

Warkworth

Assessment of Traffic Noise and Vibration Effects

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Responsibility	Name
Author	Jack Robinson, Claire Drewery
Reviewer	Siiri Wilkening
Approver	Simon Titter

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Glossary of Defined Terms and Acronyms

Acronym/Term	Description
AADT	Annual Average Daily Traffic
AC	Auckland Council
AEE	Assessment of Effects on the Environment report
AT	Auckland Transport
AUP:OP	Auckland Unitary Plan: Operative in Part
BPO	Best Practicable Option
FUZ	Future Urban Zone
N/A	Not Applicable
NOR	Notice of Requirement
NOR 1	Northern Public Transport Hub and Western Link – North
NOR 2	Woodcocks Road (Western Section)
NOR 3	State Highway 1 – South
NOR 4	Matakana Road
NOR 5	Sandspit Road
NOR 6	Western Link - South
NOR 7	Sandspit Link
NOR 8	Wider Western Link – North
NZ	New Zealand
RMA	Resource Management Act 1991
SH1	State Highway 1
Te Tupu Ngātahi	Te Tupu Ngātahi Supporting Growth Alliance
Waka Kotahi	Waka Kotahi New Zealand Transport Agency

1 Executive Summary

1.1.1.1 Overview

The Warkworth Assessment Package is a network of planned transport infrastructure with the purpose of responding to planned future growth in the Warkworth growth areas. The transport network is made of eight NORs including new corridors, existing road upgrades, and a public transport interchange with park and ride (NOR 1). The table below provides an overview of each NOR.

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

1.1.1.2 Assessment undertaken

This report provides an assessment of road traffic noise effects for the Warkworth Assessment Package.

The report contains a review of the relevant traffic noise criteria and discussion of the appropriate criteria and assessment methodology for the Projects. Predictions of road traffic noise were carried out using the method recommended in NZS 6806 in accordance with rule E25.6.33 of the Auckland Unitary Plan – Operative in Part (AUP:OP).

The assessment of effects undertaken was two-fold: in accordance with NZS 6806 and in relation to the predicted noise level changes comparing the future traffic noise levels with and without the Project.

As required by NZS 6806, the assessment methodology included the prediction of existing and future traffic noise levels, both without (Existing and Do Nothing scenarios) and with the Projects with no acoustic mitigation applied (Do Minimum scenario).

The Existing scenario represents the current road network with current traffic volumes, i.e. the existing environment as it is experienced now. The Do Nothing scenario represents the current road network with future traffic volumes, assuming a full build out of the area. The Do Minimum scenario represents the proposed future road network, incorporating NoRs 1 to 8 and other transport projects in the area.

This scenario also assumes a full build out of the area, and the transport infrastructure to support the development. This is a realistic scenario at a point in time when all NoRs are operational.

Noise effects of road traffic on existing noise sensitive locations, referred to as Protected Premises and Facilities (PPFs) within NZS 6806, have been assessed. PPFs within a 100m radius from the edge of the nearest traffic lane have been assessed as all projects fall under urban areas as defined by Statistics New Zealand. Where project areas are considered Altered Roads, these have been assessed by comparing the predicted noise levels in the design year without the Projects (Do Nothing) with the predicted noise levels in the design year with the Projects (Do Minimum). Project areas considered to be New Roads have been assessed by comparing the predicted Existing noise levels with the Do Minimum predictions. Where New Roads intersect with existing roads, PPFs within 100m of the intersection have been assessed against the Altered Roads criteria.

Each PPF has been assessed against Noise Criteria Categories as set out in NZS 6806, with Category A setting the most stringent external noise criteria and being the preferred category. Where this cannot practicably be achieved, then Category B is the next preferred with higher external noise criteria. Category C, an internal noise criterion, is the least preferred category and should only be applied where external noise levels cannot practicably be reduced any further. Where Category A noise levels can be achieved, no further mitigation is required.

Since the projects are not anticipated to be built until they are required to service the anticipated growth in Warkworth, the Best Practice Option (BPO) will be confirmed for all current PPFs, at the time of construction. The review, confirmation, and refinement of the BPO will aim to achieve the same noise criteria categories as determined with the recommended mitigation as presented in Appendix 1.

In addition to an assessment against the Noise Criteria Categories of NZS 6806, each Project is also assessed against the change in noise level without and with the implementation of a new project, and a general subjective response is applied to the predicted change.

Dwellings or other noise sensitive activities that are not yet built or do not have building consent, are not included in the modelling, however noise levels at the currently vacant land are provided in the noise contour maps within the Appendices and are indicative of the potential noise environment for that land.

For NoR 1, noise from the interchange facility has been assessed against the noise criteria corresponding to expected future zoning at the boundaries of the site.

Traffic from new or upgraded roading projects is not generally expected to create any vibration issues. The smooth and even surface typical of urban roads would likely generate no more than negligible traffic vibration impacts. Therefore, traffic vibration has not been assessed for the Projects.

1.1.1.3 Assessment assumptions

All predictions are based on traffic flows along New and Altered roads at the Design Year (2048). These traffic volumes rely on the urbanisation of the area and implementation of surrounding transport projects.

The traffic noise effects from the Projects assume that all NoRs are operational together, e.g. when the design year of NOR 2 is reached, NORs 3 to 8 are also operational. No allowance was made for individual NORs being implemented, or some NORs not being implemented at all. This is due to two

reasons; the transport models did not allow for these options, and the individual or combined assessment of NORs would lead to a large number of combinations that could not all be assessed. Therefore, the decision was made to assess the furthest point in time when all surrounding areas were developed to capacity and the associated road network.

Development of the surrounding areas and urbanisation of the receiving environment over time will likely increase activity and associated ambient noise levels. Therefore, any significant change predicted in this assessment may not hold the same significance at the Design Year, due to the change in environment at the time of construction.

As such, the results are indicative of a possible future scenario, but effects cannot be definitively determined at this stage. Reassessment of the road traffic noise at PPFs covered in this report should be carried out nearer the time of construction to determine if the recommended BPO is still relevant at the time of construction.

1.1.1.4 NOR 1 - Northern Public Transport Hub and Western Link - North

An assessment of operational noise from the Northern public transport hub and PT hub section of the Western Link - North during peak hours was carried out based on indicative information for the peak hours as provided by the Project team.

The predictions indicate that the most stringent AUP:OP night-time noise criteria will be met at adjacent existing and likely future receivers during operation of the facility.

1.1.1.5 NOR 2 – Woodcocks Road (Western Section)

The project proposes the upgrade of Woodcocks Road to a two lane urban arterial cross-section with cycle lanes and footpaths on both sides of the corridor.

An initial screening assessment has been carried out and the Woodcocks Road Upgrade (Western Section) does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. The Standard therefore does not apply, and mitigation options do not need to be considered.

A comparison of the predicted road traffic noise levels in the Do Nothing scenario (representative of the design year without the Project) and the Do Minimum scenario (representative of the design year with the Project) indicates that noise level changes will be negligible for the majority of PPFs.

1.1.1.6 NOR 3 – State Highway 1 – South

The existing SH1 corridor in which NOR 3 (SH1 – South) is located extends from the Northern Gateway Toll Road, Silverdale in the south to its intersection with Auckland Road in the northeast. The proposed upgrades covered by NOR 3 extend from the Rural Urban Boundary (RUB) in the south to the intersection with Fairwater Road in the north. The SH1 (south) upgrade involves the urbanisation of the corridor to a two-lane urban arterial with cycle lanes and footpaths on both sides of the entire corridor length.

Road traffic noise levels have been assessed in accordance with NZS 6806. Under the Do Minimum scenario, five PPFs are in Category B, with the remaining PPFs in Category A. With the recommended mitigation of a low noise road surface, all PPFs fall into Category A.

A comparison of the predicted road traffic noise levels for Altered roads in the Do Nothing scenario (representative of the design year without the Project) and the Mitigation scenario (representative of the design year with the Project and the implementation of an AC-14 road surface) indicates that noise level changes will be positive for the majority of PPFs.

1.1.1.7 NOR 4 – Matakana Road

Road traffic noise levels have been assessed in accordance with NZS 6806 for the Matakana Road Upgrade. Under the Do Minimum scenario, one PPF is in Category C, four PPFs are in Category B with the rest in Category A. With the recommended mitigation option of AC-14 low noise road surface implemented, all PPFs fall into Category A.

A comparison of the predicted road traffic noise levels in the Do Nothing scenario (representative of the design year without the Project) and the Mitigation scenario (representative of the design year with the Project and the implementation of an AC-14 road surface) indicates that noise level changes will be negligible for the majority of PPFs.

1.1.1.8 NOR 5 – Sandspit Road

The project proposes the upgrade of Sandspit Road to a two lane urban arterial cross-section with cycle lanes and footpaths on both sides of the corridor

An initial screening assessment has been carried out and the Woodcocks Road Upgrade (Western Section) does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. The Standard therefore does not apply, and mitigation options do not need to be considered. All PPFs in this scenario would fall into Category A.

A comparison of the predicted road traffic noise levels in the Do Nothing scenario and the Do Minimum scenario indicates that noise level changes will be negligible for the majority of PPFs.

1.1.1.9 NOR 6 – Western Link - South

The project proposes a new two lane urban arterial cross-section with cycle lanes and footpaths on both sides of the corridor.

NOR 6 contains both Altered and New roads. The Altered roads in this NOR did not meet the definition of an Altered Road according to NZS 6806, so mitigation measures were not investigated further for these sections.

For New roads under the Do Minimum scenario the majority of PPFs are in Category A with four in Category B. A noise barrier was considered for the four Category B PPFs, however, its performance would be compromised by the gap required to maintain access from the road. A low noise road surface, AC-14, is already included as the Do Minimum road surface. Noise levels are predicted to increase at all PPFs under the Do Minimum scenario.

A comparison of the predicted road traffic noise levels for Altered roads in the Do Nothing scenario and the Do Minimum scenario indicates that noise level changes will be negligible for the majority of PPFs if the Project were constructed, with all PPFs falling into Category A.

1.1.1.10 NOR 7 – Sandspit Link

The project proposes a new two lane urban arterial cross-section with cycle lanes and footpaths on both sides of the corridor.

NOR 7 contains both Altered and New roads. For Altered roads under the Do Minimum scenario, noise level changes are predicted to be negligible for both PPFs under consideration, with both falling into Category A. The Altered roads in this NOR did not meet the definition of an Altered Road according to NZS 6806, so mitigation measures were not investigated for these sections.

A comparison of the predicted road traffic noise levels for New roads in the Existing and the Do Minimum scenarios indicates that changes in noise levels are likely to be negligible at all three PPFs. For the Altered Roads, the comparison of the Do Nothing and Do Minimum scenarios shows a slight to moderate positive effect for both PPFs. All PPFs fall into Category A under the Do Minimum scenario.

1.1.1.11 NOR 8 – Wider Western Link – North

The project proposes a new two lane urban arterial cross-section with walking and cycling facilities on both sides of the corridor.

NOR 8 contains both New and Altered roads. For the Altered roads under the Do Minimum scenario, noise level changes are predicted to be moderately positive at one PPF, and slightly adverse at the other PPF. However, both PPFs would fall into Category A. The Altered roads in this NoR did not meet the definition of an Altered Road according to NZS 6806, so mitigation measures were not investigated for these sections.

A comparison of the predicted road traffic noise levels for the New roads in the Existing scenario and the Do Minimum scenario indicates that changes in noise levels are likely to be substantially adverse at the one PPF under consideration. However, it should be noted that this PPF would still fall into Category A.

2 Introduction

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

2.1 Warkworth Growth Area

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

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

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

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

The Warkworth Assessment Package will provide route protection for the local arterials, which include walking, cycling and public transport linkages needed to support the expected growth in Warkworth. The Warkworth Package of projects is summarised in Section 6.

This report addresses the traffic noise effects of the Warkworth Package (NOR 1 – NOR 8) identified in Table 6-1 and Figure 6-1 in Section 6.

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

2.2 Purpose and scope of this Report

This traffic noise assessment forms part of the suite of technical reports prepared to support the assessment of effects (AEE) for the Warkworth Package. Its purpose is to inform the AEE that accompanies the eight Warkworth Network NoRs sought by AT.

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

The key matters addressed in this report are as follows:

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

This report should be read alongside the AEE, which contains further details on the history and context of the Warkworth project.

2.3 Report Structure

In order to provide a clear assessment of each NoR, this report follows as appropriate, the structure set out in the AEE. This report contains an assessment of the actual and potential traffic noise effects of the Warkworth project on an overall network basis. Where appropriate, measures to avoid, remedy or mitigate effects are recommended. The sections of this report are arranged accordingly. Table 2-1 below provides an overview of the report structure and where the description of effects can be found in this report.

Table 2-1. Report Structure

Sections	Section number
Description of the Project	6
Overview of the methodology used to undertake the assessment and identification of the assessment criteria and any relevant standards or guidelines	4
Identification and description of the existing and likely receiving noise environment;	5
Assessment of specific traffic noise matters for Warkworth NOR 1	6.1
Assessment of specific traffic noise matters for Warkworth NOR 2	7
Assessment of specific traffic noise matters for Warkworth NOR 3	8
Assessment of specific traffic noise matters for Warkworth NOR 4	9
Assessment of specific traffic noise matters for Warkworth NOR 5	10
Assessment of specific traffic noise matters for Warkworth NOR 6	11
Assessment of specific traffic noise matters for Warkworth NOR 7	12

Sections	Section number
Assessment of specific traffic noise matters for Warkworth NOR 8	13
Overall conclusion of the level of potential adverse traffic noise effects of the Warkworth Project	14

3 Assessment Criteria

3.1 Road Traffic Noise

Rule E25.6.33 of the Auckland Unitary Plan (AUP:OP) requires that New Roads and Altered Roads which are within the scope of NZS 6806:2010¹ comply with the requirements of that standard. The assessment of NORs 2 to 8 has used NZS 6806. NOR 1 is assessed against the provisions of the AUP:OP (refer section 3.2).

NZS 6806 provides criteria and an assessment method for road-traffic noise. The standard is a tool which provides performance targets and requires assessment of different options for noise mitigation (ranging from low-noise road surfaces and barriers to building modification mitigation). The performance targets in NZS 6806 are set to achieve reasonable noise levels considering adverse health effects associated with noise on people and communities, the effects of relative changes in noise levels, and the potential benefits of New and Altered Roads. NZS 6806 is an appropriate tool to assess road traffic noise from the Projects as it provides a suitable and tested traffic noise assessment and mitigation methodology and includes relevant noise criteria.

NZS 6806 is not applicable to New and Altered Roads predicted to carry less than an Annual Average Daily Traffic (“AADT”) of 2000 at the design year, or where the change in noise level due to a project (i.e. the horizontal or vertical realignment of a road) does not reach certain thresholds of effects (e.g. a change of at least 3 dB for at least one PPF).

To be defined as an Altered Road in accordance with NZS 6806 the following must apply:

- The Do Minimum noise environment would be greater than or equal to 64 dB $L_{Aeq(24h)}$ and, if no specific noise mitigation was undertaken, the alterations would increase road-traffic noise at the assessment position by 3 dB $L_{Aeq(24h)}$ or more at the design year, when compared with the Do Nothing noise environment; or
- The Do Minimum noise environment is greater than or equal to 68 dB $L_{Aeq(24h)}$ and, if no specific noise mitigation was undertaken, the alterations would increase road-traffic noise at the assessment position by 1 dB $L_{Aeq(24h)}$ or more at the design year, when compared with the do-nothing noise environment.

3.1.1 Protected premises and facilities

NZS 6806 requires noise effects to be assessed at noise sensitive locations within set distances of any project. These locations are known as protected premises and facilities (PPFs), and include existing houses, schools, marae and various other premises as defined in NZS 6806. Commercial and industrial premises do not fall within the definition of a PPF. Future (unbuilt) noise-sensitive premises are also not PPFs, unless they have already been granted building consent at the time of assessment.

The distances from the road within which properties are considered to be PPFs is set in the standard as:

- Urban Areas – 100 metres from the edge of the nearside traffic lane.

¹ New Zealand Standard 6806:2010 Acoustics - Road-traffic noise – New and altered roads

- Rural Areas – 200 metres from the edge of the nearside traffic lane.

The Project extent falls within an Urban Area as defined by Statistics New Zealand² and therefore PPFs within 100 metres of the Project's road alignments have been assessed in this report. Buildings outside of these areas have not been assessed.

