurposed to contain non-noise sensitive uses). We have therefore not assessed these buildings as dwellings. Should they be retained and be used for any uses identifying them as a dwelling, they will need to be assessed and mitigation will need to be determined where necessary, during detailed design.

Table 4-1: Dwellings inside designation areas (not assessed)

NoR	Address
1	28 Awanohi Road 86, 91, 124, 408, 410, 262, 390, 392 Bawden Road 64, 69 Crossbridge Road 1318, 1546, 1559, 1561, 1591, 1595, 1599 Dairy Flat Highway 53 Dairy Stream Road 133, 135 Goodland Drive 49, 65, 71, 81, 88 Grave Hill Drive 25 Kewa Road 72, 78, 86 Kingscliff Rise 90 Old Pine Valley Road 84, 93, 95, 99, 131 Postman Road 26 Redvale Rise 9, 42, 2/44, 46, 49, 58, 59, 98 and 98A Wilks Road 4, 17, 29 Wilson Road 17 Wright Road
2	N/A
3	10, 36, 46 Old Pine Valley Road
4	21 Aeropark Drive 28 Awanohi Road 1744, 1748 Dairy Flat Highway 1268, 1274, 1764, 1776, 1897 East Coast Road 141, 145, 147, 152, 154, 158 Lonely Track Road 52, 66 Small Road 59 Sidwell Road 138, 146 Top Road 193, 211, 228, 235, 244 Wilks Road 29 Wilson Road 17 Wright Road
5	138, 146 Top Road 1764 East Coast Road
6	2, 37, 85, 88 Upper Ōrewa Road 6 Russell Road
7	240, 245 Pine Valley Road
8	2, 9 Wilks Road 1 Green Road 796, 960 1270, 1350, 1368, 1373, 1397, 1579, 1638 Dairy Flat Highway
9	1 Albany Heights Road 318, 329, 402, 444, 526, 737, 759, 774, 796 Dairy Flat Highway

NoR	Address
10	348, 401 Wainui Road 2 Upper Ōrewa Road
11	1436 Dairy Flat Highway 336, 337 Postman Road 193 Wilks Road
12	9, 25, 54, 229, 267 Bawden Road 6, 13, 18, 19, 26, Top Road
13	1726, 1764, 1780, 1852, 1857, 1862, 1942, 2020, 2036, 2076, 2150 East Coast Road

4.3 Plant and Equipment

Table 4-2 provides an indicative list of plant and equipment which may be required for construction across each designation.

Table 4-2 Indicative construction equipment

Construction	Construction Activity
Typical across all works	<ul style="list-style-type: none"> • Light vehicles • Trucks and transporters, (Hiab, concrete, tip trucks, truck and trailer, 6-wheeler) Traffic control truck units • Portable electric generators, air compressors, temporary light towers
Earthworks	<ul style="list-style-type: none"> • Excavators (various sizes 1.5T - 45T) • Rollers and vibration compactor • Water cart • Dump trucks • Stabilizers
Drainage	<ul style="list-style-type: none"> • Excavators (various sizes) • Loaders and skid steer loader • Plate compactors • Concrete pump
Pavement Construction	<ul style="list-style-type: none"> • Graders, loaders and excavators • Water cart • Smooth drum roller • Tip Trucks • Kerbing machine • Plate compactor • Asphalt pavers
Bridges and structures	<ul style="list-style-type: none"> • Excavators (various sizes) • Cranes (mobiles or crawlers) • Piling rigs with vibration equipment • Telehandlers, forklifts • Concrete pumps

4.4 Construction Noise

The expected duration of the construction phase for each of the Projects ranges from 1 – 2 years to 5 to 6 years. Predictions have been assessed against the noise criteria for greater than 20 weeks “long-duration” under NZS 6803:1999 as presented in Table 3-1. 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.

4.4.1 Equipment Noise Levels

Table 4-3 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”, manufacturer’s 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 4-3 Construction equipment sound levels and indicative compliance distance

Equipment	Sound power level (dB L_{WA})	Facade 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})	Facade 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
Bored Piling Rig	111	89	83	77	69	49

4.4.2 Activity noise levels

Table 4-4 details the sound power levels for key construction activities, combining the equipment sound power levels detailed in Table 4-3 where multiple items of equipment may be operating simultaneously. Table 4-4 also details the minimum setback distance at which compliance can be achieved for each activity.

Table 4-4 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
Earthworks	111	52
Drainage works	113	56
Pavement Construction	115	76
Bridge Construction	113	55

4.5 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 4-5.

The vibration data have been taken from British Standard 5228-2:2009 “Code of practice for noise and vibration control on construction and open sites”, manufacturer’s data or the AECOM database of vibration measurements.

Table 4-5 Vibration sources and indicative emission radii

Equipment	Night-time Occupied Buildings (Waka Kotahi and AT) (0.3 mm/s)	Daytime Occupied Buildings (Waka Kotahi) (1 mm/s)	Daytime Occupied Buildings (AT) (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	42m	21m	17m	8m	4m
Bored Piling Rig	17m	5m	4m	2m	1m	1m
Excavator	80m	24m	12m	10m	6m	2m
Tipper Truck	16m	5m	2m	2m	1m	0m
Vibratory Plate Compactor	20m	6m	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.

5 Existing and Future Receiving Environment

5.1 Planning and Land Use Context

The assessment of effects needs to consider both the existing environment and the likely future receiving environment at the time at which effects will likely occur. It is anticipated the North Projects will be constructed between 10 – 30+ years from now, meaning the receiving environment will differ significantly from what is present today.

There are existing rural and urban zonings in the study area, as well as large areas of future urban zoning (FUZ) which will influence the likely receiving environment for assessment purposes. The majority of the North Projects will be constructed and will operate within (or immediately adjacent to) areas currently zoned as FUZ. The remainder will be constructed and operated within the existing urban environment or planned environment (i.e. what can be built under the existing AUP:OP live zones). However, greater intensification is anticipated in the residential zones, centre zones (and future centres), and land adjacent to the proposed RTC stations, in line with the National Policy Statement on Urban Development (NPS:UD) and Medium Density Residential Standards (MDRS) - noting that the policy context may shift prior to construction.

The adopted Silverdale West - Dairy Flat Industrial Area Structure Plan anticipates the development of a large industrial area within an area of FUZ predominantly between Dairy Flat Highway and SH1.

The remaining areas of FUZ, including Upper Ōrewa, Pine Valley and Dairy Flat have not yet been structure planned by Auckland Council. Auckland Council has, however, released some high-level thinking on future land uses in a draft Spatial Land Use Strategy, which broadly suggests:

- A metropolitan / town centre in Dairy Flat, located adjacent to the Rapid Transit Corridor alignment
- The potential for Terrace Housing and Apartment (THAB) zoning for 800m surrounding this metropolitan / town centre
- Two potential local centres in the Pine Valley area.

All areas of FUZ have a high likelihood of change in planning and land use context. It is anticipated that the likelihood of change in the following areas / zones is low:

- Current residential areas/zones, including Single House, Mixed Housing Suburban, Mixed Housing Urban, Terrace and Apartment Buildings, and Large Lot zones
- Current business areas/zones, including Light Industry, Mixed Use, General Business, Neighbourhood Centre, Local Centre, Town Centre, Heavy Industrial zones
- Current open space areas/zones, including Informal Recreation, Community, Sport and Active Recreation, Conservation zones
- Current rural areas which are not FUZ zoned, including Countryside Living zone
- Other areas currently within the Special Purpose zone including Special Purpose – Cemetery, Special Purpose – School, and Special Purpose – North Shore Airport.

Please refer to the AEE for further information on the planning and land use context.

5.2 Existing Environment – Noise

The existing noise environments for all NoRs are controlled by traffic on existing major roads (either close by or distant) and natural sounds.

We undertook long duration noise level surveys in the vicinity of the Projects in February and March 2023. The location of the surveys is shown in Figure 5-1.

5.2.1 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 five locations:

- 146 Pine Valley
- 40 Top Road
- 112 Top Road
- 28 Lascelles Drive
- 13 Top Road

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.

5.2.2 Meteorological conditions

During the surveys, meteorological data was obtained from Auckland, North Shore Albany Ews (37852) 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.

5.2.3 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. The $L_{Aeq(24h)}$ and L_{A90} was calculated for each day where there was sufficient data after unsatisfactory meteorological conditions and abnormal events were excluded. The average $L_{Aeq(24h)}$ and L_{A90} for the unattended measurement are shown in Table 5-1



Figure 5-1 Noise survey locations

Table 5-1: Noise survey results

Measurement Position	Location	NoR	Ambient noise level	Background noise level
			dB LAeq(24h)	dB LA90
MP1	146 Pine Valley Road, Dairy Flat	1	58	43
MP2	40 Top Road, Dairy Flat	4	53	48
MP3	112 Top Road, Dairy Flat	5	56	49
MP4	28 Lascelles Drive, Dairy Flat	8	55	46
MP5	13 Top Road, Dairy Flat	12	50	37

6 Assessment of Construction Effects

6.1 Construction noise and vibration effects – relating to all NoRs

6.1.1 Construction noise

Table 6-1 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, façades may provide up to a 25 – 30 dB reduction, therefore assumptions and effects provided below are based on a conservative approach.