The assessment distance of 100 metres ensures the assessment is made at the most relevant receivers. Potential noise effects are still controlled at receivers further away by virtue of noise criteria applying at receivers nearest to the road.

3.1.2 Noise Prediction Scenarios

NZS 6806 specifies scenarios to be undertaken which include the following:

- The “Existing noise environment”, which is the ambient noise levels at the date of assessment.
- A “Do Nothing” scenario, which represents the traffic noise levels at the PPFs at the design year assuming no alterations are made to the existing road.
- A “Do Minimum” scenario, which represents the traffic noise levels at the PPFs at the design year with the Project implemented, but without any specific noise mitigation. Road surfaces, safety barriers and other structures which are required for non-acoustic purposes may provide incidental noise mitigation and are included in this scenario.
- “Mitigation” scenarios, which represent the traffic noise levels at the PPFs at the design year with various specific noise mitigation options implemented with the aim of achieving the noise criteria categories.

The Do Nothing scenario includes the growth of the surrounding area without the Project but with other projects planned to be implemented by 2048. In practice, this would be an unrealistic scenario as the future growth at full build out at the design year (2048) could not occur without the existing rural transport network being upgraded to urban standards. We also understand that the current road network could not cope with the future traffic volumes, as these volumes would lead to link and intersection delays. Therefore, while the predictions suggest a significant increase in noise level in the Do Nothing scenario compared with the Existing scenario, this would likely be unrealistic.

The Do Minimum scenario represents the proposed future road network, incorporating NoRs 1 to 8 and other transport projects in the area (refer to the discussion on Assessment Assumptions in Appendix A below). This scenario assumes a full build out of the area, and the transport infrastructure to support the development. This is a realistic scenario at a point in time when all NoRs are operational. Considering the wider distribution of future traffic over an increased road network enabled by the NoRs, traffic volumes appear to reduce on individual roads when compared with the (theoretical) Do Nothing scenario.

3.1.3 NZS 6806 Noise Criteria

For each of the Projects the noise criteria as summarised below are applicable.

² New Zealand: An Urban/Rural profile, Statistics New Zealand

Table 3-1: NZS 6806 noise criteria

Category	Criterion	Altered Road	New Roads with a predicted traffic volume of 2000 to 75000 AADT at the design year
A	Primary	64 dB $L_{Aeq(24h)}$	57 dB $L_{Aeq(24h)}$
B	Secondary	67 dB $L_{Aeq(24h)}$	64 dB $L_{Aeq(24h)}$
C	Internal	40 dB $L_{Aeq(24h)}$	40 dB $L_{Aeq(24h)}$

Section 6.2 of NZS 6806 is applicable to Projects in the Warkworth Assessment Package where it states:

6.2.1 *In certain circumstances it may be more appropriate to apply one of the sets of criteria to some assessment positions affected by a project, and another set of criteria to other assessment positions affect by the same project.*

Such circumstances may include, but are not limited to:

- a) *An intersection between a new or altered road and an existing road;*
- b) *A ‘tie-in’, ‘transition’, or merger’ where a new or altered road reconnects with an existing road; or*
- c) *Where any PPFs are significantly affected by noise from another existing road in the vicinity.*

6.2.2 *Where PPFs are affected by noise from an existing road, mitigation is only required for road-traffic noise generated on the new or altered road.*

The Warkworth Assessment Package has both “Altered Roads” and “New Roads” as defined by NZS 6806.

Altered Roads include existing SH1 - South, Matakana Road, Sandspit Road, and Woodcocks Road. For these roads, the noise predictions for the NZS 6806 assessment did not include the surrounding road network for the Do Minimum scenario, as Section 6.2.2 of the Standard states that mitigation is only required for traffic noise generated on the altered road. The surrounding road network was included in the noise predictions for all scenarios for the assessments of road traffic noise effects in relation to the change in noise level.

The three new roads that are proposed to be built are Sandspit Link, Western Link - South, and Wider Western Link - North. These roads have been assessed as a “New Road” under NZS 6806.

Where the New Road Projects listed above intersect with an existing road, all PPFs within 100m of the existing road are assessed against the “Altered Road” criteria. PPFs located beyond this distance but still within 100m of the new road alignment are subject to the “New Road” criteria.

3.1.4 Design Year

The criteria apply at a design year 10 to 20 years after the completion of a project. In this case the opening year has not yet been determined. For these Projects, the year 2048 has been selected as the design year for assessment purposes for the following reasons:

- The design year traffic data incorporates and assumes all other projects (funded and otherwise) in the Warkworth area have been constructed.
- The 2048 design year, whilst not the most conservative scenario in terms of the traffic volume for every Project road, provides the most complete overview reflective of the development intended for the areas. If some projects do not go ahead then traffic flows within the Project alignment will likely change. Nearer the time of detailed design and construction, traffic noise will need to be reassessed.

The decision to use 2048 as the design year was made in conjunction with the Project team. A full list of assumptions included within the design year has been included in Appendix A.

3.1.5 Noise Mitigation

NZS 6806 requires that noise mitigation options are assessed, and if practicable, noise levels within Category A should be achieved. If this is not practicable then mitigation should be assessed against Category B. However, if it is still not practicable to comply with categories A or B then mitigation should be implemented to ensure the internal criterion in Category C is achieved. Depending on the external noise level, building modification mitigation to achieve Category C could include ventilation and/or noise insulation improvements ranging from upgraded glazing through to new wall and ceiling linings. Building modification mitigation of Category C should only be implemented after the lowest practicable external noise level has been achieved. This means that structural mitigation such as road surface or barriers may also be implemented.

Where a requirement to consider mitigation measures is identified, NZS 6806 states that structural mitigation (low-noise road surfaces and noise barriers) should only be implemented if it achieves the following:

- a) An average reduction of at least 3 dB $L_{Aeq(24h)}$ at relevant assessment positions of all PPFs which are part of a cluster; or
- b) A minimum reduction of 5 dB $L_{Aeq(24h)}$ at any assessment position(s) for each PPF not in a cluster.

In circumstances where noise mitigation is warranted, NZS 6806 adopts a “Best Practicable Option” (BPO) approach. BPO considers the extent to which a mitigation option will achieve compliance with the relevant noise criteria and result in a noticeable noise reduction at assessment locations. The value-for-money of the option and the potential visual, shading and safety effects are also considered, amongst other things.

3.1.6 Road Traffic Vibration

Traffic vibration from new or upgraded roading projects is not generally expected to create issues. A key factor with new roads is the uniformity of the basecourse/pavement and the absence of near surface services. This is due to new or upgraded roads being designed to be smooth and even and avoiding vibration generated from passing traffic over uneven surfaces. Therefore, traffic vibration effects arising from operation of the Projects has not been assessed further.

3.2 Interchange Facility Noise

Road traffic noise originating from carparks and transit facilities is not covered by NZS 6806. The noise criteria for the underlying and adjacent zones, as set out in the AUP:OP, are therefore recommended to assess noise from the Interchange Facility.

Interchange facility noise has been predicted using the ISO 9613-2:1996 “Acoustics – Attenuation of sound outdoors – Part 2: general method of calculation” prediction algorithm, implemented in SoundPLAN v8.2 computational modelling software.

Noise from the interchange facility has been assessed according to likely future zoning when the facility becomes operational. The Warkworth Structure Plan indicates that future zoning of the area surrounding NOR 1 will be *Business – Light Industry Zone*, with a *Residential – Mixed Housing Suburban Zone* to the south west.

Table 4-1 sets out the applicable noise criteria from the AUP:OP for noise from the interchange facility received at each of the surrounding zones.

Table 3-2 Zone noise limits

Receiving Zone	AUP:OP Rule Reference	Time	Noise level
Residential – Mixed Housing Suburban Zone	E.25.6.19 – Business Zones Interface	Monday to Saturday 7am-10pm	55 dB LAeq
		Sunday 9am-6pm	45 dB LAeq
		All other times	75 dB LA _{FM} max
Business – Light Industry Zone	E25.6.5.1 Business – Light Industry Zone	All times	65 dB LAeq

3.3 Overview of Traffic Noise Effects

Adverse noise effects as a result of high levels of traffic noise may include sleep disturbance, loss of concentration, annoyance, a reduction in speech intelligibility and reduced productivity. The effects are not restricted to PPFs but would also affect future residential and other noise-sensitive developments as well which are not included in the NZS 6806 definition of PPF. Where new noise sensitive developments are established in the vicinity of a road, their design should take account of the potential noise effects and care should be taken to avoid or minimise them.

The magnitude of effects will largely depend on noise levels received in noise-sensitive spaces within buildings, although there are also potential annoyance effects associated with a loss of amenity when high noise levels are received in outdoor living or recreation spaces.

The subjective perception can generally be correlated with the numerical change in noise level. A 3 dB change in noise level is just perceptible to the majority of people. A 10 dB increase in noise level is subjectively considered to be a doubling of loudness resulting in a significant impact³.

³ Stevens, S. S. (1957). On the psychophysical law. *Psychological Review*, 64(3), 153–181. <https://doi.org/10.1037/h0046162>

Table 3-3 Noise level change compared with general subjective perception

Noise level change	General subjective perception
1 – 2 decibels	Insignificant change
3 – 4 decibels	Perceptible change
5 – 8 decibels	Noticeable change
9 – 11 decibels	Halving/doubling of loudness
> 11 decibels	More than halving/doubling of loudness

4 Assessment Methodology

Road traffic data provided for the Warkworth Assessment Package relies on the development and urbanisation of the local areas. Some projects will have a direct impact on the traffic flow.

The purpose of this assessment is to determine the future potential impacts to support the future growth within the Warkworth area. Therefore, it has been assumed all transport infrastructure developments will be constructed by the design year 2048 as indicated in Section 2.1. It should be noted an urban speed reduction is expected across all project roads (NOR 2 to NOR 8) at the time of growth. Therefore, in accordance with the standard, speed change has been applied at the Do Nothing, Do Minimum and Mitigation scenarios, where applicable. As noted previously, the Do Nothing scenario is a theoretical scenario for these Projects as the existing road network would not be able to accommodate the traffic volume expected from the full future development of the area.

NZS 6806 sets reasonable criteria for road-traffic noise levels, considering health issues associated with noise and other matters. It is considered that road-traffic noise levels in compliance with NZS 6806 Category A would generally result in acceptable noise effects. Achieving the Category B criteria may also give rise to acceptable noise effects when considered with regard to the existing environment.

To determine the potential change in noise level due to the Projects, the Do Minimum (design year with Project) scenario has been compared with the Do Nothing (design year without Project) scenario for Altered roads. For New roads, the Do Minimum scenario has been compared to the Existing scenario.

Under NZS 6806, PPFs do not include premises which are not yet built, other than those where building consent has already been obtained but not yet lapsed. No such premises that fall under this category were known at the time of this assessment.

Although the NZS 6806 assessment does not consider sites unless they contain, or have building consent for, a PPF, the predicted noise levels shown in the noise contour maps in Appendix E are considered indicative of the noise environment at adjacent sites without a PPF, including the future urbanisation areas.

4.1 Road Traffic Noise Model

A computer noise modelling software SoundPLAN (V8.2) has been used to predict road traffic noise impacts. The road traffic noise modelling employs the “*Calculation of Road Traffic Noise*” (CoRTN) algorithm, as recommended in NZS 6806. The CoRTN methodology has been adjusted for New Zealand Road Surfaces in accordance with LTNZ Report No. 326⁴ and the Waka Kotahi *Guide to state highway road surface noise*⁵. The model settings are described in Table 4-1 below.

Table 4-1: Road traffic noise modelling parameters

Parameter	Setting/source
Software	Sound Plan 8.2
Algorithm	CoRTN
Reflection	CoRTN
Ground absorption	0.8
Receiver height	1.5 m above height of each floor
Noise contour grid	1.5 m height, 5 m resolution
Receivers and grid position	Free-field

The CoRTN algorithm gives results in $L_{A10(18h)}$. To convert these results to $L_{Aeq(24h)}$ a minus 3 dB adjustment has been made. This adjustment has been implemented in the software in conjunction with the road surface adjustment detailed below.

The limitations and uncertainties of the prediction methodology, including input data, are discussed below.

4.1.1 Traffic data

All traffic data including AADT, percentage of heavy vehicles and posted speed limit has been sourced from the Project team and based on the SATURN model. The Existing scenario has been based on 2018 data as provided. Traffic volumes have to change significantly to affect noise levels to a meaningful degree. Therefore, using traffic data from 2018, which is the most up to date data, is appropriate to represent the existing circumstances. The change in traffic volume from 2018 to 2023 would amount to a less than 1 decibel change in noise level. Traffic modelling methodology and results are described in the report *Warkworth DBC Appendix D – Modelling Specifications* and the *Warkworth Transport Assessment*.

The CoRTN model has been developed based on 18-hour traffic data. However, in accordance with the requirements of NZS 6806, traffic data has been entered as the 24-hour daily traffic (AADT), which results in noise levels in the order of +0.2 dB higher than would have been calculated by CoRTN based on the 18-hour AADT. The CoRTN model assumes that traffic is free-flowing, it does not apply to interrupted vehicle flows, such as at intersection, and for low volume roads under 5,000 AADT.

⁴ <https://www.nzta.govt.nz/assets/resources/research/reports/326/docs/326.pdf>

⁵ <https://www.nzta.govt.nz/assets/resources/road-surface-noise/docs/nzta-surfaces-noise-guide-v1.0.pdf>

4.1.2 Topography

Topographic contours for the Existing scenarios have been provided from the Project team at a 1m resolution.

Contours for the Do Minimum scenarios were obtained from the Project team for the assessment area and joined with the existing contours for the surrounding areas. Road gradients and screening have been determined from the contours.

4.1.3 Buildings

The footprints and heights for all existing buildings, building usage and all other structures within 200 metres of the roads have been obtained from the Project Team. The number of floors was determined assuming 2.8 m height per floor.

Noise levels were calculated at the centre of each façade, 1.5 m above each floor height with the noise levels for each PPF stated being the highest of any façade.

Any buildings or structures within the designation boundaries for the Project have been removed from the model and not assessed for the Do Minimum scenario as we understand from the Project Team that they will be removed to provide for the Project.

4.1.4 Road alignments

Road alignments for existing roads were provided by the Project team as centrelines and widths for each carriageway section. Gradients have been calculated by SoundPLAN.

4.1.5 Road surfaces

Surfaces of existing roads in the Do Nothing scenario have been modelled as the current surfaces recorded by Mobile Road,⁶ a collaborative app supported by Waka Kotahi, including State Highway New Zealand databases and Council Road databases, including road surface types. For the Do Minimum scenarios the road surface has been modelled based on Auckland Transport's (AT) road surfacing principles. Table 4-2 below summarises the road surfaces proposed for the Do Minimum scenario for each NoR..

⁶ www.mobileroad.org

Table 4-2 Do Minimum Road Surfaces

NoR	Do Minimum Road Surface
NOR 1	AC-14 Asphalt
NOR 2	Chipseal
NOR 3	Chipseal
NOR 4	Chipseal
NOR 5	AC-14 Asphalt
NOR 6	AC-14 Asphalt
NOR 7	AC-14 Asphalt
NOR 8	AC-14 Asphalt

The procedure used to incorporate different road surfaces in the model is as follows:

- In accordance with Transit Research Report 287, a minus 2 dB adjustment has been made for an asphaltic concrete road surface compared to CoRTN.
- Surface corrections relative to asphaltic concrete (AC-10) have been made in accordance with LTNZ Research Report 326 and the Waka Kotahi Guide to state highway road surface noise. The combination of surface corrections for cars and heavy vehicles has been made using the equation in the Waka Kotahi Guide to state highway road surface noise.
- The combined correction, including the adjustment from $L_{A10(18h)}$ to $L_{Aeq(24h)}$, has been entered in the modelling software as a total road surface correction.

4.1.6 Existing noise barriers

Site visits were undertaken to determine if there are existing noise barriers along the Project. There were no noise barriers in the Project area.

Existing boundary fences of private properties have not been included in the noise model as their condition is unknown, they may not provide effective acoustic shielding and there is no certainty that these barriers will be retained by the property owners over time.

This means that for some properties, the predicted traffic noise levels may be slightly higher than would actually be experienced. However, the assessment process was used to identify properties which need noise barriers to provide adequate attenuation, as part of the mitigation appraisal.

4.2 Uncertainties and Limitations

The predicted road traffic noise levels presented in the following sections are based on a road traffic noise model developed in accordance with NZS 6806 and relevant guidance. The accuracy of the model is largely dependent upon the limitations of the available input data as detailed above.

7

Research Report 28. Traffic noise from uninterrupted traffic flows, Transit, 1994.

Uncertainties in the modelled noise levels can occur for a number of reasons. Uncertainties are typically related to the effects of topographical screening, appropriateness of the traffic data in terms of volumes of light and heavy vehicles, speeds (observed vs posted) and road surface type.

As stated, the terrain model has been developed by the Project GIS team based on 1m vertical terrain resolution, which provides sufficient detail to accurately account for any acoustic shielding from localised topographical features.

The traffic data has been sourced from the Project Transport team and it is accepted that the forecasting of future traffic flows may not necessarily reflect the actual flows when the Design Year is reached. The sensitivity of the noise predictions to changes in traffic data is not as significant as the effects of topographical screening. For example, if all other factors of the traffic data remain unchanged (speed and % of heavy vehicles), then a doubling or halving of the traffic data will only result in a 3 dB change which is only just perceptible by most people. A change in traffic volume data by +25 % or -25% will result in a 1 dB change in predicted noise level, which would be imperceptible.

Nevertheless, an uncertainty remains which of the Projects will be implemented, at which time and in which combination. The assessment assumes that all NoRs are implemented and operational in the design year 2048. In the interim, some NoRs may be implemented earlier than others, which would have an effect on the traffic distribution across the network, and therefore affect the noise generation.

The accuracy of the model can be quoted to a reasonable degree based upon known validations of the CoRTN model and comparisons with the measured existing noise levels. Generally, road traffic noise levels are quoted with an accuracy within 2 dB. NZS 6806 states in Section 5.3.4.2 that “The difference between measured and predicted levels should not exceed ±2 dB.”

Table 4-3 compares the measured data with the predicted noise levels. The predicted traffic noise levels are within the tolerance of NZS 6806 and therefore the existing model is appropriately accurate for the calculation of traffic noise levels for all scenarios.

Table 4-3: Comparison of measured and predicted noise levels

Address	Measured noise level, L _{Aeq,24hr} , dB(A)	Predicted noise level, L _{Aeq,24hr} , dB(A)	Difference, dB(A)	Notes
153 Woodcocks Road	59	62	3	Difference in noise level considered to be acceptable.
10 Georgetti Way	47	43	4	Higher than likely normal noise readings recorded in the early morning after Cyclone Gabrielle. Recorded noise later in the day reduced to expected levels. Difference considered acceptable.
171 Matakana Road	54	56	2	Within tolerance.

4.3 Potential Traffic Noise Mitigation Options

For those PPFs where the NZS 6806 Category A criterion is predicted to be exceeded, the effect of the mitigation options on road-traffic noise levels at each PPF were modelled. Where NZS 6806 does not apply due to noise levels not reaching the required threshold to qualify as an Altered road, no mitigation options have been considered.

Traffic noise mitigation measures can be broadly categorised into three methods: low noise road surfaces, traffic noise barriers, and building modification. The first two methods involve structural mitigation as described in NZS6806, whilst the third involves building modification mitigation.

4.3.1 Noise barriers

If low-noise road surfaces do not provide the required level of noise mitigation, noise barriers may be considered alongside road surfaces. Generally, barriers will only mitigate noise if they block the line-of-sight between the noise source and receiver. They are most effective and provide the widest area of mitigation when placed immediately adjacent to traffic lanes. In order to provide the most effective noise level reduction, an acoustic barrier must be of solid material (i.e. have no gaps) and have a minimum surface weight of 15 kg/m² (e.g. 17mm ply sheeting, 9 mm fibre cement, concrete, earth bunds etc.).

We note that as per Section 3.1.5, NZS 6806 recommends that the combined structural mitigation achieve:

- An average reduction of at least 3 dB $L_{Aeq(24h)}$ at relevant assessment positions of all PPFs which are part of a cluster; or
- A minimum reduction of 5 dB $L_{Aeq(24h)}$ at any assessment position(s) for each PPF not in a cluster.

4.3.2 Building modification

NZS 6806 requires that structural mitigation, such as noise barriers and low-noise road surfaces, should be implemented in preference to building modification mitigation.

Building modification can potentially inconvenience residents and does not provide any protection to outdoor amenity. However, if low-noise road surfaces and noise barriers are not practicable or do not provide the required level of noise reduction, building modification to PPFs may be considered.

Depending on the level of reduction required, building modification measures may range from provision of mechanical ventilation only (to allow doors and windows to be closed), to the upgrade or replacement of windows, wall linings, floors and ceiling linings.

4.3.3 Maintenance of structural mitigation measures

The effectiveness of the acoustic performance of noise mitigation measures will need to be maintained over time. NZS 6806 states that “structural mitigation measures should be designed in such a way that they retain the same noise-reduction properties up to the design year”.

This means that any barrier should not develop gaps or other openings or material failure. Any damage and vandalism to the barrier will need to be replaced, and asphalt surfaces should be

maintained to be smooth and even, in order to achieve the same noise reducing qualities as following initial installation. Maintenance of structural mitigation measures to the performance standards of NZS 6806 should be undertaken for the Projects in order to achieve the noise level reductions on which the noise level predictions are based.

4.4 Interchange Facility

The source noise levels, and vehicle movements used in this assessment for the interchange facility are detailed in Table 4-4. These levels and movements are based on previous interchange facilities and AECOM's library of measurements of these activities and correlate to the vehicle type and speed to be used at the Project site. It should be noted that information on predicted movement numbers is indicative at this stage and should be confirmed during detailed design.

Bus and passenger car movements around the car park and drop off areas have been modelled as moving point sources. Fixed point sources have been used to represent idling buses and those accelerating away from the stations.

The bus fleet is expected to be fully electrified by the year 2035, before construction of the interchange facility. Therefore, the bus fleet has been assumed to be fully comprised of electric vehicles for this assessment.

Total bus idle time and acceleration time at each bus stop every hour has been calculated based on the indicative number of bus stops anticipated, and assuming an idle time of 5 minutes and peak acceleration time of 3 seconds for each bus. Sound power level data for the assessment were adopted from Laib et al.⁸

The following inputs have been used within SoundPLAN:

Table 4-4 Sound power levels, vehicle movements and on-times used in assessment

Noise Source	Sound Power Level, LWA	Peak Time Operation, 2048
Electric bus movements (driving at 30 km/h)	92 dB	14 bus movements per hour
Stationary electric buses	82 dB	33 mins idle time per hour per bus stop
Electric buses accelerating away from station	98 dB	20 seconds accelerating away per hour per bus stop
Passenger car movements (driving at 30 km/h)	86 dB	228 car movements per hour

⁸ Laib et al (2019), Modelling noise reductions using electric buses in urban traffic. A case study from Stuttgart, Germany. <https://www.sciencedirect.com/science/article/pii/S2352146518306227>

5 Existing and Likely Receiving Noise Environment

The projects encompassing the Warkworth NOR package will be constructed 15-20 years from now. The implementation timeframe for each project will vary and correspond with future land release within the area. Implementation of the Projects is only required to support future urbanisation and will not happen until this occurs.

5.1 Existing and Likely Receiving Planning Environment

The Warkworth NOR package will be constructed and will operate alongside existing urban environments or planned future environments (i.e. what can be built under the AUP:OP and what is identified in the Warkworth Structure Plan):

1. **Existing environment:** A number of corridors comprising the Warkworth NOR package are partially located within/alongside existing urban areas.
 - a) Matakana Road – residential land uses (single house zone, mixed housing suburban zone, mixed housing urban zone) comprise the western and north-western extents of the corridor.
 - b) Western Link - South – residential land uses are situated to the north and northwest of the corridor and existing industrial land use on the eastern extent of the corridor.
 - c) SH1 - South – residential land uses are adjacent to the northwest and southeast of the northern extent of the corridor, additionally there are established business land uses to the northeast of the northern extent of the corridor.
 - d) Woodcocks Road – the eastern extent of the corridor has existing residential land uses to the north and south.
2. **Future environment:** All the corridors in the Warkworth NOR package will partially or wholly be constructed and implemented on land identified for future growth (Future Urban Zone) and as a result are anticipated to change to urban residential or business land uses.

The likelihood and magnitude of land use change regarding the land use planning context has been identified in Table 5-1 below. This has been used to inform the assumptions made on the likely future environment

Table 5-1. Likelihood and magnitude of land use change

Existing environment	Current AUP:OP Zoning	Likelihood of Change for the environment ¹	Magnitude of potential change	Likely Receiving Environment ²
Residential	Residential (Mixed Housing Suburban)	Low	Low	Residential
	Residential (Mixed Housing Urban)	Low	Low	Residential
	Residential (Single House)	Low	Low	Residential
Business	Business (Mixed Use)	Low	Low	Business (Industrial)
	Business (General Business)			Business (General Business)
	Business (Light Industry)	Low	Low	Business (Industrial)
	Business (Local Centre Zone)	Low	Low	Business (Neighbourhood Centre)
Open Space	Open Space – Conservation Zone	Low	Low	Informal Recreation
Greenfield areas	Future Urban Zone	High	High	Urban
Other	Special Purpose – Quarry Zone	Low	Med	Quarry

Table notes: 1. Based on AUP:OP zoning/policy direction, 2. Based on Warkworth Structure Plan and AUP:OP zoning/policy direction

Refer to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the Warkworth NOR package.

5.2 Existing Ambient Noise Environment

The criteria in NZS 6806 to assess road-traffic noise are not dependent on the existing noise levels. Measurements of existing levels are therefore not required for the assessment against that standard. However, an appreciation of the existing environment is required to assess the potential noise effects, regardless of compliance with any particular noise criteria.

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 6801⁹, 6802¹⁰ and 6806. This meant the results could adequately inform both the operational and construction noise assessments.

Measurements were undertaken at the following three locations:

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

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

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

5.2.2 Meteorological Conditions

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

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

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. Each day's data was analysed, and abnormal events were excluded. A summary of the measured noise levels at each location for each day is presented in Table 5-2.

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

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

⁹ New Zealand Standard 6801:2008 Acoustics – Measurement of environmental sound

¹⁰ New Zealand Standard 6802:2008 Acoustics – Environmental noise

Table 5-2: Summary of measured noise levels

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

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

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

6 Warkworth Package Overview

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

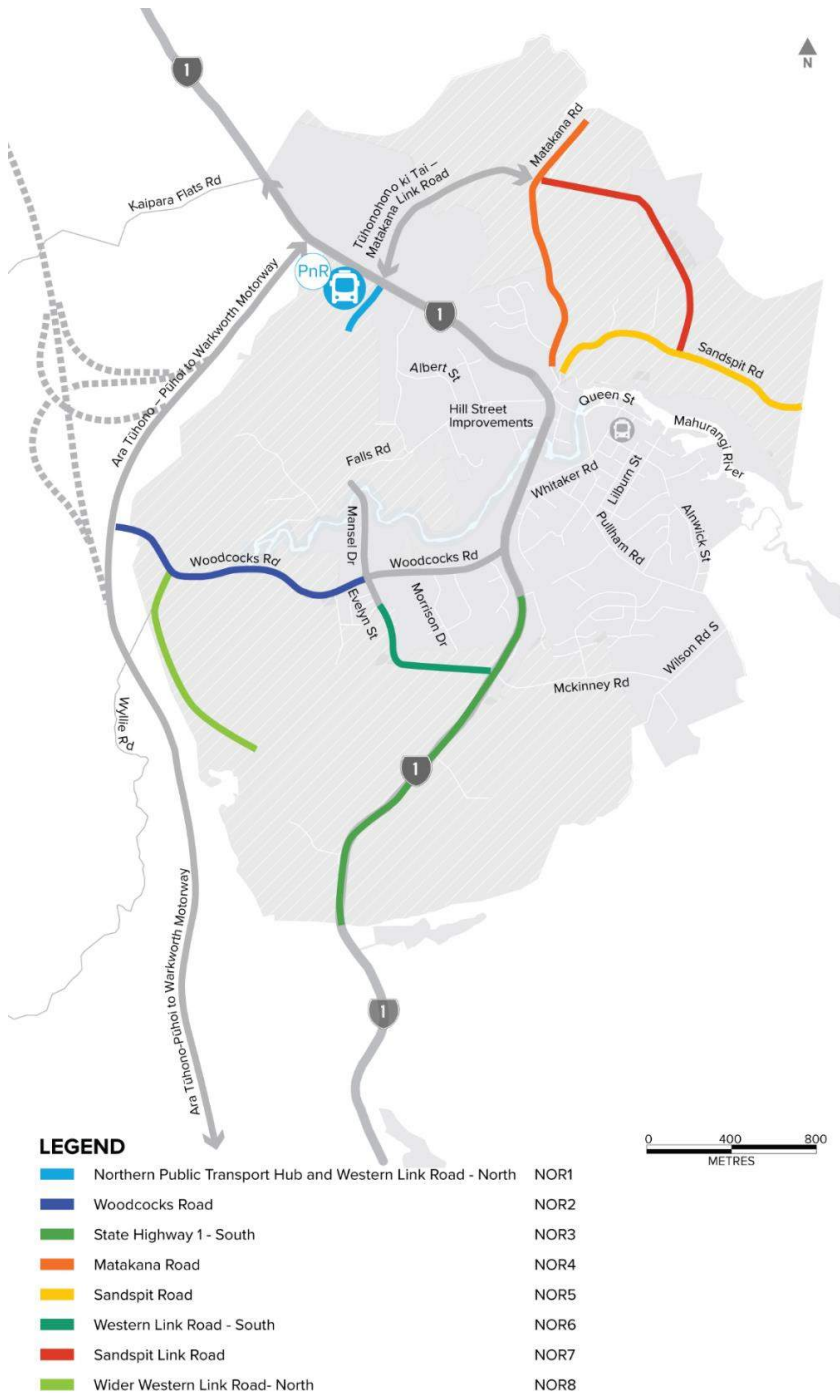
An overview of the Warkworth NOR package is set out in Table 6-1 and shown in Figure 6-1.

Table 6-1. Warkworth Assessment Package Project Summary

Corridor	NOR	Description	Requiring Authority
Northern Public Transport and Western Link - North	1	New northern public transport hub and associated facilities including a park and ride at the corner of State Highway 1 (SH1) and the new Western Link – North. New urban arterial cross-section with active mode facilities between the intersection of SH1 and Te Honohono ki Tai (Matakana Link Road) to the proposed bridge crossing, enabling a connection for development in the Warkworth Northern Precinct as provided for in the Warkworth North Precinct.	Auckland Transport
Woodcocks Road (Western Section)	2	Upgrade of the existing Woodcocks Road corridor between Mansel Drive and Ara Tūhono (Puhoi to Warkworth) to an urban arterial cross-section with active mode facilities.	Auckland Transport
State Highway 1 Upgrade - South	3	Upgrade of the existing SH1 corridor between Fairwater Road and the southern Rural Urban Boundary to an urban arterial cross-section with active mode facilities.	Auckland Transport
Matakana Road	4	Upgrade of the existing Matakana Road corridor between the Hill Street intersection and the northern Rural Urban Boundary to an urban arterial cross-section with active mode facilities.	Auckland Transport
Sandspit Road	5	Upgrade of the existing Sandspit Road corridor between the Hill Street intersection and the eastern Rural Urban Boundary to an urban arterial cross-section with active mode facilities.	Auckland Transport
Western Link - South	6	New urban arterial cross-section with active mode facilities between the intersection of SH1 and McKinney Road and Evelyn Street.	Auckland Transport

Sandspit Link	7	New urban arterial cross-section with active mode facilities between the intersection of Matakana Road and Te Honohono ki Tai (Matakana Link Road) and Sandspit Road.	Auckland Transport
Wider Western Link - North	8	New urban arterial cross-section with active mode facilities between Woodcocks Road and the Mahurangi River.	Auckland Transport

Figure 6-1. Warkworth NOR package Overview



6.1 NOR 1 - Northern Public Transport Hub and Western Link - North

This section assesses specific operational noise matters relating to NOR 1 – Northern Public Transport Hub and Western Link – North.

6.2 Overview and Description of Works

The Northern PT Hub and Park & Ride is located adjacent to the intersection of the existing SH1 and the proposed new Western Link - North). This project involves:

- A PT Hub
- Park and Ride facilities with approximately 228 car park spaces attached to the PT Hub
- The new Western Link - North an urban arterial with cycle lanes and footpaths on both sides

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

Note that the Western Link - North has not been assessed against NZS 6806, as there are no existing PPFs or future PPFs with building consent as of the time of writing of this assessment within 100m of the road edge.