Table 6-1 Potential construction noise effects on receivers

External Noise Level	Potential Daytime Effects Outdoors	Corresponding Internal Noise Level	Potential Daytime Effects Indoors
65 dB LAeq	Conversation becomes strained, particularly over longer distances	45 dB LAeq	Noise levels would be noticeable but unlikely to interfere with residential or office daily activities.
65 to 70 dB LAeq	People would not want to spend any length of time outside, except when unavoidable through workplace requirements	45 to 50 dB LAeq	Concentration would start to be affected. TV and telephone conversations would begin to be affected.
70 to 75 dB LAeq	Businesses that involve substantial outdoor use (for example garden centres) would experience considerable disruption.	50 to 55 dB LAeq	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 LAeq	Some people may choose protection for long periods of exposure. Conversation would be very difficult, even with raised voices.	55 to 60 dB LAeq	Continuing office work would be extremely difficult and become unproductive. In a residential context, people would actively seek respite.
80 to 90 dB LAeq	Hearing protection would be required for prolonged exposure (8 hours at 85	60 to 70 dB LAeq	Untenable for both office and residential environments. Unlikely to

External Noise Level	Potential Daytime Effects Outdoors	Corresponding Internal Noise Level	Potential Daytime Effects Indoors
	dB) to prevent hearing loss.		be tolerated for any extent of time.

With effective management of construction activities (refer to Section 6.3), 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 high. 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.

6.1.2 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 / DIN criteria have been combined below and adopted for this assessment.

Table 6-2 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. This is the AUP:OP limit for construction vibration generated at night-time for sensitive receivers.

Vibration level (mm/s PPV)	Potential effects Indoors
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 to 2 mm/s during the day, and the Guide sets the criteria for amenity to 1 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, and any receiver within a 42m radius of the construction area may experience vibration of 1 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.

The AUP:OP and the Guide set the night-time vibration criterion at 0.3 mm/s. At this level, 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 6.3.1).

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.

6.2 Construction noise and vibration effects – relating to specific NoRs

The assessment of effects considers both the existing environment and the likely future receiving environment at the time at which effects will likely occur. It is anticipated the North Projects will be constructed between 10 – 30+ years from now, meaning the receiving environment will differ significantly from what is present today. Many of the areas crossed by the NoRs are zoned FUZ and will change significantly in future. It should also be noted that generally the projects will not be built until the area is developing.

While the assessment focuses on existing receivers, it comments on potential future receivers also. Construction noise and vibration is assessed for all receivers present at the time of construction. Any management of effects will be set out in the CNVMP that will be produced at the time.

6.2.1 NoR 1 New Rapid Transit Corridor (RTC) between Albany and Milldale, including new walking and cycling path

6.2.1.1 Construction Noise Effects

Existing receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being less than 9m. High noise generating activities may not occur right on the construction boundary but if they do, around 180 existing receivers could experience noise levels that exceed the daytime noise criterion without mitigation. Details of all properties where the criteria could be exceeded are provided in Appendix A.

With mitigation in place, as set out in Section 6.3, noise levels of up to 81 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 are 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, particularly considering this Project is located in part within the FUZ.

Future receivers constructed within 76m of the works could experience noise levels that exceed the 70 dB L_{Aeq} noise criterion during high noise generating activities such as the pavement works, without mitigation implemented.

Operation of construction equipment will be intermittent in nature. Construction will likely be linear so as the equipment moves away from the receiver, noise levels will reduce. The worst-case situations are not expected to be frequent, due to the setback distances to most of the proposed works and the use of equipment with lower source noise levels for large portions of the works (i.e. where the active mode transport facilities are constructed). Mitigation in the form of barriers can achieve noise level reductions of about 10 decibels. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

It is unlikely that night-time works will be required for this NoR, given the RTC can be constructed generally offline. We therefore have not discussed night-time construction for this NoR.

6.2.1.2 Construction Vibration Effects

Existing receivers are predominately residential type structures. No dwellings are predicted to experience vibration levels above 5mm/s PPV if the roller compactor is used on the construction

boundary in the closest position to them. No commercial receivers are predicted to receive vibration levels exceeding the 10mm/s PPV daytime criteria. Once the compactor is 8m or more 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 42 m of the roller compactor or within the emission radii identified for the other vibration generating equipment in Table 4-5. 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.

6.2.2 NoR 2 New Milldale Station and Associated Facilities

6.2.2.1 Construction Noise Effects

Existing receivers are located at varying distances from the construction boundary around the station and associated facilities with the closest receivers being less than 5m from the potential works. High noise generating activities may not occur right on the designation boundary but if they do, around 15 existing receivers could experience noise levels that exceed the daytime noise criterion without mitigation. Details of all properties where the criteria could be exceeded are provided in Appendix A.

Station construction will require some retaining wall construction including piling adjacent to the platforms (refer Figure 6-1 below). We have predicted noise levels from the potential bored piling activity to the closest dwellings and predict that the daytime noise limit of 70 dB L_{Aeq} can be complied with.

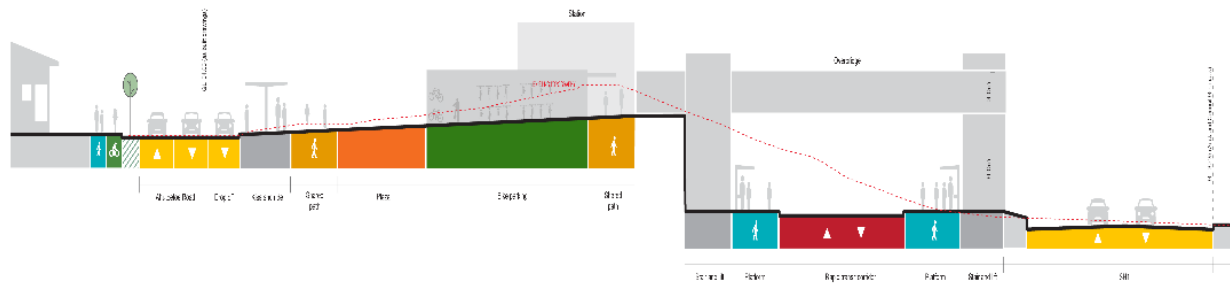


Figure 6-1 Milldale Station Indicative Cross section

With mitigation in place, as set out in Section 6.3, noise levels of up to 78 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 are likely to include loss of concentration, annoyance, and a reduction in speech intelligibility.

Future receivers constructed within 76m of the works could experience noise levels that exceed the 70 dB L_{Aeq} noise criterion during high noise generating activities such as the pavement works, without mitigation implemented.

Operation of construction equipment will be intermittent in nature. Construction will likely be linear so as the equipment moves away from the receiver, noise levels will reduce. The worst-case situations are not expected to be frequent, due to the setback distances to most of the proposed works and the use of equipment with lower source noise levels for large portions of the works (i.e. where the active mode transport facilities are constructed). Mitigation in the form of barriers can achieve noise level reductions of about 10 decibels. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

It is unlikely that night-time works will be required for this NoR, given the station can be constructed off line and is unlikely to significantly affect other roads. We therefore have not discussed night-time construction for this NoR.

6.2.2.2 Construction Vibration Effects

Existing receivers are predominately residential type structures. Three dwellings may experience vibration levels above 5mm/s PPV if the roller compactor is used on the construction boundary in the closest position to them. No commercial receivers are predicted to receive vibration levels exceeding the 10mm/s PPV daytime criteria. Once the compactor is 8m or more away from the dwellings the Category B criteria 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 42 m of the roller compactor or within the emission radii identified for the other vibration generating equipment in Table 4-5. 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.

Potential bored piling at the station (refer Figure 6-1 above) is predicted to comply with both Category A and B vibration criteria, due to the distance of the works to the closest houses.

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.

6.2.3 NoR 3 New Pine Valley East Station and Associated Facilities

6.2.3.1 Construction Noise Effects

One existing receiver is located near the designation boundary at 44m. High noise generating activities may not occur right on the boundary but if they do, this receiver could experience noise levels, prior to mitigation, that exceed the daytime noise criterion. Details of this property where the criteria could be exceeded are provided in Appendix A.

With mitigation in place, as set out in Section 6.3, noise levels are predicted to comply with the daytime criteria.

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.

We do not anticipate that any of the construction works will need to be undertaken during night-time as the works do not affect existing major transport routes.

6.2.3.2 Construction Vibration Effects

The one existing receiver is a residential type structure. The receiver is not expected to experience vibration levels above 1mm/s PPV, complying with the daytime Category A vibration amenity criteria.

6.2.4 NoR 4 SH1 Improvements Package

6.2.4.1 Construction Noise Effects

Existing receivers are located at varying distances from the designation boundary along the alignment with the closest existing receiver being less than 3m. High noise generating activities may not occur right on the designation boundary. However, if they do, over 300 existing receivers could experience noise levels that exceed the daytime noise criterion prior to mitigation being implemented. Details of all properties where the criteria could be exceeded are provided in Appendix A.

With mitigation in place, as set out in Section 6.3, noise levels of up to 80 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 are 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, particularly considering this Project is located partly within the FUZ.

Future receivers constructed within 76m of the works could experience noise levels (prior to mitigation) 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 likely 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 75 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 generally 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, such as the construction of the proposed bridges across SH1) are likely to be limited in duration and will be managed through the CNVMP (as per Section 6.3.1) and a Schedule (as per Section 6.3.2).