6.2.1 Noise Environment

The proposed site for the Northern Public Transport Hub is currently located in a rural environment with few dwellings nearby. The noise environment is dominated by road traffic noise from vehicles using the existing SH1.

PPC25 and the Warkworth Structure Plan indicate that the land near the Northern Public Transport Hub will likely be re-zoned to Light Industry or Business Zone. This zoning would likely result in an increase in ambient noise levels.

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

6.3 Predicted Operational Noise Levels

Predicted worst-case noise levels for peak hours are shown in Table 6-2, and have been assessed in the context of the future land use zoning for the area, as shown in Figure 6-2. It is assumed the interchange will start operation at around 5am and will have the potential to operate until after 10pm. Therefore, predicted noise levels have been assessed against the most stringent criteria during the night-time. The prediction locations relative to the Facility and adjacent land use receivers are shown in Figure 6-2. Noise contour maps are provided in Appendix E.

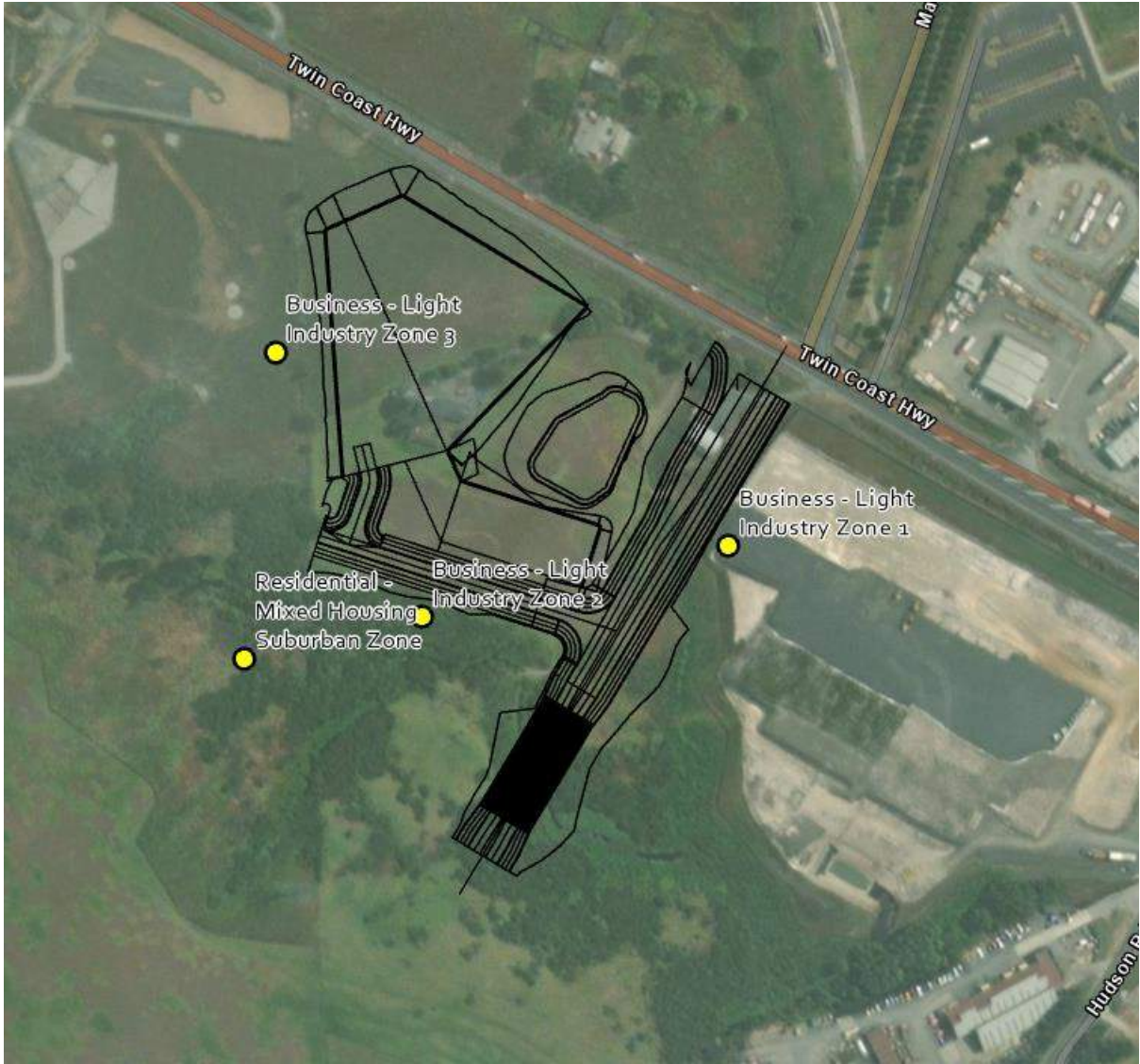


Figure 6-2 Assessed receiver locations relative to the Facility - NOR 1

Table 6-2 Predicted peak hour noise levels at future land use zones - NOR 1

Likely Future Land Use Zone	Noise Criterion		Design Year 2048
	Daytime noise criterion, dB LAeq	Night-time noise criterion, dB LAeq	Predicted worst-case peak hour noise level, dB LAeq
Residential – Mixed Housing Suburban Zone	55	45	34
Business - Light Industry Zone 1	65	65	31
Business - Light Industry Zone 2	65	65	41
Business - Light Industry Zone 3	65	65	34

6.3.1 Summary of Predicted Noise Levels

Predictions show operational noise levels during peak hours, without mitigation, will meet the daytime and night-time criteria at adjacent sites based on the likely future land use zoning in both assessed scenarios. This applies to any remaining existing receivers as well as potential future receivers. Further mitigation measures have therefore not been recommended at this stage, however this assessment should be revisited during detailed design, when more information on the design and proposed movements is known.

6.3.2 Noise Effects

The noise levels modelled represent a worst-case situation which is predicted to last 2 hours at most. Predicted noise levels were assessed against the most stringent criteria for night-time, but it is yet to be confirmed when the peak use of the site will occur.

These operational traffic volumes rely on the urbanisation of the area. As such, the results are only indicative of a possible future scenario which does not consider the noise effects from the wider development of the area. It is not possible to determine with certainty at this stage what the impact will ultimately be when the Project and surrounding infrastructure is built. Development of the surrounding areas will likely increase activity and associated noise levels. The future urban environment may also include a range of other noise sources.

6.4 Conclusions

An assessment of operational noise from the interchange facility during peak hours was carried out based on indicative information for the peak hours as provided by the Project team.

The predictions indicate that the most stringent night-time noise criteria will be met at adjacent existing and likely future receivers after completion of the full build design in 2048. The predictions were undertaken for the daytime peak hour.

7 NOR 2 – Woodcocks Road (Western Section)

This section assesses specific traffic noise matters relating to NOR 2 – Woodcocks Road (Western Section).

7.1 Overview and description of works

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

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

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

7.1.1 Noise Environment

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

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

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

7.2 Assessment of Road Traffic Noise Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

All PPFs for this NOR have been assessed against the Altered Roads criteria as per Section 3.1.3.

Predicted road-traffic noise levels at all existing PPFs for the Existing, Do Nothing and Do Minimum scenarios are shown in Appendix D. The cells are colour coded according to the NZS 6806 category: category A – green, category B – orange, and category C – red.

Noise contour maps showing indicative levels across a 100m radius from the alignment are provided in Appendix E. Specific noise level values should not be taken directly from the contours as they are interpolated from a grid resulting in some localised inaccuracies.

Based on information provided by the Project team, the following residential buildings will be removed to make room for the Project alignment and have not been considered in the assessment:

- 2 Wyllie Road
- 111 Woodcocks Road
- 105 Woodcocks Road

- 105-103 Woodcocks Road
- 99 Woodcocks Road
- 97 Woodcocks Road
- 95 Woodcocks Road

7.2.1 Road Traffic Model Results Analysis

An initial screening assessment has been carried out and the Woodcocks Road Upgrade (Western Section) does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. The Standard therefore does not apply, and mitigation options do not need to be considered. A summary of the results of the screening assessment are presented in Table 7-1.

As noted in Section 3.1.3, the NZS 6806 assessment requires that mitigation is only provided for the contribution of noise within the Altered Road extents, therefore the noise level predictions for PPFs at the ends of the NOR are reduced for the Do Minimum scenario as the surrounding road network contribution is not included. The surrounding road network is included in the noise predictions for the Do Minimum scenario for the assessment of road traffic noise effects in Section 7.2.2.

Table 7-1 NZS 6806 Assessment and Summary

Category	Criteria	Number of PPFs		
		Existing	Do Nothing	Do Minimum
Cat A	64 dB $L_{Aeq(24h)}$	53	46	53
Cat B	67 dB $L_{Aeq(24h)}$	0	4	0
Cat C	40 dB Internal $L_{Aeq(24h)}$	0	3	0
Total		53	53	53

Existing scenario predictions show that noise levels within the Project area is between 37 dB $L_{Aeq(24h)}$ and 62 dB $L_{Aeq(24h)}$. All PPFs are in Category A.

Under the Do Nothing scenario, there is an increase in noise levels due to the predicted traffic volume increase with a predicted range of 42 dB $L_{Aeq(24h)}$ and 71 dB $L_{Aeq(24h)}$. Four PPFs, one located at 87 Woodcocks Road and three at 86-94 Woodcocks Road, are in Category B. Three PPFs located at 5, 6, and 7 Evelyn Street are in Category C, with the remainder in Category A.

For the Do Minimum scenario, predictions show a traffic noise level range between 33 dB $L_{Aeq(24h)}$ and 64 dB $L_{Aeq(24h)}$. All PPFs in this scenario fall into Category A

7.2.2 Assessment of Road Traffic Noise Effects

The effects associated with a change in noise level have been considered in addition to the NZS 6806 assessment. The Do Nothing scenario and Do Minimum scenario can be compared to determine the predicted noise level increase or decrease at PPFs as a result of the Project. Figure 7-1 shows the predicted change in noise level at PPFs when comparing the Do Nothing and Do Minimum scenarios, with the local road network included.

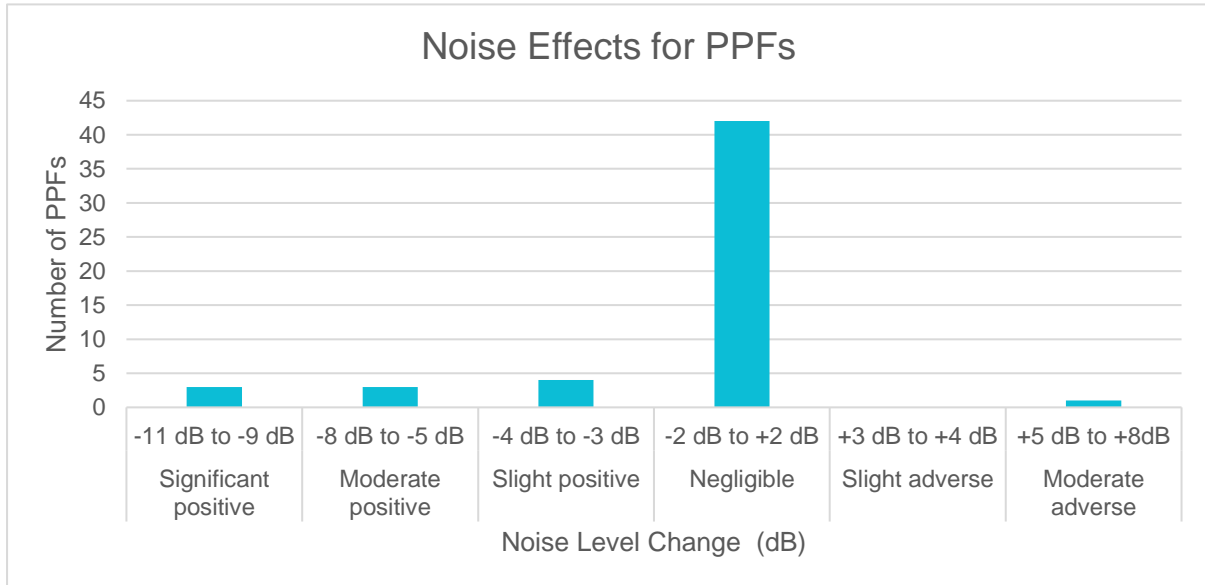


Figure 7-1: Change in Noise Level - Do Nothing Vs Do Minimum – NOR 2

Noise levels are predicted to change by a negligible margin (± 2 dB between the Do Nothing and Do Minimum scenario) at 42 PPFs after implementation of the Project.

Predictions indicate that one PPF will experience an increase in noise level of 5-8 dB, resulting in moderate adverse noise effects.

Increases in noise levels at this PPF is due to the proposed surrounding road network, which includes Woodcocks Road in addition to Western Link - South. All PPFs are predicted to remain in Category A in the Do Minimum scenario.

Predictions indicate that four PPFs will experience a decrease in noise levels of 3-4 dB, resulting in slight positive effects. Three PPFs will experience a decrease in noise levels of 5-8 dB, resulting in moderate positive effects. Three PPFs will experience a decrease in noise levels of 9-11 dB, resulting in significant positive effects.

Positive noise level changes are brought about by a reduction in road traffic flow due to redistributed road traffic throughout the surrounding proposed road network and road design changes including retaining walls providing some shielding to PPFs.

Ambient noise levels will likely increase as the area urbanises and therefore the change in noise level due to the Project may not be as noticeable at the time.

Some PPFs may not exist anymore at the time of road construction particularly given the proposed zone change in the area allowing for urban development. Therefore, the predicted effects may not be experienced by current residents.

7.3 Conclusions

Road traffic noise levels have been assessed in accordance with NZS 6806 for the Woodcocks Road Upgrade (Western Section).

An initial screening assessment has been carried out and the Woodcocks Road Upgrade (Western Section) does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. The Standard therefore does not apply, and mitigation options have not been considered.

A comparison of the predicted road traffic noise levels between the Do Nothing scenario and the Do Minimum scenario indicates that noise level changes will be negligible for the majority of PPFs.

8 NOR 3 – State Highway 1 Upgrade - South

This section assesses specific traffic noise matters relating to NOR 3 – State Highway 1 - South.

8.1 Overview and description of works

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

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

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

8.1.1 Noise Environment

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

The existing SH1 is an existing road with commercial buildings and residential dwellings along the road corridor. The noise environment is dominated by road traffic noise from vehicles on the existing SH1.

It is anticipated that the noise environment in the future will change as a result of the opening of Ara Tūhono (Puhoi to Warkworth). When Ara Tūhono opens, the road will no longer be SH1 and it is anticipated that the majority of traffic passing through Warkworth will use the new corridor.

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

8.2 Assessment of Road Traffic Noise Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

All PPFs for this NOR have been assessed against the Altered Roads criteria as per Section 3.1.3.

Predicted road-traffic noise levels at all existing PPFs for the Existing, Do Nothing and Do Minimum scenarios are shown in Appendix D. The cells are colour coded according to the NZS 6806 category: category A – green, category B – orange, and category C – red.

Noise contour maps showing indicative levels across a 100m radius from the alignment are provided in Appendix E. Specific noise level values should not be taken directly from the contours as they are interpolated from a grid resulting in some localised inaccuracies.

Based on information provided by the Project team, the following residential buildings will be removed to make room for the Project alignment and have not been considered in the assessment:

- 1693 State Highway 1

8.2.1 Road Traffic Model Results Analysis

An initial screening assessment has been carried out and the Existing State Highway 1 Upgrade (Southern Section) meets the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. A summary of the results is presented in Table 8-1.

As noted in Section 3.1.3, the NZS 6806 assessment requires that mitigation is only provided for the contribution of noise within the Altered Road extents, therefore the noise level predictions for PPFs at the ends of the NOR are reduced for the Do Minimum and Mitigation scenarios as the surrounding road network contribution is not included. The surrounding road network is included in the noise predictions for the Mitigation scenario for the assessment of road traffic noise effects in Section 7.2.2.

Table 8-1 NZS 6806 Assessment and Summary

Category		Number of PPFs			
	Criteria	Existing	Do Nothing	Do Minimum	Mitigation
Cat A	64 dB L _{Aeq(24h)}	85	97	92	97
Cat B	67 dB L _{Aeq(24h)}	12	0	5	0
Cat C	40 dB Internal L _{Aeq(24h)}	0	0	0	0
Total		97	97	97	97

Existing scenario predictions show that noise levels within the Project area is between 47 dB L_{Aeq(24h)} and 67 dB L_{Aeq(24h)}. 12 PPFs are in Category B, with the remaining PPFs in Category A.