6.2.4.2 Construction Vibration Effects

Existing receivers are predominately residential type structures. More than 40 existing dwellings may experience vibration levels above 5mm/s PPV, if no mitigation is implemented. This would occur if the roller compactor is used on the designation boundary closest to these dwellings. No commercial receivers are predicted to receive vibration levels exceeding 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 42 m of the roller compactor or within the emission radii identified for the other vibration generating equipment in Table 4-5. 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.

6.2.5 NoR 5 New SH1 crossing at Dairy Stream

6.2.5.1 Construction Noise Effects

Existing receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 13m. High noise generating activities may not occur right on the construction boundary but if they do, 3 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 6.3, 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 likely be linear 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 6.3.1) and a Schedule (as per Section 6.3.2).

6.2.5.2 Construction Vibration Effects

Existing receivers near Top Road are predominately residential type structures. Vibration levels are predicted to meet the Category B criteria at the existing receivers. The Category B criteria would also 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 4-5. 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.

6.2.6 NoR 6 New Connection between Milldale and Grand Drive

6.2.6.1 Construction Noise Effects

Existing receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 12m away. High noise generating activities may not occur right on the construction boundary but if they do, four 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 6.3, 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 likely be linear 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 6.3.1) and a Schedule (as per Section 6.3.2).

6.2.6.2 Construction Vibration Effects

Existing receivers near the proposed new connection between Milldale and Grand Drive are predominately residential type structures. Vibration levels are predicted to meet the Category B criteria at the existing receivers. The Category B criteria would also 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 is predicted to be met at all existing receivers. The Category A 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 4-5. 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.

6.2.7 NoR 7 Upgrade to Pine Valley Road

6.2.7.1 Construction Noise Effects

Existing receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 28m away. High noise generating activities may not occur right on the construction boundary but if they do, four 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 6.3, 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 likely be linear 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 6.3.1) and a Schedule (as per Section 6.3.2).

6.2.7.2 Construction Vibration Effects

Existing receivers near Pine Valley Road are predominately residential type structures. Vibration levels are predicted to meet the Category B criteria at the existing receivers. 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 is predicted to be met at all existing receivers. The Category A 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 4-5. 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.

6.2.8 NoR 8 Upgrade to Dairy Flat Highway between Silverdale and Dairy Flat

6.2.8.1 Construction Noise Effects

Existing receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 3m away. High noise generating activities may not occur right on the construction boundary but if they do, 74 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 6.3, 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 likely 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 6.3.1) and a Schedule (as per Section 6.3.2).

6.2.8.2 Construction Vibration Effects

Existing receivers near Dairy Flat Highway are predominately residential type structures. Four existing dwellings may experience vibration levels above 5mm/s PPV, exceeding the daytime Category B criterion, if the roller compactor is used on the construction boundary in the closest position to them. 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 4-5. 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.

6.2.9 NoR 9 Upgrade to Dairy Flat Highway between Dairy Flat and Albany

6.2.9.1 Construction Noise Effects

Existing receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 2m away. High noise generating activities may not occur right on the construction boundary but if they do, 45 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 6.3, 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 likely 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 6.3.1) and a Schedule (as per Section 6.3.2).

6.2.9.2 Construction Vibration Effects

Existing receivers near Dairy Flat Highway are predominately residential type structures. Five existing dwellings may experience vibration levels above 5mm/s PPV, exceeding the daytime Category B criterion, if the roller compactor is used on the construction boundary in the closest position to them. 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 4-5. 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.

6.2.10 NoR 10 Upgrade to Wainui Road

6.2.10.1 Construction Noise Effects

Existing receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 9m away. High noise generating activities may not occur right on the construction boundary but if they do, nine 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 6.3, noise levels of up to 75 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 likely 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 75 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 6.3.1) and a Schedule (as per Section 6.3.2).

6.2.10.2 Construction Vibration Effects

Existing receivers near Wainui Road are predominately residential type structures. Vibration levels are predicted to meet the Category B criteria at the existing receivers. The Category B criteria would also 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 4-5. 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.

6.2.11 NoR 11 New connection between Dairy Flat Highway and Wilks Road

6.2.11.1 Construction Noise Effects

Existing receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 7m away. High noise generating activities may not occur right on the construction boundary but if they do, 24 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 6.3, noise levels of up to 79 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 likely 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 79 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 6.3.1) and a Schedule (as per Section 6.3.2).

6.2.11.2 Construction Vibration Effects

Existing receivers near the proposed new connection are predominately residential type structures. Vibration levels are predicted to meet the Category B criteria at the existing receivers. The Category B criteria would also 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 4-5. 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.

6.2.12 NoR 12 Upgrade and Extension to Bawden Road

6.2.12.1 Construction Noise Effects

Existing receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 9m away. 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 6.3, noise levels of up to 75 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 likely 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 75 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 6.3.1) and a Schedule (as per Section 6.3.2).

6.2.12.2 Construction Vibration Effects

Existing receivers near Bawden Road are predominately residential type structures. Vibration levels are predicted to meet the Category B criteria at the existing receivers. 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 4-5. 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.

6.2.13 NoR 13 Upgrade to East Coast Road between Silverdale and Ō Mahurangi Penlink (Redvale) Interchange

6.2.13.1 Construction Noise Effects

Existing receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 3m away. High noise generating activities may not occur right on the construction boundary but if they do, 104 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 6.3, 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 likely 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 6.3.1) and a Schedule (as per Section 6.3.2).

6.2.13.2 Construction Vibration Effects

Existing receivers near East Coast Road are predominately residential type structures. 30 existing dwellings may experience vibration levels above 5mm/s PPV, exceeding the daytime Category B criterion, if the roller compactor is used on the construction boundary in the closest position to them. One commercial receiver is predicted to exceed the 10mm/s PPV daytime criteria. The address of the receiver where the Category B criteria may be exceeded is 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 4-5. 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.

6.3 Recommended Measures to Avoid, Remedy or Mitigate Construction Effects

6.3.1 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. AUP:OP Rule E25.6.29(5) sets out the minimum level of information that must be provided in a CNVMP. The Guide also sets out information that should be included 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.

6.3.2 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.

6.3.3 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;
- Liaising with neighbours so they can work around specific activities;
- Selecting equipment and methodologies to restrict noise;
- 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.

6.3.4 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);
- Liaising with neighbours so they can work around specific activities;
- Operating vibration generating equipment as far from sensitive sites as possible;
- 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).

6.3.5 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 vibration 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.

6.3.6 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 that cannot be carried out at any other time. 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; and
- 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.

7 Conclusion

An assessment of the construction noise and vibration effects due to the North Projects has been undertaken 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 6.3, 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 6.3.1 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 criteria (2mm/s PPV for AT projects, 1mm/s PPV for Waka Kotahi projects) 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 predicted to receive noise levels exceeding 70 dB LAeq

1.1 NoR 1

Address	Building Type/Structure
71 Ahutoetoe Road, Wainui	Residential
73 Ahutoetoe Road, Wainui	Residential
75 Ahutoetoe Road, Wainui	Residential
77 Ahutoetoe Road, Wainui	Residential
79 Ahutoetoe Road, Wainui	Residential
81 Ahutoetoe Road, Wainui	Residential
83 Ahutoetoe Road, Wainui	Residential
85 Ahutoetoe Road, Wainui	Residential
87 Ahutoetoe Road, Wainui	Residential
89 Ahutoetoe Road, Wainui	Residential
91 Ahutoetoe Road, Wainui	Residential
93 Ahutoetoe Road, Wainui	Residential
95 Ahutoetoe Road, Wainui	Residential
91A Ahutoetoe Road, Wainui	Residential
72 Bawden Road, Dairy Flat	Residential
83 Bawden Road, Dairy Flat	Residential
99 Bawden Road, Dairy Flat	Residential
120 Bawden Road, Dairy Flat	Residential
124 Bawden Road, Dairy Flat	Residential
140 Bawden Road, Dairy Flat	Residential
174 Bawden Road, Dairy Flat	Residential
178 Bawden Road, Dairy Flat	Residential
396 Bawden Road, Dairy Flat	Residential
410 Bawden Road, Dairy Flat	Residential
224E Bawden Road, Dairy Flat	Residential
24 Cherry Hill, Fairview Heights, Auckland	Residential
29 Dahlia Drive, Fairview Heights, Auckland	Residential

Address	Building Type/Structure
35 Dahlia Drive, Fairview Heights, Auckland	Residential
926 Dairy Flat Highway, Dairy Flat	Residential
1252 Dairy Flat Highway, Dairy Flat	Residential
1320 Dairy Flat Highway, Dairy Flat	Residential
1550 Dairy Flat Highway, Dairy Flat	Residential
1583 Dairy Flat Highway, Dairy Flat	Residential
1599 Dairy Flat Highway, Dairy Flat	Residential
1603 Dairy Flat Highway, Dairy Flat	Residential
1270A Dairy Flat Highway, Dairy Flat	Residential
33 Dairy Stream Road, Dairy Flat	Residential
47 Dairy Stream Road, Dairy Flat	Residential
52 Dairy Stream Road, Dairy Flat	Residential
39 Elm Haven, Fairview Heights, Auckland	Residential
44 Elm Haven, Fairview Heights, Auckland	Residential
49 Fuschia Lane, Fairview Heights, Auckland	Residential
54 Fuschia Lane, Fairview Heights, Auckland	Residential
55 Fuschia Lane, Fairview Heights, Auckland	Residential
60 Gardenia Grove, Fairview Heights, Auckland	Residential
61 Gardenia Grove, Fairview Heights, Auckland	Residential
143 Goodland Drive, Dairy Flat	Residential
146 Goodland Drive, Dairy Flat	Residential
9 Grace Hill Drive, Dairy Flat	Residential
64 Hibiscus Crescent, Fairview Heights, Auckland	Residential
65 Hibiscus Crescent, Fairview Heights, Auckland	Residential
66 Hibiscus Crescent, Fairview Heights, Auckland	Residential
67 Hibiscus Crescent, Fairview Heights, Auckland	Residential
5 Kewa Road, Albany Heights, Auckland	Residential
9 Kewa Road, Albany Heights, Auckland	Residential
15 Kewa Road, Albany Heights, Auckland	Residential