Under the Do Nothing scenario, there is a decrease in noise levels with a predicted range of 46 dB L_{Aeq(24h)} and 64 dB L_{Aeq(24h)}. All PPFs are in Category A.

For the Do Minimum scenario, predictions show a traffic noise level range between 37 dB L_{Aeq(24h)} and 66 dB L_{Aeq(24h)}. Five PPFs are in Category B, with the remaining PPFs in Category A.

Mitigation has been considered to reduce noise levels at PPFs. This mitigation option involves applying AC-14 to the road surface, resulting in all PPFs falling into Category A. This is the recommended mitigation option for NOR 3.

8.2.2 Assessment of Road Traffic Noise Effects

The effects associated with a change in noise level have been considered in addition to the NZS 6806 assessment. The Do Nothing scenario and Mitigation scenario can be compared to determine the predicted noise level increase or decrease at PPFs as a result of the Project. Figure 8-1 shows the predicted change in noise level at PPFs when comparing the Do Nothing and Mitigation scenarios, with the local road network included.

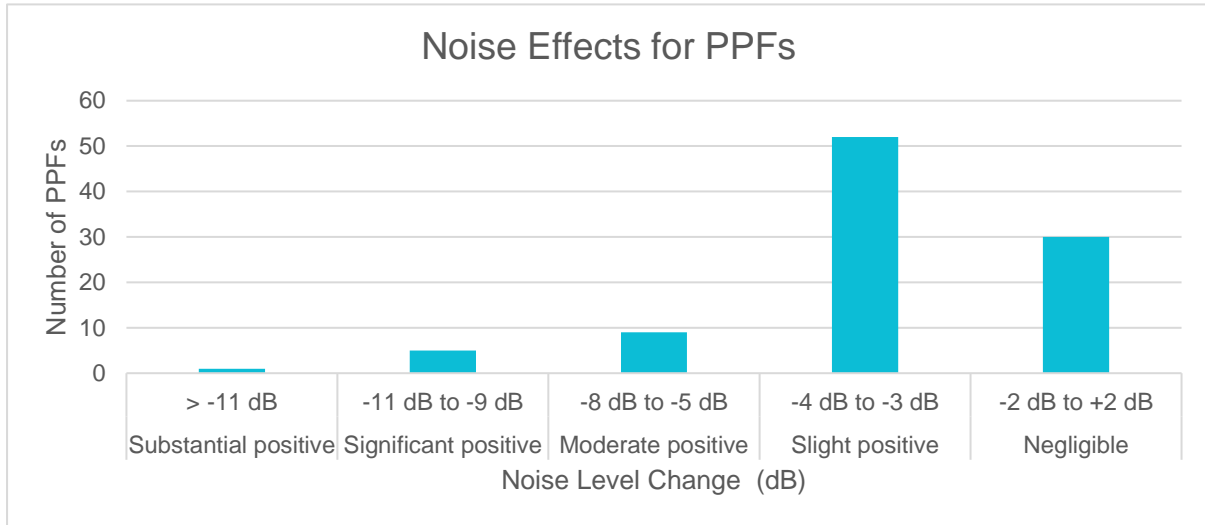


Figure 8-1: Change in Noise Level - Do Nothing Vs Mitigation– NOR 3

Noise levels are predicted to change by a negligible margin (± 2 dB between the Do Nothing and Mitigation scenario) at 30 PPFs after implementation of the Project.

Predictions indicate that 52 PPFs will experience a decrease in noise levels of 3-4 dB, resulting in slight positive effects, 9 PPFs will experience a decrease in noise levels of 5-8 dB, resulting in moderate positive effects, five PPFs will experience a decrease in noise levels of 9-11 dB, resulting in significant positive effects, and one PPF will experience a decrease in noise levels of greater than 11 dB, resulting in substantial positive effects.

Positive noise level changes are brought about by changes to the road design (including speed limit reductions, concrete safety barriers and retaining walls) along some sections of the alignment and a reduction in road traffic flow due to redistributed road traffic throughout the surrounding proposed road network. Ambient noise levels will likely increase as the area urbanises and therefore the change in noise level due to the Project may not be as noticeable at the time.

Some PPFs may not exist anymore at the time of road construction particularly given the proposed zone change in the area allowing for urban development. Therefore, the predicted effects may not be experienced by current residents.

8.3 Conclusions

Road traffic noise levels have been assessed in accordance with NZS 6806 for the Existing State Highway 1 Upgrade (Southern Section).

Under the Do Minimum scenario, five PPFs are in Category B, with the remaining PPFs in Category A. With the recommended mitigation of a low noise road surface, all PPFs fall into Category A.

A comparison of the predicted road traffic noise levels in the Do Nothing scenario and the Mitigation scenario indicates that noise level changes will be positive for the majority of PPFs.

9 NOR 4 – Matakana Road Upgrade

This section assesses specific traffic noise matters relating to NOR 4 – Matakana Road Upgrade.

9.1 Overview and description of works

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

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

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

9.1.1 Noise Environment

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

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

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

9.2 Assessment of Road Traffic Noise Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

All PPFs for this NOR have been assessed against the Altered Roads criteria as per Section 3.1.3.

Predicted road-traffic noise levels at all existing PPFs for the Existing, Do Nothing and Do Minimum scenarios are shown in Appendix D. The cells are colour coded according to the NZS 6806 category: category A – green, category B – orange, and category C – red.

Noise contour maps showing indicative levels across a 100m radius from the alignment are provided in Appendix E. Specific noise level values should not be taken directly from the contours as they are interpolated from a grid resulting in some localised inaccuracies.

Based on information provided by the Project team, the following residential buildings will be removed to make room for the Project alignment and have not been considered in the assessment:

- 304 Matakana Road

9.2.1 Road Traffic Model Results Analysis

An initial screening assessment has been carried out and the Matakana Road Upgrade meets the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. A summary of the results of the assessment are presented in Table 9-1.

As noted in Section 3.1.3, the NZS 6806 assessment requires that mitigation is only provided for the contribution of noise within the Altered Road extents, therefore the noise level predictions for PPFs at the ends of the NOR are reduced for the Do Minimum and Mitigation scenarios as the surrounding road network contribution is not included. The surrounding road network is included in the noise predictions for the Mitigation scenario for the assessment of road traffic noise effects in Section 7.2.2.

Table 9-1 NZS 6806 Assessment and Summary

Category		Number of PPFs			
	Criteria	Existing	Do Nothing	Do Minimum	Mitigation
Cat A	64 dB L _{Aeq(24h)}	54	61	63	68
Cat B	67 dB L _{Aeq(24h)}	9	4	4	0
Cat C	40 dB Internal L _{Aeq(24h)}	5	3	1	0
Total		68	68	68	68

Existing scenario predictions show that noise levels within the Project area are between 50 dB L_{Aeq(24h)} and 72 dB L_{Aeq(24h)}. Nine PPFs are predicted to fall within Category B, and five PPFs are predicted to fall into Category C. The Category C PPFs are as follows:

- 299 Matakana Road
- 170 Matakana Road
- 74 Matakana Road
- 1 Millstream Place
- 96 Matakana Road

Under the Do Nothing scenario, noise levels are predicted to be in the range of 47 dB L_{Aeq(24h)} to 69 dB L_{Aeq(24h)}. Three PPFs are predicted to fall in Category C, four PPFs are in Category B, with the remainder in Category A. The PPFs in Category C are 74 Matakana Road, 96 Matakana Road, and 1 Millstream Place.

For the Do Minimum scenario, predictions show a traffic noise level range between 42 dB L_{Aeq(24h)} and 68 dB L_{Aeq(24h)}. One PPF at 96 Matakana Road remains in Category C. Four PPFs remain in Category B, these PPFs are:

- 299 Matakana Road
- 303 Matakana Road
- 170 Matakana Road
- 130 Matakana Road

One mitigation option has been considered to reduce noise levels at PPFs. The option comprises the use of AC-14 low noise road surface. This option results in all PPFs falling into Category A. This is the recommended mitigation option for NOR 4.

9.2.2 Assessment of Road Traffic Noise Effects

The effects associated with a change in noise level have been considered in addition to the NZS 6806 assessment. The Do Nothing scenario and Mitigation scenario can be compared to determine the predicted noise level increase or decrease at PPFs as a result of the Project. Figure 9-1 shows the predicted change in noise level at PPFs when comparing the Do Nothing and Mitigation scenarios with the local road network included.

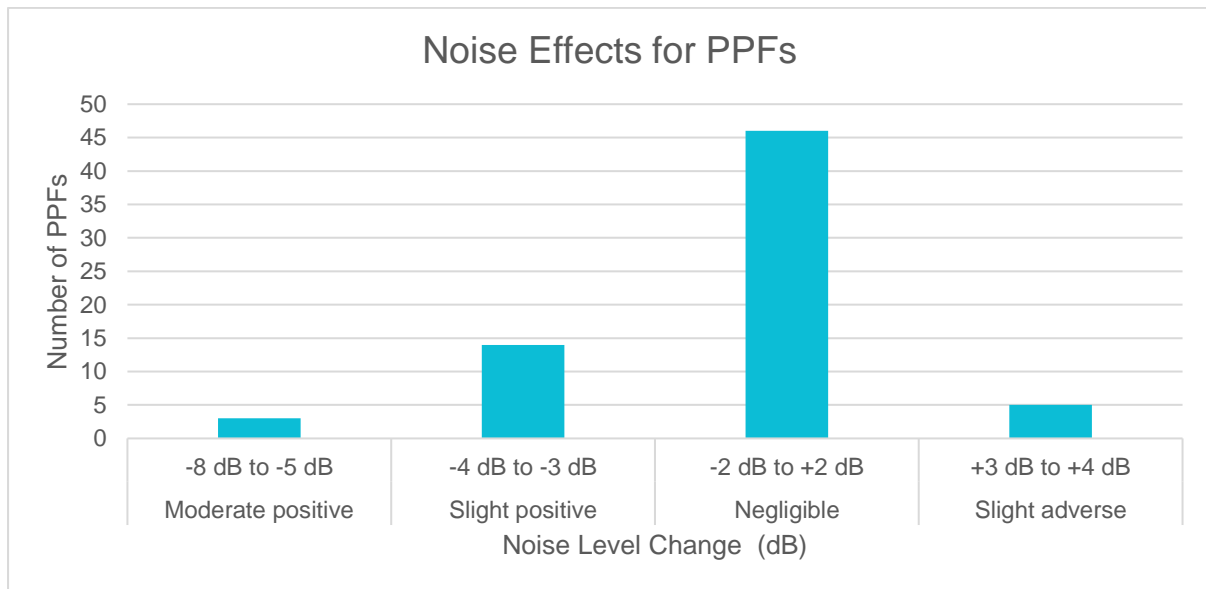


Figure 9-1: Change in Noise Level - Do Nothing Vs Mitigation – NOR 4

Noise levels are predicted to change by a negligible margin (± 2 dB between the Do Nothing and Mitigation scenario) at 46 PPFs after implementation of the Project.

Predictions indicate that five PPFs will experience an increase in noise level of 3-4 dB, resulting in slight adverse effects.

Increases in noise levels at these PPFs are due to the demolition of some houses which would otherwise provide acoustic shielding to PPFs behind, in addition to bringing the road alignment closer to some PPFs.

Predictions indicate that eight PPFs will experience a decrease in noise levels of 3-4 dB, resulting in slight positive effects, and a further eight PPFs will experience a decrease in noise levels of 5-8 dB, resulting in moderate positive effects.

Positive noise level changes are brought about by localised terrain changes (addition of active transport corridor providing screening between Matakana Road and some PPFs), a reduction in road traffic flow due to redistributed road traffic throughout the surrounding proposed road network, in addition to the inclusion of a low noise AC-14 road surface.

Ambient noise levels will likely increase as the area urbanises and therefore the change in noise level due to the Project may not be as noticeable at the time.

Some PPFs may not exist anymore at the time of road construction particularly given the proposed zone change in the area allowing for urban development. Therefore, the predicted effects may not be experienced by current residents.

9.3 Conclusions

Road traffic noise levels have been assessed in accordance with NZS 6806 for the Matakana Road Upgrade. Under the Do Minimum scenario, one PPF at 96 Matakana Road is in Category C, and four PPFs are in Category B, with the rest in Category A. With the recommended mitigation option of AC-14 low noise road surface implemented, all PPFs fall into Category A.

A comparison of the predicted road traffic noise levels in the Do Nothing scenario and the Mitigation scenario indicates that noise level changes will be negligible for the majority of PPFs.

10 NOR 5 – Sandspit Road Upgrade

This section assesses specific traffic noise matters relating to NOR 5 – Sandspit Road Upgrade.

10.1 Overview and description of works

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

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

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

10.1.1 Noise Environment

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

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

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

10.2 Assessment of Road Traffic Noise Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

All PPFs for this NOR have been assessed against the Altered Roads criteria as per Section 3.1.3.

Predicted road-traffic noise levels at all existing PPFs for the Existing, Do Nothing and Do Minimum scenarios are shown in Appendix D. The cells are colour coded according to the NZS 6806 category: category A – green, category B – orange, and category C – red.

Noise contour maps showing indicative levels across a 100m radius from the alignment are provided in Appendix E. Specific noise level values should not be taken directly from the contours as they are interpolated from a grid resulting in some localised inaccuracies.

Based on information provided by the Project team, the following residential buildings will be removed to make room for the Project alignment and have not been considered in the assessment:

- 360 Sandspit Road
- 325 Sandspit Road

- 126 Sandspit Road
- 101-105 Sandspit Road
- 89 Sandspit Road
- 35 Sandspit Road
- 2 Millstream Place

10.2.1 Road Traffic Model Results Analysis

An initial screening assessment has been carried out and the Sandspit Road Upgrade does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. The Standard therefore does not apply, and mitigation options do not need to be considered. A summary of the results of the screening assessment are presented in Table 10-1.

As noted in Section 3.1.3, the NZS 6806 assessment requires that mitigation is only provided for the contribution of noise within the Altered Road extents, therefore the noise level predictions for PPFs at the ends of the NOR are reduced for the Do Minimum scenario as the surrounding road network contribution is not included. The surrounding road network is included in the noise predictions for the Do Minimum scenario for the assessment of road traffic noise effects in Section 7.2.2

Table 10-1 NZS 6806 Assessment and Summary

Category	Criteria	Number of PPFs		
		Existing	Do Nothing	Do Minimum
Cat A	64 dB $L_{Aeq(24h)}$	14	15	18
Cat B	67 dB $L_{Aeq(24h)}$	2	0	0
Cat C	40 dB Internal $L_{Aeq(24h)}$	2	3	0
Total		18	18	18

Existing scenario predictions show that noise levels within the Project area are between 50 dB $L_{Aeq(24h)}$ and 70 dB $L_{Aeq(24h)}$. Two PPFs are predicted to fall in Category B, and two PPFs are predicted to fall within Category C. The Category C PPFs are shown below:

- 108 Sandspit Road
- 1 Millstream Place

Under the Do Nothing scenario, the range of predicted noise levels falls between 50 dB $L_{Aeq(24h)}$ and 69 dB $L_{Aeq(24h)}$. Compared to the Existing scenario, 108 Sandspit Road and 1 Millstream Place remain in Category C, and 384 Sandspit Road moves to Category C, with all other PPFs being in Category A.

For the Do Minimum scenario, there is an overall reduction in noise levels at the upper end, with a predicted range of between 47 dB $L_{Aeq(24h)}$ and 64 dB $L_{Aeq(24h)}$. All PPFs in this scenario fall into Category A.

10.2.2 Assessment of Road Traffic Noise Effects

The effects associated with a change in noise level have been considered in addition to the NZS 6806 assessment. The Do Nothing scenario and Do Minimum scenario can be compared to determine the predicted noise level increase or decrease at PPFs as a result of the Project. Figure 10-1 shows the

predicted change in noise level at PPFs when comparing the Do Nothing and Do Minimum scenarios with the local road network included.

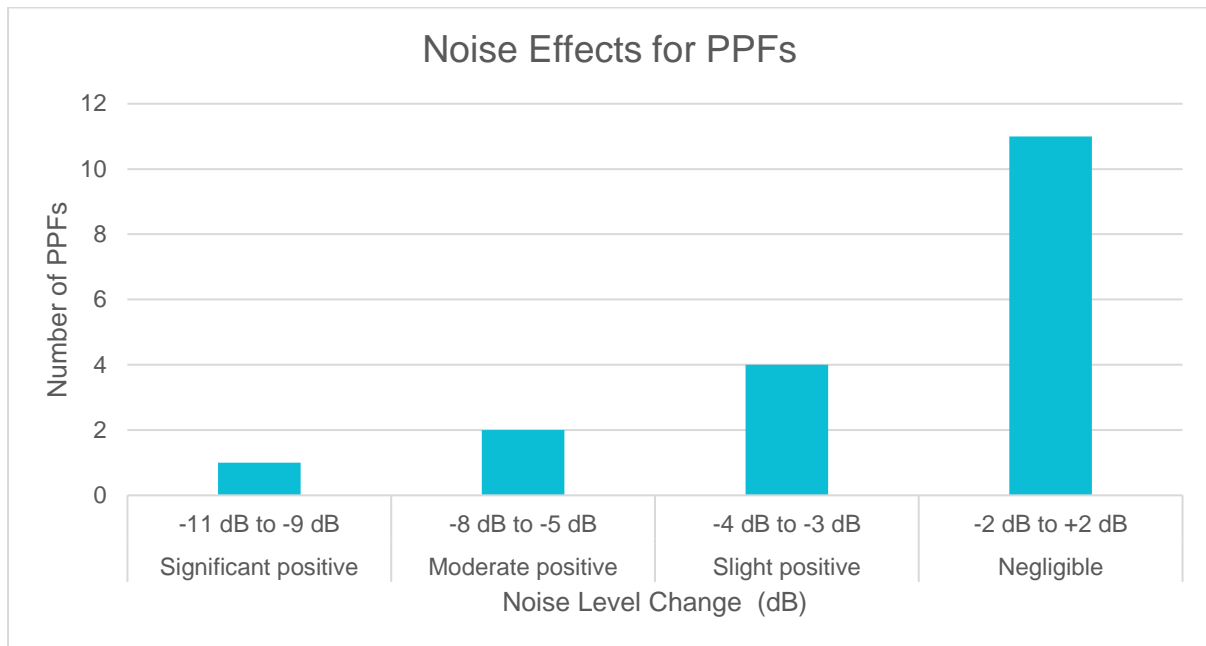


Figure 10-1: Change in Noise Level - Do Nothing Vs Do Minimum – NOR 5

Noise levels are predicted to change by a negligible margin (± 2 dB between the Do Nothing and Mitigation scenario) at 11 PPFs after implementation of the Project.

Predictions indicate that four PPFs will experience a decrease in noise level of 3-4 dB, resulting in slight positive effects, two PPFs will experience a decrease in noise level of 5-8 dB, resulting in moderate positive effects. One PPF will experience a decrease in noise level of 9-11 dB, resulting in significant positive effects

Positive noise level changes are brought about by localised terrain changes (addition of active transport corridor providing screening between Sandspit Road and some PPFs), the addition of a low noise AC-14 pavement, and a reduction in road traffic flow due to redistributed road traffic throughout the surrounding proposed road network.

Ambient noise levels will likely increase as the area urbanises and therefore the change in noise level due to the Project may not be as noticeable at the time.

Some PPFs may not exist anymore at the time of road construction particularly given the proposed zone change in the area allowing for urban development. Therefore, the predicted effects may not be experienced by current residents.

10.3 Conclusions

Road traffic noise levels have been assessed in accordance with NZS 6806. An initial screening assessment has been carried out and the Sandspit Road Upgrade does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 2.1. The Standard therefore does not apply, and mitigation options do not need to be considered.

A comparison of the predicted road traffic noise levels in the Do Nothing scenario and the Do Minimum scenario indicates that noise level changes will be negligible for the majority of PPFs.

11 NOR 6 – Western Link - South

This section assesses specific traffic noise matters relating to NOR 6 – Western Link - South.

11.1 Overview and description of works

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

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

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

11.1.1 Noise Environment

Western Link - South is an existing road with commercial and residential dwellings along the road corridor. The noise environment is dominated by road traffic noise from vehicles on the existing SH1, and industrial noise from the neighbouring Business – Light Industry Zone.

The majority of land adjacent to the Western Link - South is currently zoned as Future Urban Zone. There is a small area zoned as Business – Light Industry Zone.

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

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

11.2 Assessment of Road Traffic Noise Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

The traffic noise assessment for this NOR has been separated into the typology of Altered Road and New Road. Each PPF was assessed against the relevant noise criteria of either a New or Altered Road, depending on the classification as described in Section 3.1.3.

Predicted road-traffic noise levels at all existing PPFs for the Existing, Do Nothing, and Do Minimum scenarios are shown in Appendix D. The cells are colour coded according to the NZS 6806 category: Category A – green, Category B – orange, and Category C – red.

Noise contour maps showing indicative levels across a 100m radius from the alignment are provided in Appendix E. Specific noise level values should not be taken directly from the contours as they are interpolated from a grid resulting in some localised inaccuracies.

11.2.1 Altered Roads

11.2.1.1 Road Traffic Model Results Analysis

An initial screening assessment has been carried out and the Western Link - South does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. The Standard therefore does not apply, and mitigation options do not need to be considered. A summary of the results of the NZS 6806 assessment is shown in Table 11-1.

Table 11-1 NZS 6806 Assessment and Summary – Altered Roads

Category		Number of PPFs		
	Criteria	Existing	Do Nothing	Do Minimum
Cat A	57 dB $L_{Aeq(24h)}$	9	8	11
Cat B	64 dB $L_{Aeq(24h)}$	2	0	0
Cat C	40 dB Internal $L_{Aeq(24h)}$	0	3	0
Total		11	11	11

Existing scenario predictions show the noise level within the Project area is between 40 dB $L_{Aeq(24h)}$ and 65 dB $L_{Aeq(24h)}$. Two PPFs at 1848 State Highway 1 and 8F McKinney Road are in Category B. No PPFs are in Category C.

In the Do Nothing scenario, noise levels within the Project area are between 54 dB $L_{Aeq(24h)}$ and 71 dB $L_{Aeq(24h)}$. This scenario results in all PPFs falling into Category A, with the exception of 5, 6, and 7 Evelyn Street, which fall into Category C.

For the Do Minimum scenario, noise levels within the Project area are between 41 dB $L_{Aeq(24h)}$ and 62 dB $L_{Aeq(24h)}$. This scenario results in all PPFs falling into Category A.

11.2.1.2 Assessment of Road Traffic Noise Effects

The effects associated with a change in noise level have been considered in addition to the NZS 6806 assessment. The Do Nothing scenario and Do Minimum scenario can be compared to determine the predicted noise level increase or decrease at PPFs as a result of the Project. Figure 11-2 shows the predicted change in noise level at PPFs when comparing the Do Nothing and Do Minimum scenarios with the local road network included.

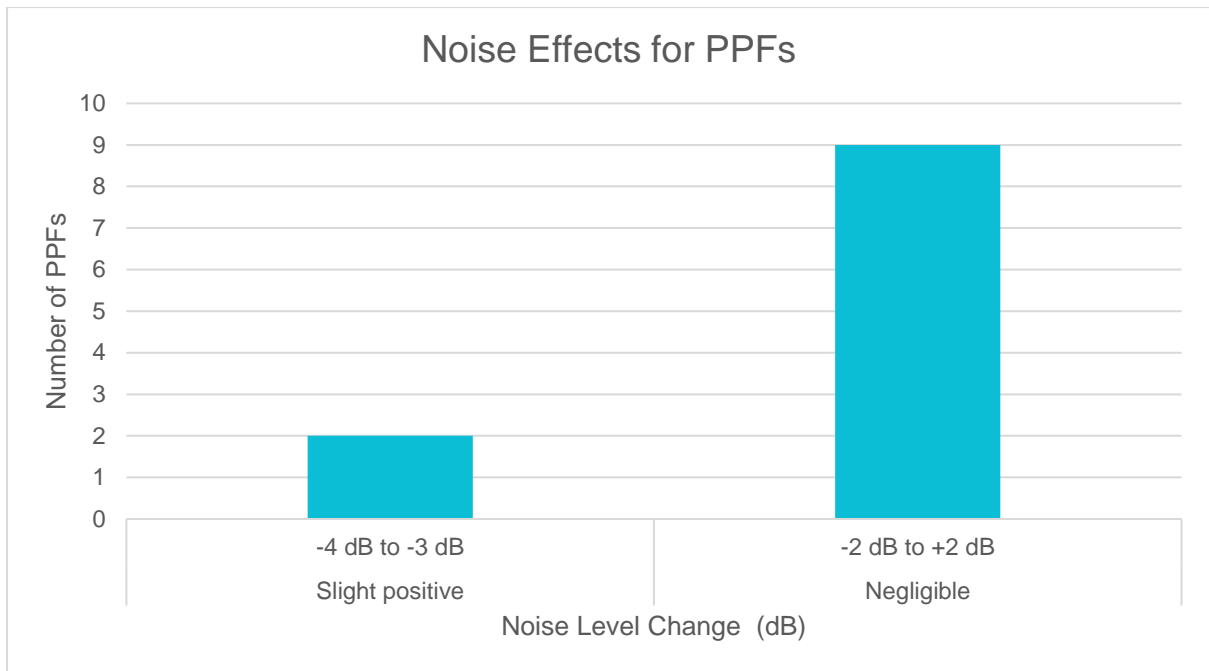


Figure 11-1: Change in Noise Level – Do Nothing Vs Do Minimum – NOR 6 Altered Roads

Predictions indicate that noise level changes will typically be negligible at the majority of PPFs when comparing the Do Nothing and Do Minimum scenarios.

Predictions indicate that two PPFs will experience a decrease in noise level of 3-4 dB, resulting in slight positive effects.

Ambient noise levels will likely increase regardless as the area urbanises and therefore the change in noise level due to the Project may not be as noticeable at the time.

Some PPFs may not exist anymore at the time of road construction particularly given the proposed zone change in the area allowing for urban development. Therefore, the predicted effects may not be experienced by current residents.

11.2.2 New Roads

11.2.2.1 Road Traffic Model Results Analysis

In accordance with NZS 6806 there is no Do Nothing scenario for the New road, so the Existing and Do Minimum scenarios are compared.

A summary of the results of the NZS 6806 assessment is shown in Table 11-2.

Table 11-2 NZS 6806 Assessment and Summary – New Roads

Category	Criteria	Number of PPFs	
		Existing	Do Minimum
Cat A	57 dB L _{Aeq(24h)}	27	23
Cat B	64 dB L _{Aeq(24h)}	0	4
Cat C	40 dB Internal L _{Aeq(24h)}	0	0
Total		27	27

Existing scenario predictions show the noise level within the Project area is between 37 dB L_{Aeq(24h)} and 42 dB L_{Aeq(24h)}. All PPFs are predicted to fall into Category A.

For the Do Minimum scenario there is an overall increase in noise levels with a predicted range of 43 dB L_{Aeq(24h)} to 62 dB L_{Aeq(24h)}. In this scenario, four PPFs are predicted to fall into Category B. These are located at:

- 2 Jamie Lane
- 1 Christopher Lane
- 2 Christopher Lane
- 1 Oliver Street

Since AC-14 is already considered as the Do Minimum road surface for NOR 6, a noise barrier was considered for the four Category B PPFs. However, a gap would be required in the barrier to maintain access from the road, which would compromise the barrier's performance and is therefore not recommended as BPO.

11.2.2.2 Assessment of Road Traffic Noise Effects

The effects associated with a change in noise level have been considered in addition to the NZS 6806 assessment. The Existing scenario and Do Minimum scenario can be compared to determine the predicted noise level increase or decrease at PPFs as a result of the Project. Figure 11-2 shows the predicted change in noise level at PPFs when comparing the Existing and Do Minimum scenarios with the local road network included.

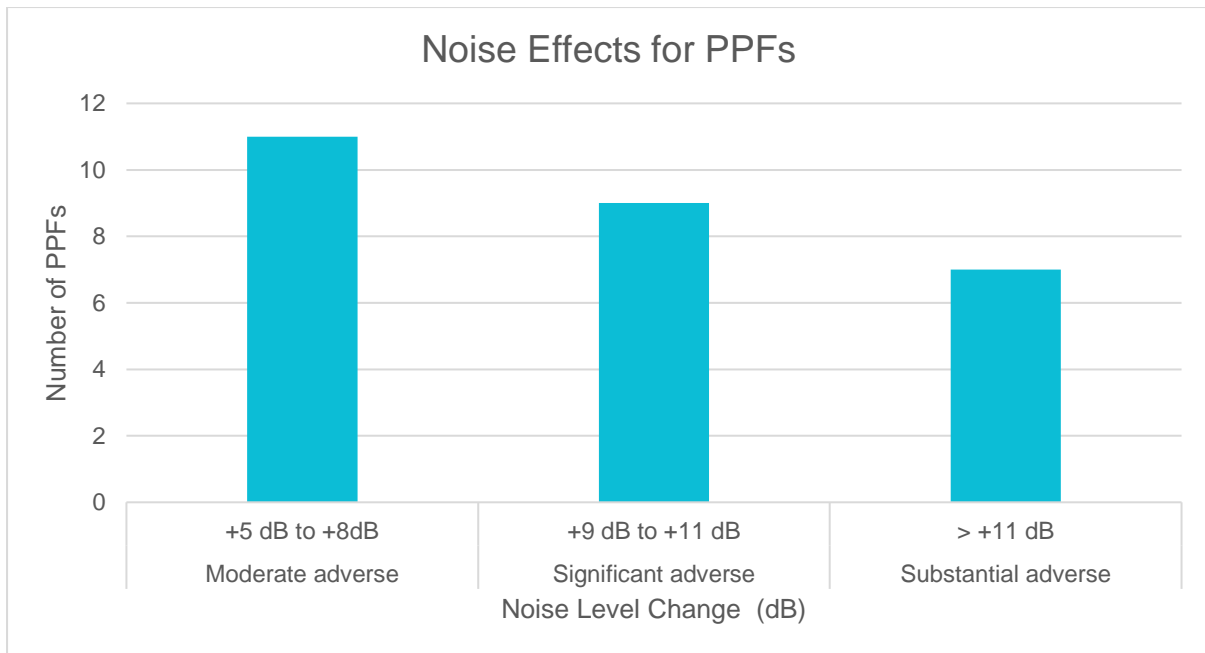


Figure 11-2: Change in Noise Level - Existing Vs Do Minimum – NOR 6 New Roads

Predictions indicate that noise levels will increase at all PPFs assessed against the New Road criteria when comparing the Existing and Do Minimum scenarios.

Predictions indicate that 11 PPFs will experience an increase in noise level of 5-8 dB, resulting in moderate adverse effects. Nine PPFs will experience an increase in noise level of 9-11 dB, resulting in significant adverse noise effects. Seven PPFs will experience an increase in noise level of more than 11 dB, resulting in substantial adverse effects.

Increases in noise levels at these PPFs is due to the construction of a new road corridor throughout this project extent, where no road previously existed. Some PPFs are located within close proximity to this proposed road alignment, resulting in a significant shift in road traffic noise levels at these locations.

Ambient noise levels will likely increase regardless as the area urbanises and therefore the change in noise level due to the Project may not be as noticeable at the time.

Some PPFs may not exist anymore at the time of road construction particularly given the proposed zone change in the area allowing for urban development. Therefore, the predicted effects may not be experienced by current residents.

11.3 Conclusions

Road traffic noise levels have been assessed in accordance with NZS 6806 for the Western Link - South. The Altered roads in this NOR did not meet the definition of an Altered Road according to NZS 6806, so mitigation measures were not investigated further for these sections.

A comparison of the predicted road traffic noise levels for Altered roads in the Do Nothing scenario (representative of the design year without the Project) and the Do Minimum scenario (representative of the design year with the Project) indicates that noise level changes will be negligible for the majority of PPFs if the Project were constructed, with all PPFs falling into Category A.

A comparison of the predicted road traffic noise levels for New roads in the Existing scenario and the Do Minimum scenario indicates that noise levels are likely to increase at most PPFs, with up to 16 PPFs experiencing significant or substantial adverse effects. Since AC-14 is already considered as the Do Minimum road surface for NOR 6, a noise barrier was considered for this location. However, its performance would be compromised due to the gap required to maintain access from the road.