Address	Building Type/Structure
21 Kewa Road, Albany Heights, Auckland	Residential
25 Kewa Road, Albany Heights, Auckland	Residential
29 Kewa Road, Albany Heights, Auckland	Residential
31 Kewa Road, Albany Heights, Auckland	Residential
33 Kewa Road, Albany Heights, Auckland	Residential
35 Kewa Road, Albany Heights, Auckland	Residential
37 Kewa Road, Albany Heights, Auckland	Residential
39 Kewa Road, Albany Heights, Auckland	Residential
42 Kewa Road, Albany Heights, Auckland	Residential
61 Kewa Road, Albany Heights, Auckland	Residential
17 Lascelles Drive, Dairy Flat	Residential
190D Lonely Track Road, Dairy Flat	Residential
90 Old Pine Valley Road, Dairy Flat	Residential
1 Paikea Street, Albany Heights, Auckland	Residential
2 Paikea Street, Albany Heights, Auckland	Residential
3 Paikea Street, Albany Heights, Auckland	Residential
4 Paikea Street, Albany Heights, Auckland	Residential
5 Paikea Street, Albany Heights, Auckland	Residential
6 Paikea Street, Albany Heights, Auckland	Residential
7 Paikea Street, Albany Heights, Auckland	Residential
8 Paikea Street, Albany Heights, Auckland	Residential
9 Paikea Street, Albany Heights, Auckland	Residential
10 Paikea Street, Albany Heights, Auckland	Residential
11 Paikea Street, Albany Heights, Auckland	Residential
12 Paikea Street, Albany Heights, Auckland	Residential
13 Paikea Street, Albany Heights, Auckland	Residential
15 Paikea Street, Albany Heights, Auckland	Residential
17 Paikea Street, Albany Heights, Auckland	Residential
19 Paikea Street, Albany Heights, Auckland	Residential
21 Paikea Street, Albany Heights, Auckland	Residential
23 Paikea Street, Albany Heights, Auckland	Residential

Address	Building Type/Structure
25 Paikea Street, Albany Heights, Auckland	Residential
27 Paikea Street, Albany Heights, Auckland	Residential
29 Paikea Street, Albany Heights, Auckland	Residential
81 Postman Road, Dairy Flat	Residential
87 Postman Road, Dairy Flat	Residential
99 Postman Road, Dairy Flat	Residential
149 Postman Road, Dairy Flat	Residential
295 Postman Road, Dairy Flat	Residential
313 Postman Road, Dairy Flat	Residential
327 Postman Road, Dairy Flat	Residential
143A Postman Road, Dairy Flat	Residential
61A Rautahi Terrace, Redvale, Auckland	Residential
30 Wilks Road, Dairy Flat	Residential
58 Wilks Road, Dairy Flat	Residential
82 Wilks Road, Dairy Flat	Residential
90 Wilks Road, Dairy Flat	Residential
44A Wilks Road, Dairy Flat	Residential
9A Wilks Road, Dairy Flat	Residential
4 Wilson Road, Dairy Flat	Residential
7 Wilson Road, Dairy Flat	Residential
29 Wilson Road, Dairy Flat	Residential
39 Wright Road, Dairy Flat	Residential
91 Bawden Road, Dairy Flat	Commercial/non-residential
404 Bawden Road, Dairy Flat	Commercial/non-residential
408 Bawden Road, Dairy Flat	Commercial/non-residential
422 Bawden Road, Dairy Flat	Commercial/non-residential
1549 Dairy Flat Highway, Dairy Flat	Commercial/non-residential
1559 Dairy Flat Highway, Dairy Flat	Commercial/non-residential
1561 Dairy Flat Highway, Dairy Flat	Commercial/non-residential
1226 East Coast Road, Redvale, Auckland	Commercial/non-residential
30 Highgate Parkway, Silverdale	Commercial/non-residential

Address	Building Type/Structure
32 Highgate Parkway, Silverdale	Commercial/non-residential
193 Pine Valley Road, Dairy Flat	Commercial/non-residential
77 Postman Road, Dairy Flat	Commercial/non-residential
95 Postman Road, Dairy Flat	Commercial/non-residential
131 Postman Road, Dairy Flat	Commercial/non-residential
133 Postman Road, Dairy Flat	Commercial/non-residential
143 Postman Road, Dairy Flat	Commercial/non-residential
42 Wright Road, Dairy Flat	Commercial/non-residential
71A Wright Road, Dairy Flat	Commercial/non-residential

1.2 NoR 2

Address	Building Type/Structure
89 Ahutoetoe Road, Wainui	Residential
91 Ahutoetoe Road, Wainui	Residential
92 Ahutoetoe Road, Wainui	Residential
93 Ahutoetoe Road, Wainui	Residential
94 Ahutoetoe Road, Wainui	Residential
95 Ahutoetoe Road, Wainui	Residential
96 Ahutoetoe Road, Wainui	Residential
100 Ahutoetoe Road, Wainui	Residential
102 Ahutoetoe Road, Wainui	Residential
106 Ahutoetoe Road, Wainui	Residential
108 Ahutoetoe Road, Wainui	Residential
91A Ahutoetoe Road, Wainui	Residential
92A Ahutoetoe Road, Wainui	Residential
1 John Fair Drive, Wainui	Residential
1 Siren Street, Wainui	Residential
3 Snowden Road, Wainui	Residential

1.3 NoR 3

Address	Building Type/Structure
37 Old Pine Valley Road, Dairy Flat	Residential

1.4 NoR 4

Address	Building Type/Structure
10 Aeropark Drive, Dairy Flat	Residential
12 Aeropark Drive, Dairy Flat	Residential
14 Aeropark Drive, Dairy Flat	Residential
1 Ahorangi Road, Silverdale	Residential
2 Ahorangi Road, Silverdale	Residential
3 Ahorangi Road, Silverdale	Residential
4 Ahorangi Road, Silverdale	Residential
5 Ahorangi Road, Silverdale	Residential
6 Ahorangi Road, Silverdale	Residential
7 Ahorangi Road, Silverdale	Residential
8 Ahorangi Road, Silverdale	Residential
9 Ahorangi Road, Silverdale	Residential
10 Ahorangi Road, Silverdale	Residential
11 Ahorangi Road, Silverdale	Residential
13 Ahorangi Road, Silverdale	Residential
15 Ahorangi Road, Silverdale	Residential
17 Ahorangi Road, Silverdale	Residential
19 Ahorangi Road, Silverdale	Residential
21 Ahorangi Road, Silverdale	Residential
23 Ahorangi Road, Silverdale	Residential
25 Ahorangi Road, Silverdale	Residential
1A Ahorangi Road, Silverdale	Residential
1B Ahorangi Road, Silverdale	Residential
1C Ahorangi Road, Silverdale	Residential
1D Ahorangi Road, Silverdale	Residential
1E Ahorangi Road, Silverdale	Residential
87 Ahutoetoe Road, Wainui	Residential

Address	Building Type/Structure
89 Ahutoetoe Road, Wainui	Residential
2 Aileron Rise, Dairy Flat	Residential
4 Aileron Rise, Dairy Flat	Residential
5 Aileron Rise, Dairy Flat	Residential
2 Airini Road, Silverdale	Residential
4 Airini Road, Silverdale	Residential
5 Airini Road, Silverdale	Residential
6 Airini Road, Silverdale	Residential
7 Airini Road, Silverdale	Residential
8 Airini Road, Silverdale	Residential
5 Ash Avenue, Fairview Heights, Auckland	Residential
421 Bawden Road, Dairy Flat	Residential
6 Beech Way, Fairview Heights, Auckland	Residential
7 Beech Way, Fairview Heights, Auckland	Residential
1 Breeze Lane, Silverdale	Residential
2 Breeze Lane, Silverdale	Residential
23 Cherry Hill, Fairview Heights, Auckland	Residential
24 Cherry Hill, Fairview Heights, Auckland	Residential
28 Dahlia Drive, Fairview Heights, Auckland	Residential
29 Dahlia Drive, Fairview Heights, Auckland	Residential
32 Dahlia Drive, Fairview Heights, Auckland	Residential
33 Dahlia Drive, Fairview Heights, Auckland	Residential
34 Dahlia Drive, Fairview Heights, Auckland	Residential
35 Dahlia Drive, Fairview Heights, Auckland	Residential
1732 Dairy Flat Highway, Dairy Flat	Residential
1172 East Coast Road, Redvale, Auckland	Residential
1226 East Coast Road, Redvale, Auckland	Residential
1262 East Coast Road, Redvale, Auckland	Residential
1274 East Coast Road, Redvale, Auckland	Residential
1370 East Coast Road, Redvale, Auckland	Residential
1384 East Coast Road, Redvale, Auckland	Residential
1401 East Coast Road, Redvale, Auckland	Residential
1413 East Coast Road, Redvale, Auckland	Residential

Address	Building Type/Structure
1425 East Coast Road, Redvale, Auckland	Residential
1513 East Coast Road, Redvale, Auckland	Residential
36 Elm Haven, Fairview Heights, Auckland	Residential
37 Elm Haven, Fairview Heights, Auckland	Residential
38 Elm Haven, Fairview Heights, Auckland	Residential
39 Elm Haven, Fairview Heights, Auckland	Residential
40 Elm Haven, Fairview Heights, Auckland	Residential
41 Elm Haven, Fairview Heights, Auckland	Residential
43 Elm Haven, Fairview Heights, Auckland	Residential
44 Elm Haven, Fairview Heights, Auckland	Residential
21 Fairview Avenue, Fairview Heights, Auckland	Residential
46 Fuschia Lane, Fairview Heights, Auckland	Residential
47 Fuschia Lane, Fairview Heights, Auckland	Residential
48 Fuschia Lane, Fairview Heights, Auckland	Residential
49 Fuschia Lane, Fairview Heights, Auckland	Residential
50 Fuschia Lane, Fairview Heights, Auckland	Residential
51 Fuschia Lane, Fairview Heights, Auckland	Residential
52 Fuschia Lane, Fairview Heights, Auckland	Residential
53 Fuschia Lane, Fairview Heights, Auckland	Residential
54 Fuschia Lane, Fairview Heights, Auckland	Residential
55 Fuschia Lane, Fairview Heights, Auckland	Residential
56 Gardenia Grove, Fairview Heights, Auckland	Residential
57 Gardenia Grove, Fairview Heights, Auckland	Residential
59 Gardenia Grove, Fairview Heights, Auckland	Residential
60 Gardenia Grove, Fairview Heights, Auckland	Residential
61 Gardenia Grove, Fairview Heights, Auckland	Residential
45 Godfrey Drive, Orewa	Residential
47 Godfrey Drive, Orewa	Residential
49 Godfrey Drive, Orewa	Residential
51 Godfrey Drive, Orewa	Residential
53 Godfrey Drive, Orewa	Residential
55 Godfrey Drive, Orewa	Residential
57 Godfrey Drive, Orewa	Residential

Address	Building Type/Structure
59 Godfrey Drive, Orewa	Residential
61 Godfrey Drive, Orewa	Residential
63 Godfrey Drive, Orewa	Residential
65 Godfrey Drive, Orewa	Residential
67 Godfrey Drive, Orewa	Residential
69 Godfrey Drive, Orewa	Residential
71 Godfrey Drive, Orewa	Residential
73 Godfrey Drive, Orewa	Residential
75 Godfrey Drive, Orewa	Residential
77 Godfrey Drive, Orewa	Residential
79 Godfrey Drive, Orewa	Residential
81 Godfrey Drive, Orewa	Residential
83 Godfrey Drive, Orewa	Residential
85 Godfrey Drive, Orewa	Residential
87 Godfrey Drive, Orewa	Residential
4 Harris Drive, Silverdale	Residential
6 Harris Drive, Silverdale	Residential
8 Harris Drive, Silverdale	Residential
10 Harris Drive, Silverdale	Residential
12 Harris Drive, Silverdale	Residential
14 Harris Drive, Silverdale	Residential
16 Harris Drive, Silverdale	Residential
18 Harris Drive, Silverdale	Residential
20 Harris Drive, Silverdale	Residential
22 Harris Drive, Silverdale	Residential
24 Harris Drive, Silverdale	Residential
26 Harris Drive, Silverdale	Residential
28 Harris Drive, Silverdale	Residential
30 Harris Drive, Silverdale	Residential
32 Harris Drive, Silverdale	Residential
34 Harris Drive, Silverdale	Residential
38 Harris Drive, Silverdale	Residential
40 Harris Drive, Silverdale	Residential

Address	Building Type/Structure
42 Harris Drive, Silverdale	Residential
44 Harris Drive, Silverdale	Residential
46 Harris Drive, Silverdale	Residential
48 Harris Drive, Silverdale	Residential
50 Harris Drive, Silverdale	Residential
52 Harris Drive, Silverdale	Residential
54 Harris Drive, Silverdale	Residential
56 Harris Drive, Silverdale	Residential
58 Harris Drive, Silverdale	Residential
20A Harris Drive, Silverdale	Residential
22A Harris Drive, Silverdale	Residential
24A Harris Drive, Silverdale	Residential
26A Harris Drive, Silverdale	Residential
62 Hibiscus Crescent, Fairview Heights, Auckland	Residential
63 Hibiscus Crescent, Fairview Heights, Auckland	Residential
64 Hibiscus Crescent, Fairview Heights, Auckland	Residential
65 Hibiscus Crescent, Fairview Heights, Auckland	Residential
66 Hibiscus Crescent, Fairview Heights, Auckland	Residential
67 Hibiscus Crescent, Fairview Heights, Auckland	Residential
68 Hibiscus Crescent, Fairview Heights, Auckland	Residential
69 Hibiscus Crescent, Fairview Heights, Auckland	Residential
70 Hibiscus Crescent, Fairview Heights, Auckland	Residential
71 Hibiscus Crescent, Fairview Heights, Auckland	Residential
81 Iris Watch, Fairview Heights, Auckland	Residential
7 Jack Hawken Lane, Silverdale	Residential
9 Jack Hawken Lane, Silverdale	Residential
11 Jack Hawken Lane, Silverdale	Residential
12 Jack Hawken Lane, Silverdale	Residential
13 Jack Hawken Lane, Silverdale	Residential
14 Jack Hawken Lane, Silverdale	Residential
15 Jack Hawken Lane, Silverdale	Residential
17 Jack Hawken Lane, Silverdale	Residential
19 Jack Hawken Lane, Silverdale	Residential

Address	Building Type/Structure
21 Jack Hawken Lane, Silverdale	Residential
23 Jack Hawken Lane, Silverdale	Residential
30 Jackson Way, Stillwater	Residential
10 Johns Creek Crescent, Silverdale	Residential
14 Johns Creek Crescent, Silverdale	Residential
27 Johns Creek Crescent, Silverdale	Residential
29 Johns Creek Crescent, Silverdale	Residential
31 Johns Creek Crescent, Silverdale	Residential
32 Johns Creek Crescent, Silverdale	Residential
33 Johns Creek Crescent, Silverdale	Residential
34 Johns Creek Crescent, Silverdale	Residential
35 Johns Creek Crescent, Silverdale	Residential
36 Johns Creek Crescent, Silverdale	Residential
37 Johns Creek Crescent, Silverdale	Residential
38 Johns Creek Crescent, Silverdale	Residential
39 Johns Creek Crescent, Silverdale	Residential
40 Johns Creek Crescent, Silverdale	Residential
41 Johns Creek Crescent, Silverdale	Residential
42 Johns Creek Crescent, Silverdale	Residential
43 Johns Creek Crescent, Silverdale	Residential
45 Johns Creek Crescent, Silverdale	Residential
47 Johns Creek Crescent, Silverdale	Residential
49 Johns Creek Crescent, Silverdale	Residential
5 Kewa Road, Albany Heights, Auckland	Residential
6 Kewa Road, Albany Heights, Auckland	Residential
9 Kewa Road, Albany Heights, Auckland	Residential
15 Kewa Road, Albany Heights, Auckland	Residential
21 Kewa Road, Albany Heights, Auckland	Residential
25 Kewa Road, Albany Heights, Auckland	Residential
29 Kewa Road, Albany Heights, Auckland	Residential
31 Kewa Road, Albany Heights, Auckland	Residential
33 Kewa Road, Albany Heights, Auckland	Residential
35 Kewa Road, Albany Heights, Auckland	Residential

Address	Building Type/Structure
37 Kewa Road, Albany Heights, Auckland	Residential
39 Kewa Road, Albany Heights, Auckland	Residential
51 Kowhai Road, Orewa	Residential
20 Lagonda Rise, Oteha, Auckland	Residential
22 Lagonda Rise, Oteha, Auckland	Residential
24 Lagonda Rise, Oteha, Auckland	Residential
26 Lagonda Rise, Oteha, Auckland	Residential
28 Lagonda Rise, Oteha, Auckland	Residential
29 Lagonda Rise, Oteha, Auckland	Residential
30 Lagonda Rise, Oteha, Auckland	Residential
31 Lagonda Rise, Oteha, Auckland	Residential
32 Lagonda Rise, Oteha, Auckland	Residential
33 Lagonda Rise, Oteha, Auckland	Residential
1 Lancia Way, Oteha, Auckland	Residential
2 Lancia Way, Oteha, Auckland	Residential
3 Lancia Way, Oteha, Auckland	Residential
4 Lancia Way, Oteha, Auckland	Residential
5 Lancia Way, Oteha, Auckland	Residential
6 Lancia Way, Oteha, Auckland	Residential
7 Lancia Way, Oteha, Auckland	Residential
129 Lonely Track Road, Fairview Heights, Auckland	Residential
144 Lonely Track Road, Redvale, Auckland	Residential
148 Lonely Track Road, Redvale, Auckland	Residential
162 Lonely Track Road, Redvale, Auckland	Residential
177 Lonely Track Road, Albany Heights, Auckland	Residential
181 Lonely Track Road, Albany Heights, Auckland	Residential
196 Lonely Track Road, Dairy Flat	Residential
190D Lonely Track Road, Dairy Flat	Residential
2 Makaka Lane, Silverdale	Residential
1 Masons Road, Oteha, Auckland	Residential
3 Masons Road, Oteha, Auckland	Residential
5 Masons Road, Oteha, Auckland	Residential
7 Masons Road, Oteha, Auckland	Residential