12 NOR 7 – Sandspit Link

This section assesses specific traffic noise matters relating to NOR 7 – Sandspit Link.

12.1 Overview and description of works

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

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

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

12.1.1 Noise Environment

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

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

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

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

12.2 Assessment of Road Traffic Noise Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

The traffic noise assessment for this NOR has been separated into the typology of Altered Road and New Road. Each PPF was assessed against the relevant noise criteria of either a New or Altered Road, depending on the classification as described in Section 3.1.3.

Predicted road-traffic noise levels at all existing PPFs for the Existing, Do Nothing, and Do Minimum scenarios are shown in Appendix D. The cells are colour coded according to the NZS 6806 category: category A – green, category B – orange, and category C – red.

Noise contour maps showing indicative levels across a 100m radius from the alignment are provided in Appendix E. Specific noise level values should not be taken directly from the contours as they are interpolated from a grid resulting in some localised inaccuracies.

Based on information provided by the Project team, the following residential building will be removed to make room for the Project alignment and have not been considered in the assessment:

- 181 Sandspit Road

12.2.1 Altered Roads

12.2.1.1 Road Traffic Model Results Analysis

An initial screening assessment has been carried out and the Sandspit Link does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. The Standard therefore does not apply, and mitigation options do not need to be considered. A summary of the results of the NZS 6806 assessment is shown in Table 12-1.

Table 12-1 NZS 6806 Assessment and Summary – Altered Roads

Category	Criteria	Number of PPFs		
		Existing	Do Nothing	Do Minimum
Cat A	57 dB L _{Aeq(24h)}	2	2	2
Cat B	64 dB L _{Aeq(24h)}	0	0	0
Cat C	40 dB Internal L _{Aeq(24h)}	0	0	0
Total		2	2	2

Existing scenario predictions show the noise level within the Project area is between 59 dB L_{Aeq(24h)} and 61 dB L_{Aeq(24h)}. The two PPFs assessed under the Altered road criteria both fall into Category A.

For the Do Nothing Scenario, predictions show that noise levels within the Project are between 58 dB L_{Aeq(24h)} and 60 dB L_{Aeq(24h)}. Similarly, all PPFs fall into Category A.

For the Do Minimum scenario traffic noise levels are predicted in the range of 54 dB L_{Aeq(24h)} at both PPFs. All PPFs in this scenario fall into Category A.

12.2.1.2 Assessment of Road Traffic Noise Effects

The effects associated with a change in noise level have been considered in addition to the NZS 6806 assessment. The Do Nothing scenario and Do Minimum scenario can be compared to determine the predicted noise level increase or decrease at PPFs as a result of the Project. Figure 12-1 shows the predicted change in noise level at PPFs when comparing the Do Nothing and Do Minimum scenarios with the local road network included.

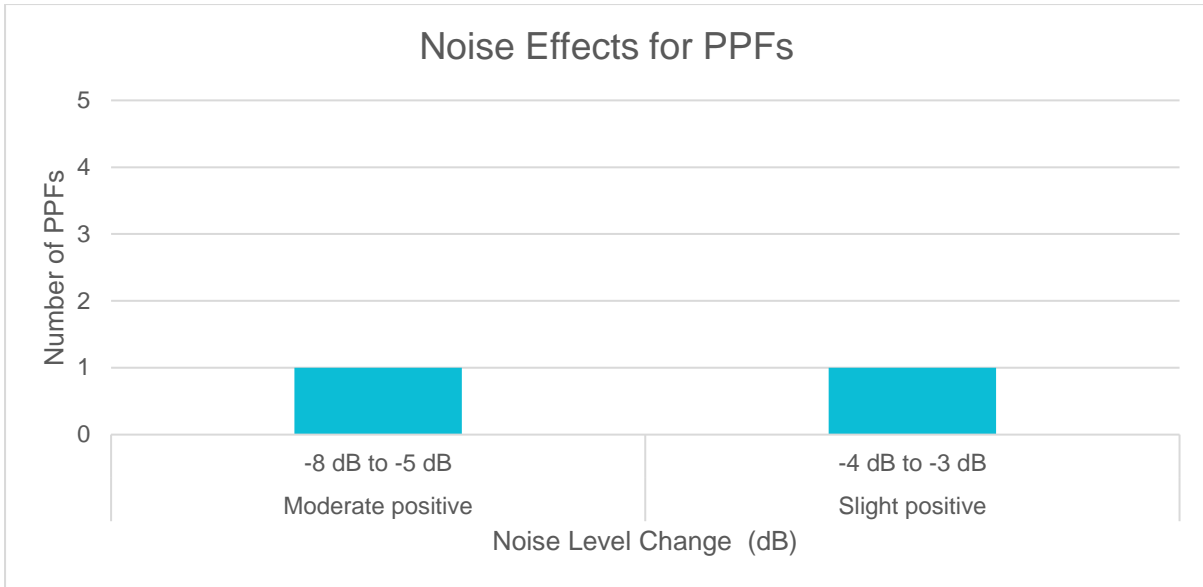


Figure 12-1: Change in Noise Level – Do Nothing Vs Do Minimum – NOR 7 Altered Roads

Predictions indicate that noise levels at one PPF are predicted to decrease by 3-4 dB, resulting in slight positive effects. One PPF will experience a decrease of 5-8 dB, resulting in moderate positive effects.

Decreases in noise levels at these PPFs are predominantly due to an overall reduction in road traffic flow on Altered roads as a result of the redistribution of traffic throughout the Project area.

Ambient noise levels will likely increase as the area urbanises and therefore the change in noise level due to the Project may not be as noticeable at the time.

The PPFs may not exist anymore at the time of road construction particularly given the proposed zone change in the area allowing for urban development. Therefore, the predicted effects may not be experienced by current residents.

12.2.2 New Roads

12.2.2.1 Road Traffic Model Results Analysis

In accordance with NZS 6806 there is no Do Nothing scenario for the New road, so the Existing and Do Minimum scenarios are compared.

A summary of the results of the NZS 6806 assessment is shown in Table 12-2.

Table 12-2 NZS 6806 Assessment and Summary – New Roads

Category		Number of PPFs	
	Criteria	Existing	Do Minimum
Cat A	57 dB L _{Aeq(24h)}	3	3
Cat B	64 dB L _{Aeq(24h)}	0	0
Cat C	40 dB Internal L _{Aeq(24h)}	0	0
Total		3	3

Existing scenario predictions show the noise level within the Project area is between 46 dB L_{Aeq(24h)} and 48 dB L_{Aeq(24h)}, with all PPFs falling into Category A.

For the Do Minimum scenario traffic noise levels are predicted in the range of 46 dB L_{Aeq(24h)} to 48 dB L_{Aeq(24h)}. All PPFs in this scenario fall into Category A.

12.2.2.2 Assessment of Road Traffic Noise Effects

The effects associated with a change in noise level have been considered in addition to the NZS 6806 assessment. The Existing scenario and Do Minimum scenario can be compared to determine the predicted noise level increase or decrease at PPFs as a result of the Project. Figure 12-2 shows the predicted change in noise level at the three PPFs when comparing the Existing and Do Minimum scenarios with the local road network included.

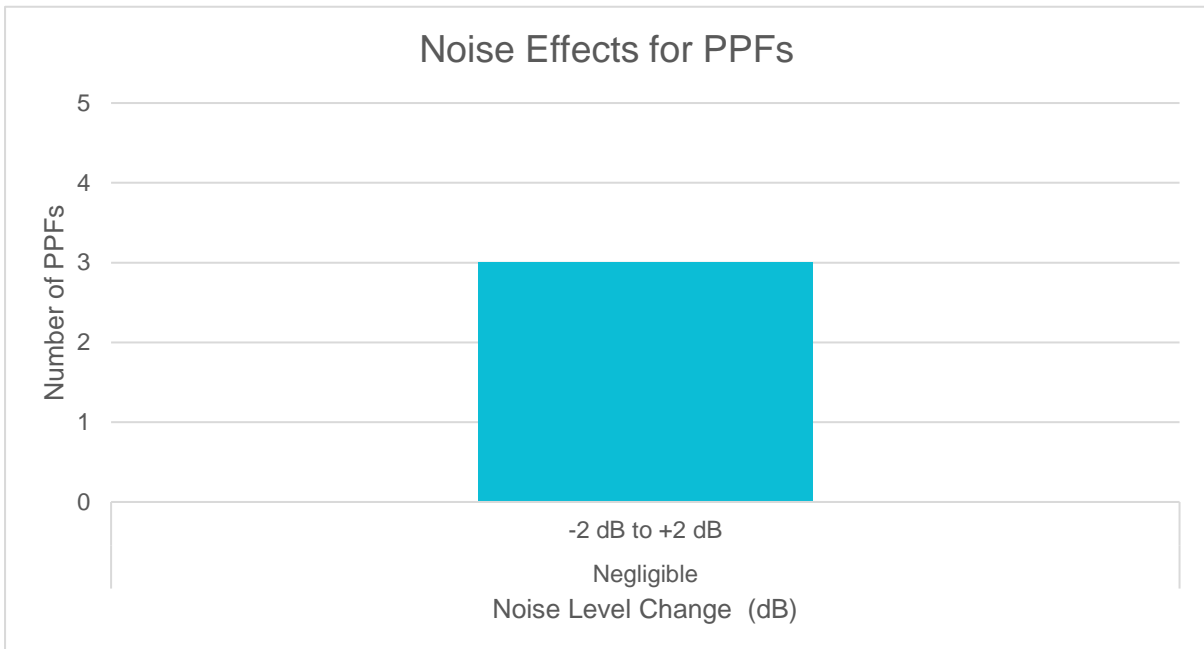


Figure 12-2: Change in Noise Level - Existing Vs Do Minimum – NOR 7 New Roads

Predictions indicate that noise levels are predicted to change by a negligible margin (± 2 dB between the Existing and Do Minimum scenario) at all three PPFs after implementation of the Project.

Despite the construction of a new road corridor near these PPFs, the overall reduction of road traffic on the surrounding road network results in a net change that is negligible.

Ambient noise levels will likely increase as the area urbanises and therefore the change in noise level due to the Project may not be as noticeable at the time.

The PPFs may not exist anymore at the time of road construction particularly given the proposed zone change in the area allowing for urban development. Therefore, the predicted effects may not be experienced by current residents.

12.3 Conclusions

Road traffic noise levels have been assessed in accordance with NZS 6806 for the Sandspit Link Upgrade. The Altered roads in this NOR did not meet the definition of an Altered Road according to NZS 6806, so mitigation measures were not investigated for these sections.

A comparison of the predicted road traffic noise levels for Altered roads in the Do Nothing scenario and the Do Minimum scenario indicates that noise levels changes will be slightly to moderately positive for all PPFs, due to a reduction of road traffic on Altered roads as traffic is redistributed throughout the Project Area.

A comparison of the predicted road traffic noise levels for New roads in the Existing scenario and the Do Minimum scenario indicates that changes in noise levels are likely to be negligible at all three PPFs. All PPFs would fall into Category A in the Do Minimum scenario.

13 NOR 8 – Wider Western Link – North

This section assesses specific traffic noise matters relating to NOR 8 – Wider Western Link – North.

13.1 Overview and description of works

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

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

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

13.1.1 Noise Environment

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

It is anticipated that the noise environment in the future will change as a result of the opening of Ara Tuhono (Puhoi to Warkworth). When Ara Tuhono opens, the road will no longer be SH1, and it is anticipated that the majority of traffic passing through Warkworth will use the new corridor.

Wider Western Link (Northern Section) is located on land which is zoned as FUZ. There is a high likelihood of urban development in the FUZ. This is signalled by the Warkworth Structure Plan which identifies a future change to Business – Heavy Industrial Zone in the northern section of the alignment and residential land uses in the southern section of the alignment. This zoning would likely result in an increase in ambient noise levels as the area urbanises compared to the current rural nature.

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

13.2 Assessment of Road Traffic Noise Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

The traffic noise assessment for this NOR has been separated into the typology of Altered Road and New Road. Each PPF was assessed against the relevant noise criteria of either a New or Altered Road, depending on the classification as described in Section 3.1.3.

Predicted road-traffic noise levels at all existing PPFs for the Existing and Do Minimum scenarios are shown in Appendix D. The cells are colour coded according to the NZS 6806 category: category A – green, category B – orange, and category C – red.

Noise contour maps showing indicative levels across a 100m radius from the alignment are provided in Appendix E. Specific noise level values should not be taken directly from the contours as they are interpolated from a grid resulting in some localised inaccuracies.

Based on information provided by the Project team, the following residential building will be removed to make room for the Project alignment and has not been considered in the assessment:

- 2 Wyllie Road

13.2.1 Altered Roads

13.2.1.1 Road Traffic Model Results Analysis

An initial screening assessment has been carried out and the Sandspit Link does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. The Standard therefore does not apply, and mitigation options do not need to be considered. A summary of the results of the NZS 6806 assessment is shown in Table 13-1.

Table 13-1 NZS 6806 Assessment and Summary – Altered Roads

Category		Number of PPFs		
	Criteria	Existing	Do Nothing	Do Minimum
Cat A	57 dB $L_{Aeq(24h)}$	2	2	2
Cat B	64 dB $L_{Aeq(24h)}$	0	0	0
Cat C	40 dB Internal $L_{Aeq(24h)}$	0	0	0
Total		2	2	2

Existing scenario predictions show the noise level within the Project area is between 53 dB $L_{Aeq(24h)}$ and 62 dB $L_{Aeq(24h)}$. Both PPFs are predicted to fall into Category A.

In the Do Nothing scenario, noise levels within the Project area are between 52 dB $L_{Aeq(24h)}$ and 60 dB $L_{Aeq(24h)}$. Both PPFs are similarly predicted to fall into Category A.

For the Do Minimum scenario traffic noise levels are predicted in the range of 54 dB $L_{Aeq(24h)}$ to 56 dB $L_{Aeq(24h)}$. This scenario results in all PPFs falling into Category A.

13.2.1.2 Assessment of Road Traffic Noise Effects

The effects associated with a change in noise level have been considered in addition to the NZS 6806 assessment. The Do Nothing scenario and Do Minimum scenario can be compared to determine the predicted noise level increase or decrease at PPFs as a result of the Project. Figure 13-1

shows the predicted change in noise level at PPFs when comparing the Do Nothing and Do Minimum scenarios with the local road network included.

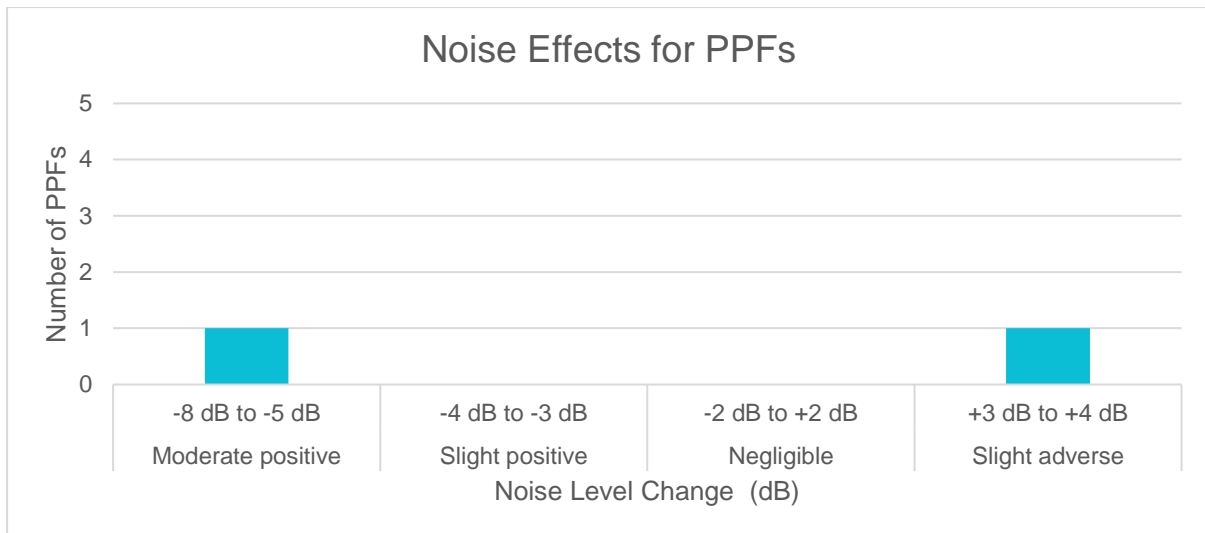


Figure 13-1: Change in Noise Level – Do Nothing Vs Do Minimum – NOR 8 Altered Roads

Predictions indicate that one PPF at 346 Woodcocks Road will experience a decrease in noise level of 6 dB, resulting in moderate positive effects.