Address	Building Type/Structure
9 Masons Road, Oteha, Auckland	Residential
11 Masons Road, Oteha, Auckland	Residential
13 Masons Road, Oteha, Auckland	Residential
15 Masons Road, Oteha, Auckland	Residential
17 Masons Road, Oteha, Auckland	Residential
17A Masons Road, Oteha, Auckland	Residential
3 Meridian Court, Oteha, Auckland	Residential
4 Meridian Court, Oteha, Auckland	Residential
5 Meridian Court, Oteha, Auckland	Residential
7 Meridian Court, Oteha, Auckland	Residential
9 Meridian Court, Oteha, Auckland	Residential
11 Meridian Court, Oteha, Auckland	Residential
13 Meridian Court, Oteha, Auckland	Residential
15 Meridian Court, Oteha, Auckland	Residential
17 Meridian Court, Oteha, Auckland	Residential
19 Meridian Court, Oteha, Auckland	Residential
21 Meridian Court, Oteha, Auckland	Residential
23 Meridian Court, Oteha, Auckland	Residential
25 Meridian Court, Oteha, Auckland	Residential
141 Oteha Valley Road, Fairview Heights, Auckland	Residential
1 Paikea Street, Albany Heights, Auckland	Residential
3 Paikea Street, Albany Heights, Auckland	Residential
5 Paikea Street, Albany Heights, Auckland	Residential
7 Paikea Street, Albany Heights, Auckland	Residential
9 Paikea Street, Albany Heights, Auckland	Residential
11 Paikea Street, Albany Heights, Auckland	Residential
13 Paikea Street, Albany Heights, Auckland	Residential
15 Paikea Street, Albany Heights, Auckland	Residential
17 Paikea Street, Albany Heights, Auckland	Residential
19 Paikea Street, Albany Heights, Auckland	Residential
21 Paikea Street, Albany Heights, Auckland	Residential
23 Paikea Street, Albany Heights, Auckland	Residential
7 Sidwell Road, Wainui	Residential

Address	Building Type/Structure
19 Sidwell Road, Wainui	Residential
25 Sidwell Road, Wainui	Residential
7 Stubbs Place, Fairview Heights, Auckland	Residential
9 Stubbs Place, Fairview Heights, Auckland	Residential
10 Stubbs Place, Fairview Heights, Auckland	Residential
11 Stubbs Place, Fairview Heights, Auckland	Residential
12 Stubbs Place, Fairview Heights, Auckland	Residential
13 Stubbs Place, Fairview Heights, Auckland	Residential
14 Stubbs Place, Fairview Heights, Auckland	Residential
3 Tendril Court, Orewa	Residential
4 Tendril Court, Orewa	Residential
5 Tendril Court, Orewa	Residential
6 Tendril Court, Orewa	Residential
7 Tendril Court, Orewa	Residential
8 Tendril Court, Orewa	Residential
9 Tendril Court, Orewa	Residential
1 Throttle Close, Dairy Flat	Residential
2 Throttle Close, Dairy Flat	Residential
6 Throttle Close, Dairy Flat	Residential
2 Timberland Drive, Silverdale	Residential
4 Timberland Drive, Silverdale	Residential
46 Top Road, Dairy Flat	Residential
64 Top Road, Dairy Flat	Residential
106 Top Road, Dairy Flat	Residential
293 Wainui Road, Wainui	Residential
235 Wilks Road, Stillwater	Residential
243 Wilks Road, Stillwater	Residential
251 Wilks Road, Stillwater	Residential
4 Wilson Road, Dairy Flat	Residential
7 Wilson Road, Dairy Flat	Residential
29 Wilson Road, Dairy Flat	Residential
39 Wright Road, Dairy Flat	Residential
1 Aeropark Drive, Dairy Flat	Commercial/non-residential

Address	Building Type/Structure
1744 Dairy Flat Highway, Silverdale	Commercial/non-residential
1748 Dairy Flat Highway, Silverdale	Commercial/non-residential
1748A Dairy Flat Highway, Silverdale	Commercial/non-residential
1374 East Coast Road, Redvale, Auckland	Commercial/non-residential
1451 East Coast Road, Redvale, Auckland	Commercial/non-residential
1746 East Coast Road, Stillwater	Commercial/non-residential
2 Highgate Parkway, Wainui	Commercial/non-residential
20 Highgate Parkway, Silverdale	Commercial/non-residential
22 Highgate Parkway, Silverdale	Commercial/non-residential
30 Highgate Parkway, Silverdale	Commercial/non-residential
32 Highgate Parkway, Silverdale	Commercial/non-residential
24-28 Highgate Parkway, Silverdale	Commercial/non-residential
198 Lonely Track Road, Dairy Flat	Commercial/non-residential
143 Oteha Valley Road, Fairview Heights, Auckland	Commercial/non-residential
157 Oteha Valley Road, Fairview Heights, Auckland	Commercial/non-residential
52 Small Road, Silverdale	Commercial/non-residential
66 Small Road, Silverdale	Commercial/non-residential
87 Small Road, Silverdale	Commercial/non-residential
142 Top Road, Dairy Flat	Commercial/non-residential
1 Wilson Road, Dairy Flat	Commercial/non-residential
42 Wright Road, Dairy Flat	Commercial/non-residential

1.5 NoR 5

Address	Building Type/Structure
132 Top Road, Dairy Flat	Residential
143 Top Road, Dairy Flat	Residential
151 Top Road, Dairy Flat	Residential

1.6 NoR 6

Address	Building Type/Structure
11 Russell Road, Wainui	Residential
406 Wainui Road, Wainui	Residential
85 Upper Orewa Road, Wainui	Residential
90 Upper Orewa Road, Wainui	Residential

1.7 NoR 7

Address	Building Type/Structure
257 Pine Valley Road, Dairy Flat	Residential
10 Old Pine Valley Road, Dairy Flat	Residential
223 Pine Valley Road, Dairy Flat	Residential
195 Pine Valley Road, Dairy Flat	Residential

1.8 NoR 8

Address	Building Type/Structure
1321 Dairy Flat Highway, Dairy Flat	Residential
1686 Dairy Flat Highway, Dairy Flat	Residential
1680 Dairy Flat Highway, Dairy Flat	Residential
1349 Dairy Flat Highway, Dairy Flat	Residential
1615 Dairy Flat Highway, Dairy Flat	Residential
1452 Dairy Flat Highway, Dairy Flat	Residential
27 Green Road, Dairy Flat	Residential
25 Lynwood Grove, Dairy Flat	Residential
957 Dairy Flat Highway, Dairy Flat	Residential
1338 Dairy Flat Highway, Dairy Flat	Residential
1258 Dairy Flat Highway, Dairy Flat	Residential
1424 Dairy Flat Highway, Dairy Flat	Residential
1564A Dairy Flat Highway, Dairy Flat	Residential
792 Dairy Flat Highway, Dairy Flat	Residential
1008 Dairy Flat Highway, Dairy Flat	Residential
1306 Dairy Flat Highway, Dairy Flat	Residential

Address	Building Type/Structure
2 Horseshoe Bush Road, Dairy Flat	Residential
10 Bawden Road, Dairy Flat	Residential
1285 Dairy Flat Highway, Dairy Flat	Residential
41 Durey Road, Dairy Flat	Residential
12 Durey Road, Dairy Flat	Residential
1284 Dairy Flat Highway, Dairy Flat	Residential
1731 Dairy Flat Highway, Dairy Flat	Residential
1361 Dairy Flat Highway, Dairy Flat	Residential
1286 Dairy Flat Highway, Dairy Flat	Residential
1570 Dairy Flat Highway, Dairy Flat	Residential
1315 Dairy Flat Highway, Dairy Flat	Residential
4 Lascelles Drive, Dairy Flat	Residential
1355 Dairy Flat Highway, Dairy Flat	Residential
18 Langford Place, Dairy Flat	Residential
1584 Dairy Flat Highway, Dairy Flat	Residential
11 Jeffs Road, Dairy Flat	Residential
1550 Dairy Flat Highway, Dairy Flat	Residential
1182 Dairy Flat Highway, Dairy Flat	Residential
825 Dairy Flat Highway, Dairy Flat	Residential
1596 Dairy Flat Highway, Dairy Flat	Residential
1005A Dairy Flat Highway, Dairy Flat	Residential
2 Lynwood Grove, Dairy Flat	Residential
5 Postman Road, Dairy Flat	Residential
1 Richards Road, Dairy Flat	Residential
7 Landfill Access Road, Dairy Flat	Commercial
22 Langford Place, Dairy Flat	Residential
18 Wilks Road West, Dairy Flat	Residential
11 Durey Road, Dairy Flat	Residential
6 Kennedy Road, Dairy Flat	Residential
15 Wilks Road, Dairy Flat	Residential
1006 Dairy Flat Highway, Dairy Flat	Residential
1564 Dairy Flat Highway, Dairy Flat	Residential
1636 Dairy Flat Highway, Dairy Flat	Residential
785 Dairy Flat Highway, Dairy Flat	Residential
1700 Dairy Flat Highway, Dairy Flat	Residential
12 Postman Road, Dairy Flat	Residential
1617 Dairy Flat Highway, Dairy Flat	Residential
1250 Dairy Flat Highway, Dairy Flat	Residential
1646 Dairy Flat Highway, Dairy Flat	Residential
958 Dairy Flat Highway, Dairy Flat	Residential
1215 Dairy Flat Highway, Dairy Flat	Residential
1602A Dairy Flat Highway, Dairy Flat	Residential
859 Dairy Flat Highway, Dairy Flat	Residential
1660 Dairy Flat Highway, Dairy Flat	Residential
851 Dairy Flat Highway, Dairy Flat	Residential
16 Durey Road, Dairy Flat	Residential

Address	Building Type/Structure
20 Jeffs Road, Dairy Flat	Residential
1579A Dairy Flat Highway, Dairy Flat	Residential
6 Lynwood Grove, Dairy Flat	Residential
1153 Dairy Flat Highway, Dairy Flat	Residential
956 Dairy Flat Highway, Dairy Flat	Residential
20 Langford Place, Dairy Flat	Residential
883 Dairy Flat Highway, Dairy Flat	Residential
16 Langford Place, Dairy Flat	Residential
9 Goodland Drive, Dairy Flat	Residential
1412 Dairy Flat Highway, Dairy Flat	Residential
1016 Dairy Flat Highway, Dairy Flat	Residential
1448 Dairy Flat Highway, Dairy Flat	Residential
55 Kennedy Road, Dairy Flat	Residential
22 Lynwood Grove, Dairy Flat	Residential

1.9 NoR 9

Address	Building Type/Structure
430 Dairy Flat Highway, Albany Heights	Residential
2 Foley Quarry Road, Dairy Flat	Residential
623 Dairy Flat Highway, Dairy Flat	Residential
508 Dairy Flat Highway, Dairy Flat	Residential
452 Dairy Flat Highway, Albany Heights	Residential
2 Stevensons Crescent, Albany	Residential
473 Dairy Flat Highway, Lucas Heights	Residential
406 Dairy Flat Highway, Albany Heights	Residential
533 Dairy Flat Highway, Lucas Heights	Commercial
615 Dairy Flat Highway, Dairy Flat	Residential
449 Dairy Flat Highway, Lucas Heights	Residential
624 Dairy Flat Highway, Dairy Flat	Residential
341 Dairy Flat Highway, Lucas Heights	Residential
614 Dairy Flat Highway, Dairy Flat	Residential
459 Dairy Flat Highway, Lucas Heights	Residential
347 Dairy Flat Highway, Lucas Heights	Residential
349 Dairy Flat Highway, Lucas Heights	Residential
792 Dairy Flat Highway, Dairy Flat	Residential
345 Dairy Flat Highway, Lucas Heights	Residential
501 Dairy Flat Highway, Lucas Heights	Residential
461 Dairy Flat Highway, Lucas Heights	Residential
328 Dairy Flat Highway, Albany Heights	Residential
540 Dairy Flat Highway, Dairy Flat	Residential
448 Dairy Flat Highway, Albany Heights	Residential
3 Stevensons Crescent, Albany	Commercial
1 Potter Road, Dairy Flat	Residential
652 Dairy Flat Highway, Dairy Flat	Residential

Address	Building Type/Structure
1 Hobson Road, Lucas Heights	Residential
641 Dairy Flat Highway, Dairy Flat	Residential
316 Dairy Flat Highway, Albany Heights	Residential
664 Dairy Flat Highway, Dairy Flat	Residential
8 Stevensons Crescent, Albany	Residential
481 Dairy Flat Highway, Lucas Heights	Residential
785 Dairy Flat Highway, Dairy Flat	Residential
18 Albany Heights Road, Albany Heights	Residential
2 Potter Road, Dairy Flat	Residential
733 Dairy Flat Highway, Dairy Flat	Residential
310 Dairy Flat Highway, Albany Heights	Residential
471 Dairy Flat Highway, Lucas Heights	Residential
23 Agnew Place, Albany	Residential
529 Dairy Flat Highway, Lucas Heights	Commercial
12 Agnew Place, Albany	Residential
442 Dairy Flat Highway, Albany Heights	Residential
557 Dairy Flat Highway, Dairy Flat	Residential
668 Dairy Flat Highway, Dairy Flat	Residential
508B Dairy Flat Highway, Dairy Flat	Residential

1.10 NoR 10

Address	Building Type/Structure
315 Wainui Road, Wainui	Residential
42 Kowhai Road, Wainui	Residential
411 Wainui Road, Wainui	Residential
362 Wainui Road, Wainui	Residential
330 Wainui Road, Wainui	Residential
406 Wainui Road, Wainui	Residential
480 Wainui Road, Wainui	Residential
379 Wainui Road, Wainui	Residential
411 Wainui Road, Wainui	Residential

1.11 NoR 11

Address	Building Type/Structure
1424 Dairy Flat Highway, Dairy Flat	Residential
65 Lascelles Drive, Dairy Flat	Residential
1452 Dairy Flat Highway, Dairy Flat	Residential
12 Kahikatea Flat Road, Dairy Flat	Residential
174 Wilks Road, Dairy Flat	Residential
10 Kahikatea Flat Road, Dairy Flat	Residential
1440 Dairy Flat Highway, Dairy Flat	Residential
332 Postman Road, Dairy Flat	Residential

Address	Building Type/Structure
2 Horseshoe Bush Road, Dairy Flat	Residential
343 Postman Road, Dairy Flat	Residential
16 Kahikatea Flat Road, Dairy Flat	Residential
325 Postman Road, Dairy Flat	Residential
132 Wilks Road, Dairy Flat	Residential
349 Postman Road, Dairy Flat	Residential
1432 Dairy Flat Highway, Dairy Flat	Residential
1448 Dairy Flat Highway, Dairy Flat	Residential
323 Postman Road, Dairy Flat	Residential
1443 Dairy Flat Highway, Dairy Flat	Commercial
1433 Dairy Flat Highway, Dairy Flat	Commercial
2 Kahikatea Flat Road, Dairy Flat	Commercial
15 Kahikatea Flat Road, Dairy Flat	Commercial
11 Kahikatea Flat Road, Dairy Flat	Commercial
16 Kahikatea Flat Road, Dairy Flat	Commercial
9 Kahikatea Flat Road, Dairy Flat	Commercial

1.12 NoR 12

Address	Building Type/Structure
63 Bawden Road, Dairy Flat	Residential
152 Bawden Road, Dairy Flat	Residential
351 Bawden Road, Dairy Flat	Residential
119 Bawden Road, Dairy Flat	Residential
335 Bawden Road, Dairy Flat	Residential
59 Bawden Road, Dairy Flat	Residential
166 Bawden Road, Dairy Flat	Residential
38 Bawden Road, Dairy Flat	Residential
1006 Dairy Flat Highway, Dairy Flat	Residential
49 Top Road, Dairy Flat	Residential
41 Top Road, Dairy Flat	Residential
218 Bawden Road, Dairy Flat	Residential
74 Bawden Road, Dairy Flat	Residential
99 Bawden Road, Dairy Flat	Residential
135 Bawden Road, Dairy Flat	Residential
357 Bawden Road, Dairy Flat	Residential
40 Top Road, Dairy Flat	Residential
2 Bobs Way, Dairy Flat	Residential
264 Bawden Road, Dairy Flat	Residential
34 Top Road, Dairy Flat	Residential
320 Bawden Road, Dairy Flat	Residential
77 Bawden Road, Dairy Flat	Residential
358 Bawden Road, Dairy Flat	Residential
83 Bawden Road, Dairy Flat	Residential
120 Bawden Road, Dairy Flat	Residential

1.13 NoR 13

Address	Building Type/Structure
57 Kea Road, Silverdale	Residential
37 Kea Road, Silverdale	Residential
55 Kea Road, Silverdale	Residential
39 Kea Road, Silverdale	Residential
31 Kea Road, Silverdale	Residential
41 Kea Road, Silverdale	Residential
33 Kea Road, Silverdale	Residential
29 Kea Road, Silverdale	Residential
27 Kea Road, Silverdale	Residential
25 Kea Road, Silverdale	Residential
23 Kea Road, Silverdale	Residential
53 Kea Road, Silverdale	Residential
19 Kea Road, Silverdale	Residential
21 Kea Road, Silverdale	Residential
17 Kea Road, Silverdale	Residential
15 Kea Road, Silverdale	Residential
13 Kea Road, Silverdale	Residential
11 Kea Road, Silverdale	Residential
9 Kea Road, Silverdale	Residential
43 Kea Road, Silverdale	Residential
35 Kea Road, Silverdale	Residential
7 Kea Road, Silverdale	Residential
5 Kea Road, Silverdale	Residential
3 Kea Road, Silverdale	Residential
51 Kea Road, Silverdale	Residential
1 Kea Road, Silverdale	Residential
49 Kea Road, Silverdale	Residential
47 Kea Road, Silverdale	Residential
45 Kea Road, Silverdale	Residential
2118 East Coast Road, Stillwater	Residential
2157 East Coast Road, Stillwater	Residential
1914 East Coast Road, Stillwater	Residential
1959 East Coast Road, Stillwater	Residential
1787 East Coast Road, Stillwater	Residential
8 Jackson Way, Stillwater	Residential
2104 East Coast Road, Stillwater	Residential
1838 East Coast Road, Stillwater	Residential
2127 East Coast Road, Stillwater	Residential
1791 East Coast Road, Stillwater	Residential
2109 East Coast Road, Stillwater	Residential
1853 East Coast Road, Stillwater	Residential
1837 East Coast Road, Stillwater	Residential
1824 East Coast Road, Stillwater	Residential
2087 East Coast Road, Stillwater	Residential

Address	Building Type/Structure
60 Kea Road, Silverdale	Residential
2077 East Coast Road, Stillwater	Residential
1832 East Coast Road, Stillwater	Residential
1778 East Coast Road, Stillwater	Residential
58 Kea Road, Silverdale	Residential
2083 East Coast Road, Stillwater	Residential
56 Kea Road, Silverdale	Residential
1958 East Coast Road, Stillwater	Residential
1871 East Coast Road, Stillwater	Residential
54 Kea Road, Silverdale	Residential
1971 East Coast Road, Stillwater	Residential
10 Newman Road, Stillwater	Residential
2 Kea Road, Silverdale	Residential
55 Mita Road, Silverdale	Residential
52 Kea Road, Silverdale	Residential
4 Kea Road, Silverdale	Residential
6 Kea Road, Silverdale	Residential
8 Kea Road, Silverdale	Residential
10 Kea Road, Silverdale	Residential
12 Kea Road, Silverdale	Residential
14 Kea Road, Silverdale	Residential
16 Kea Road, Silverdale	Residential
18 Kea Road, Silverdale	Residential
20 Kea Road, Silverdale	Residential
22 Kea Road, Silverdale	Residential
53 Mita Road, Silverdale	Residential
24 Kea Road, Silverdale	Residential
26 Kea Road, Silverdale	Residential
38 Kea Road, Silverdale	Residential
28 Kea Road, Silverdale	Residential
42 Kea Road, Silverdale	Residential
36 Kea Road, Silverdale	Residential
30 Kea Road, Silverdale	Residential
32 Kea Road, Silverdale	Residential
40 Kea Road, Silverdale	Residential
34 Kea Road, Silverdale	Residential
44 Kea Road, Silverdale	Residential
50 Kea Road, Silverdale	Residential
48 Kea Road, Silverdale	Residential
2 Spur Road, Stillwater	Residential
46 Kea Road, Silverdale	Residential
1746 East Coast Road, Stillwater	Residential
51 Mita Road, Silverdale	Residential
49 Mita Road, Silverdale	Residential
1797 East Coast Road, Stillwater	Residential
1910 East Coast Road, Stillwater	Residential

Address	Building Type/Structure
47 Mita Road, Silverdale	Residential
1921 East Coast Road, Stillwater	Residential
45 Mita Road, Silverdale	Residential
1 Mita Road, Silverdale	Residential
3 Mita Road, Silverdale	Residential
5 Mita Road, Silverdale	Residential
7 Mita Road, Silverdale	Residential
9 Mita Road, Silverdale	Residential
11 Mita Road, Silverdale	Residential
13 Mita Road, Silverdale	Residential
15 Mita Road, Silverdale	Residential
43 Mita Road, Silverdale	Residential
17 Mita Road, Silverdale	Residential
19 Mita Road, Silverdale	Residential
21 Mita Road, Silverdale	Residential
23 Mita Road, Silverdale	Residential
25 Mita Road, Silverdale	Residential
27 Mita Road, Silverdale	Residential
39 Mita Road, Silverdale	Residential
37 Mita Road, Silverdale	Residential
29 Mita Road, Silverdale	Residential
35 Mita Road, Silverdale	Residential
31 Mita Road, Silverdale	Residential
33 Mita Road, Silverdale	Residential
41 Mita Road, Silverdale	Residential
1826 East Coast Road, Stillwater	Residential
2065A East Coast Road, Stillwater	Residential
2065 East Coast Road, Stillwater	Residential
17 Hibiscus Coast Highway, Silverdale	Commercial
13/2181 East Coast Road, Silverdale	Commercial
47 Tavern Road, Silverdale	Commercial
9/2181 East Coast Road, Silverdale	Commercial
2200 East Coast Road, Silverdale	Commercial
13/2181 East Coast Road, Silverdale	Commercial
19 Tavern Road, Silverdale	Commercial
6/2181 East Coast Road, Silverdale	Commercial
91A Small Road, Silverdale	Commercial
18 Hibiscus Coast Highway, Silverdale	Commercial
2 David McCathie Place, Silverdale	Commercial
14 David McCathie Place, Silverdale	Commercial
8 David McCathie Place, Silverdale	Commercial

2 Appendix B – Receivers predicted to received vibration levels exceeding 5mm/s PPV

2.1 NoR 2

Address	Building Type/Structure
100 Ahutoetoe Road, Wainui	Residential
102 Ahutoetoe Road, Wainui	Residential
1 John Fair Drive, Wainui	Residential

2.2 NoR 4

Address	Building Type/Structure
3 Ahorangi Road, Silverdale	Residential
5 Ahorangi Road, Silverdale	Residential
7 Ahorangi Road, Silverdale	Residential
9 Ahorangi Road, Silverdale	Residential
11 Ahorangi Road, Silverdale	Residential
13 Ahorangi Road, Silverdale	Residential
15 Ahorangi Road, Silverdale	Residential
17 Ahorangi Road, Silverdale	Residential
19 Ahorangi Road, Silverdale	Residential
21 Ahorangi Road, Silverdale	Residential
23 Ahorangi Road, Silverdale	Residential
25 Ahorangi Road, Silverdale	Residential
1B Ahorangi Road, Silverdale	Residential
1E Ahorangi Road, Silverdale	Residential
5 Ash Avenue, Fairview Heights, Auckland	Residential
5 Ash Avenue, Fairview Heights, Auckland	Residential
24 Cherry Hill, Fairview Heights, Auckland	Residential
29 Dahlia Drive, Fairview Heights, Auckland	Residential
35 Dahlia Drive, Fairview Heights, Auckland	Residential
39 Elm Haven, Fairview Heights, Auckland	Residential
44 Elm Haven, Fairview Heights, Auckland	Residential
49 Fuschia Lane, Fairview Heights, Auckland	Residential

Address	Building Type/Structure
55 Fuschia Lane, Fairview Heights, Auckland	Residential
60 Gardenia Grove, Fairview Heights, Auckland	Residential
61 Gardenia Grove, Fairview Heights, Auckland	Residential
65 Hibiscus Crescent, Fairview Heights, Auckland	Residential
66 Hibiscus Crescent, Fairview Heights, Auckland	Residential
81 Iris Watch, Fairview Heights, Auckland	Residential
81 Iris Watch, Fairview Heights, Auckland	Residential
19 Jack Hawken Lane, Silverdale	Residential
21 Jack Hawken Lane, Silverdale	Residential
23 Jack Hawken Lane, Silverdale	Residential
4 Lancia Way, Oteha, Auckland	Residential
6 Lancia Way, Oteha, Auckland	Residential
7 Lancia Way, Oteha, Auckland	Residential
1 Masons Road, Oteha, Auckland	Residential
17 Meridian Court, Oteha, Auckland	Residential
19 Meridian Court, Oteha, Auckland	Residential
23 Meridian Court, Oteha, Auckland	Residential
1226 East Coast Road, Redvale, Auckland	Commercial
21 Fairview Avenue, Fairview Heights, Auckland	Commercial
32 Highgate Parkway, Silverdale	Commercial
1 Wilson Road, Dairy Flat	Commercial

2.3 NoR 8

Address	Building Type/Structure
1321 Dairy Flat Highway, Dairy Flat	Residential
1686 Dairy Flat Highway, Dairy Flat	Residential
1680 Dairy Flat Highway, Dairy Flat	Residential
1349 Dairy Flat Highway, Dairy Flat	Residential

2.4 NoR 9

Address	Building Type/Structure
430 Dairy Flat Highway, Albany Heights	Residential
2 Foley Quarry Road, Dairy Flat	Residential
623 Dairy Flat Highway, Dairy Flat	Residential
508 Dairy Flat Highway, Dairy Flat	Residential
452 Dairy Flat Highway, Albany Heights	Residential

2.5 NoR 13

Address	Building Type/Structure
57 Kea Road, Silverdale	Residential
17 Hibiscus Coast Highway, Silverdale	Commercial
37 Kea Road, Silverdale	Residential
55 Kea Road, Silverdale	Residential
39 Kea Road, Silverdale	Residential
31 Kea Road, Silverdale	Residential
41 Kea Road, Silverdale	Residential
33 Kea Road, Silverdale	Residential
29 Kea Road, Silverdale	Residential
27 Kea Road, Silverdale	Residential
25 Kea Road, Silverdale	Residential
23 Kea Road, Silverdale	Residential
53 Kea Road, Silverdale	Residential
19 Kea Road, Silverdale	Residential
21 Kea Road, Silverdale	Residential
17 Kea Road, Silverdale	Residential
15 Kea Road, Silverdale	Residential
13 Kea Road, Silverdale	Residential
11 Kea Road, Silverdale	Residential
9 Kea Road, Silverdale	Residential
43 Kea Road, Silverdale	Residential
35 Kea Road, Silverdale	Residential
7 Kea Road, Silverdale	Residential
5 Kea Road, Silverdale	Residential
3 Kea Road, Silverdale	Residential
51 Kea Road, Silverdale	Residential
1 Kea Road, Silverdale	Residential
49 Kea Road, Silverdale	Residential
47 Kea Road, Silverdale	Residential
45 Kea Road, Silverdale	Residential