One PPF located at 12 Wyllie Road is predicted to have traffic noise levels increase by 4 dB, resulting in slight adverse effects. However, it should be noted that all PPFs are in Category A.

While the PPF at 12 Wyllie Road is within 100m of Woodcocks Road (hence its assessment against the Altered Roads criteria), an increase in noise level is predicted at this PPF due to the construction of the new road corridor to the east of the PPF where no road previously existed.

Reduced traffic flows along Woodcocks Road results in the PPF at 346 Woodcocks Road experiencing a reduction in road traffic noise levels.

Ambient noise levels will likely increase as the area urbanises and therefore the change in noise level due to the Project may not be as noticeable at the time.

Some PPFs may not exist anymore at the time of road construction particularly given the proposed zone change in the area allowing for urban development. Therefore, the predicted effects may not be experienced by current residents.

13.2.2 New Roads

13.2.2.1 Road Traffic Model Results Analysis

In accordance with NZS 6806 there is no Do Nothing scenario for the New road, so the Existing and Do Minimum scenarios are compared.

A summary of the results of the NZS 6806 assessment is shown in Table 13-2.

Table 13-2 NZS 6806 Assessment and Summary – New Roads

Category		Number of PPFs	
	Criteria	Existing	Do Minimum
Cat A	57 dB L _{Aeq(24h)}	1	1
Cat B	64 dB L _{Aeq(24h)}	0	0
Cat C	40 dB Internal L _{Aeq(24h)}	0	0
Total		1	1

Existing scenario predictions show the noise level at the single PPF under consideration at 123 Valerie Close in this assessment is 35 dB L_{Aeq(24h)}, therefore falling into Category A.

For the Do Minimum scenario traffic noise levels are predicted to be 48 dB L_{Aeq(24h)}. This scenario results in the PPF falling into Category A.

13.2.2.2 Assessment of Road Traffic Noise Effects

The effects associated with a change in noise level have been considered in addition to the NZS 6806 assessment. The Existing scenario and Do Minimum scenario with the local road network included can be compared to determine the predicted noise level increase or decrease at 123 Valerie Close as a result of the Project.

Predictions indicate that this PPF will experience an increase in noise level of 13 dB, resulting in substantial adverse effects.

The increase in noise level at this PPF is due to the construction of a new road corridor throughout this project extent, where no road previously existed. The PPF is located within close proximity to this proposed road alignment, resulting in a shift in road traffic noise levels at this location. Although a 13 dB increase is predicted at this PPF, the resulting noise level of 48 dB L_{Aeq(24h)} is still typical of a rural environment.

Ambient noise levels will likely increase as the area urbanises and therefore the change in noise level due to the Project may not be as noticeable at the time.

13.3 Conclusions

Road traffic noise levels have been assessed in accordance with NZS 6806 for the Wider Western Link (Northern Section). The Altered roads in this NOR did not meet the definition of an Altered road according to NZS 6806, so mitigation measures were not investigated for these sections.

A comparison of the predicted road traffic noise levels for Altered roads in the Do Nothing scenario and the Do Minimum scenario indicated noise level changes will be moderately positive at one PPF and slightly adverse at the other. Both PPFs in this case would fall into Category A for both scenarios.

A comparison of the predicted road traffic noise levels for New roads in the Existing scenario and the Do Minimum scenario indicates that changes in noise levels are likely to be substantially adverse at

the single PPF under consideration in the assessment. Despite this noise level increase, this PPF would still fall into Category A in both the Existing and Do Minimum scenarios. Although a 13 dB increase is predicted at this PPF, the resulting noise level of 48 dB $L_{Aeq(24h)}$ is still typical of a rural environment.

14 Conclusions

An assessment of traffic noise has been carried out for the Warkworth Assessment Package for New and Altered Roads based on NZS 6806 and the predicted change in noise level. To determine the change in noise level a comparison has been made between the predicted road traffic noise levels in the Existing (for New Roads) or Do Nothing (for Altered Roads) scenarios (representative of the design year without the Project, assuming traffic from full area development on the existing road network) and Do Minimum or Mitigated scenarios (with the Project and all other Warkworth Package projects implemented along with BPO mitigation where applicable).

All existing PPFs within 100m of each alignment have been considered within the assessment. Buildings that are within the NOR designation areas have been removed from the Do Minimum and Mitigated scenarios as they will not remain following the Project implementation.

An assessment of operational noise from the interchange facility (NOR 1) during peak hours was carried out based on indicative information for the peak hours as provided by the Project team. The predictions indicate that the most stringent night-time noise criteria will be met at adjacent existing and likely future receivers at the Design Year.

NOR 2 does not meet the definition of an Altered Road. The Standard therefore does not apply, and mitigation options do not need to be considered. A comparison of the Do Nothing and Mitigation scenarios indicates that noise level changes will be negligible at a majority of PPFs as a result of speed reduction and redistribution of traffic across the network. All PPFs would fall into Category A.

For NOR 3, noise level changes are predicted to be positive at the majority of PPFs with the implementation of AC-14 low noise road surface mitigation for the existing SH1. With mitigation in place, all PPFs fall into Category A.

For NOR 4, noise level changes are predicted to be negligible at the vast majority of PPFs after implementation of the recommended mitigation option of low-noise road surface. With mitigation in place all PPFs are in Category A.

NOR 5 does not meet the definition of an Altered Road. The Standard therefore does not apply, and mitigation options do not need to be considered. A comparison of the Do Nothing and Mitigation scenarios indicates that noise level changes will be negligible at a majority of PPFs as a result of speed reduction and redistribution of traffic across the network. All PPFs would fall into Category A.

NOR 6 contains both Altered and New roads. Altered roads in this NOR did not meet the definition of an Altered Road according to NZS 6806, so mitigation measures were not investigated further. A comparison of the predicted road traffic noise levels for Altered roads in the Do Nothing scenario and the Do Minimum scenario indicates that noise level changes will be negligible or positive, with all PPFs falling into Category A.

For New roads under the Do Minimum scenario the majority of PPFs are in Category A with four PPFs in Category B. A low noise road surface, AC-14, is already included as the Do Minimum road surface. A noise barrier was considered for the four PPFs in Category B, however, its performance would be compromised by the gap required to maintain access from the road. Noise levels are predicted to increase at all PPFs under the Do Minimum scenario.

NOR 7 contains both Altered and New roads. For Altered roads under the Do Minimum scenario, noise level changes are predicted to be negligible for the two PPFs under consideration, with both

falling into Category A. The Altered roads in this NOR did not meet the definition of an Altered Road according to NZS 6806, so mitigation measures were not investigated for these sections.

A comparison of the predicted road traffic noise levels for New roads in the Existing and the Do Minimum scenarios indicates that changes in noise levels are likely to be moderately or slightly positive at all three PPFs. All PPFs fall into Category A under the Do Minimum scenario.

NOR 8 contains both New and Altered roads. For the Altered roads under the Do Minimum scenario, noise level changes are predicted to be moderately positive at one PPF, and slightly adverse at the other PPF. However, both PPFs would fall into Category A. The Altered roads in this NOR did not meet the definition of an Altered Road according to NZS 6806, so mitigation measures were not investigated.

A comparison of the predicted road traffic noise levels for the New roads in the Existing scenario and the Do Minimum scenario indicates that changes in noise levels are likely to be substantially adverse at the one PPF under consideration. However, the PPF would still fall into Category A and the resulting noise level of 48 dB $L_{Aeq(24h)}$ is still typical of a rural environment.

All predictions are based on traffic flow along New and Altered Roads at the design year (2048). These traffic volumes are predicated on the anticipated urbanisation of the area and implementation of surrounding infrastructure projects. Development of the surrounding areas will likely increase activity and associated noise levels. Therefore, any changes predicted for the traffic noise effects related to these Projects are not likely to represent such a significant change at the time of construction due to the change in environment.

As such, the results are indicative of a possible future scenario, but effects cannot be definitively determined at this stage. Reassessment of the road traffic noise at current PPFs will be carried out nearer the time of construction to confirm that the recommended mitigation still represents the best practicable option. The review, confirmation, and refinement of the BPO shall aim to achieve the same noise criteria categories as determined with the current BPO.

Nevertheless, the predictions show that all but four PPFs across all Projects will receive levels within the Category A criteria, which is the most stringent Category and represents the lowest design noise levels. This is provided that any mitigation measures outlined in this document are implemented.

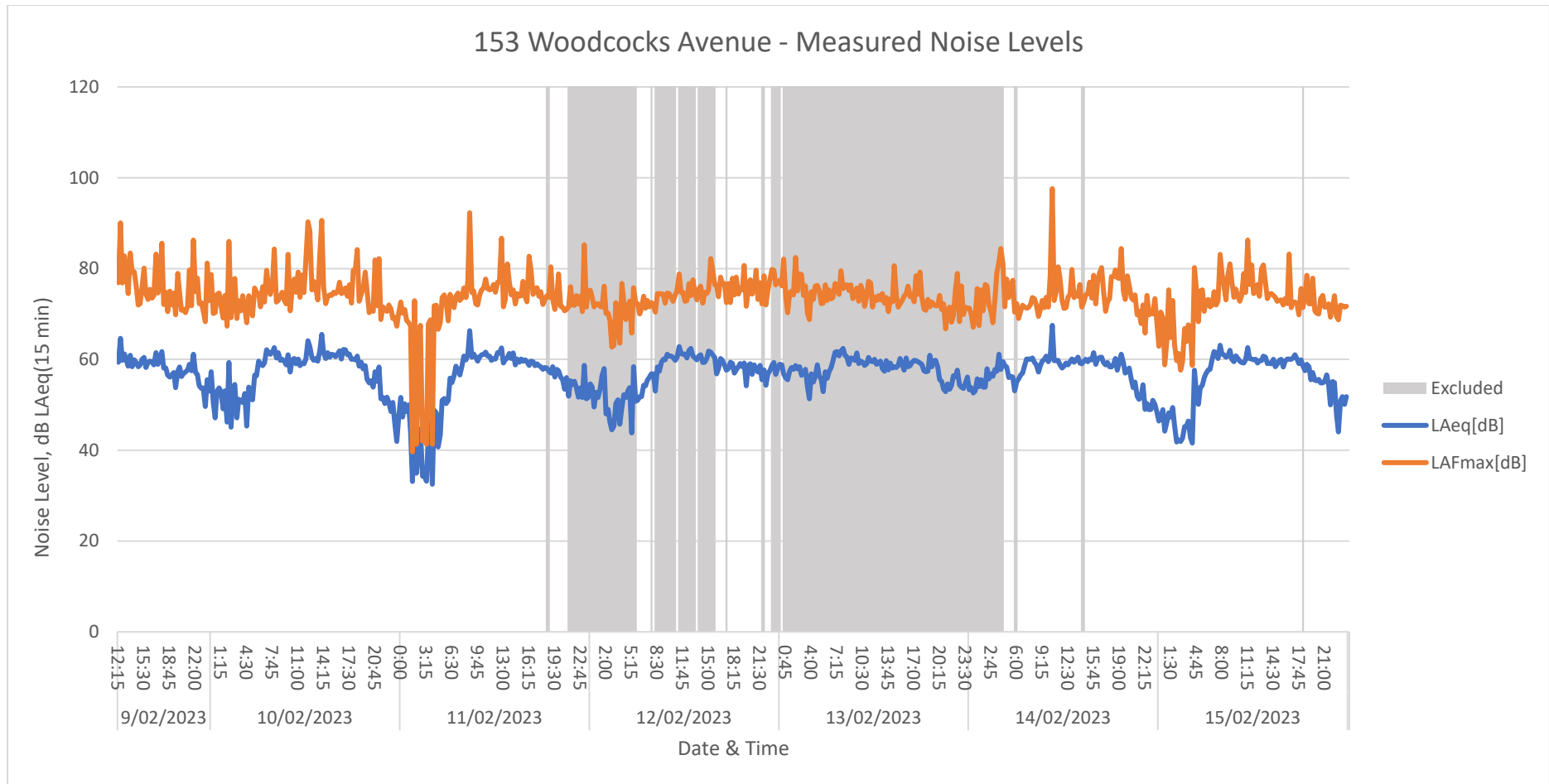
Traffic vibration from new or upgraded roading projects is not generally expected to create any vibration issues. Therefore, traffic vibration has not been assessed for the Projects.

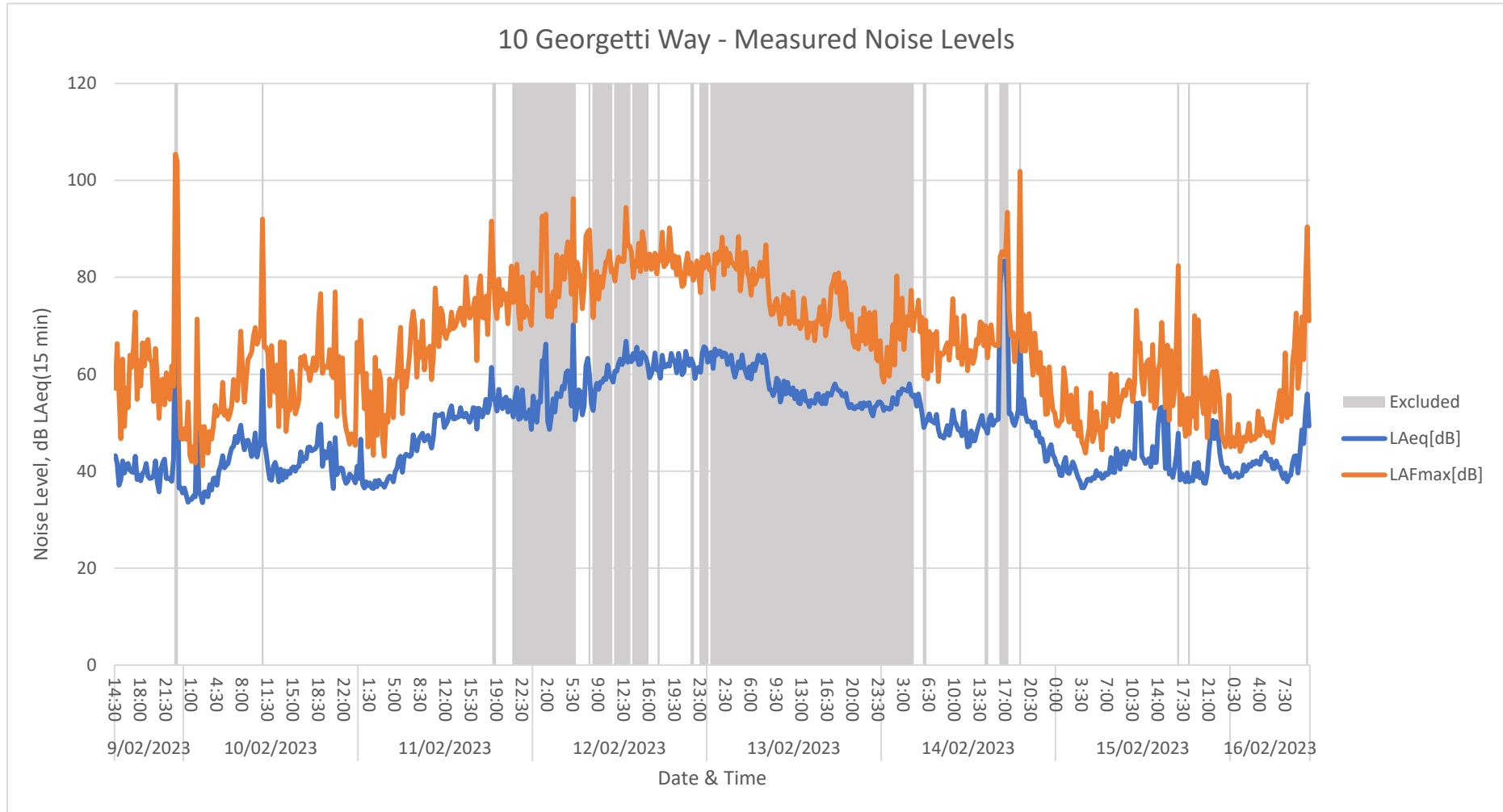
1 Appendix A: Assumptions

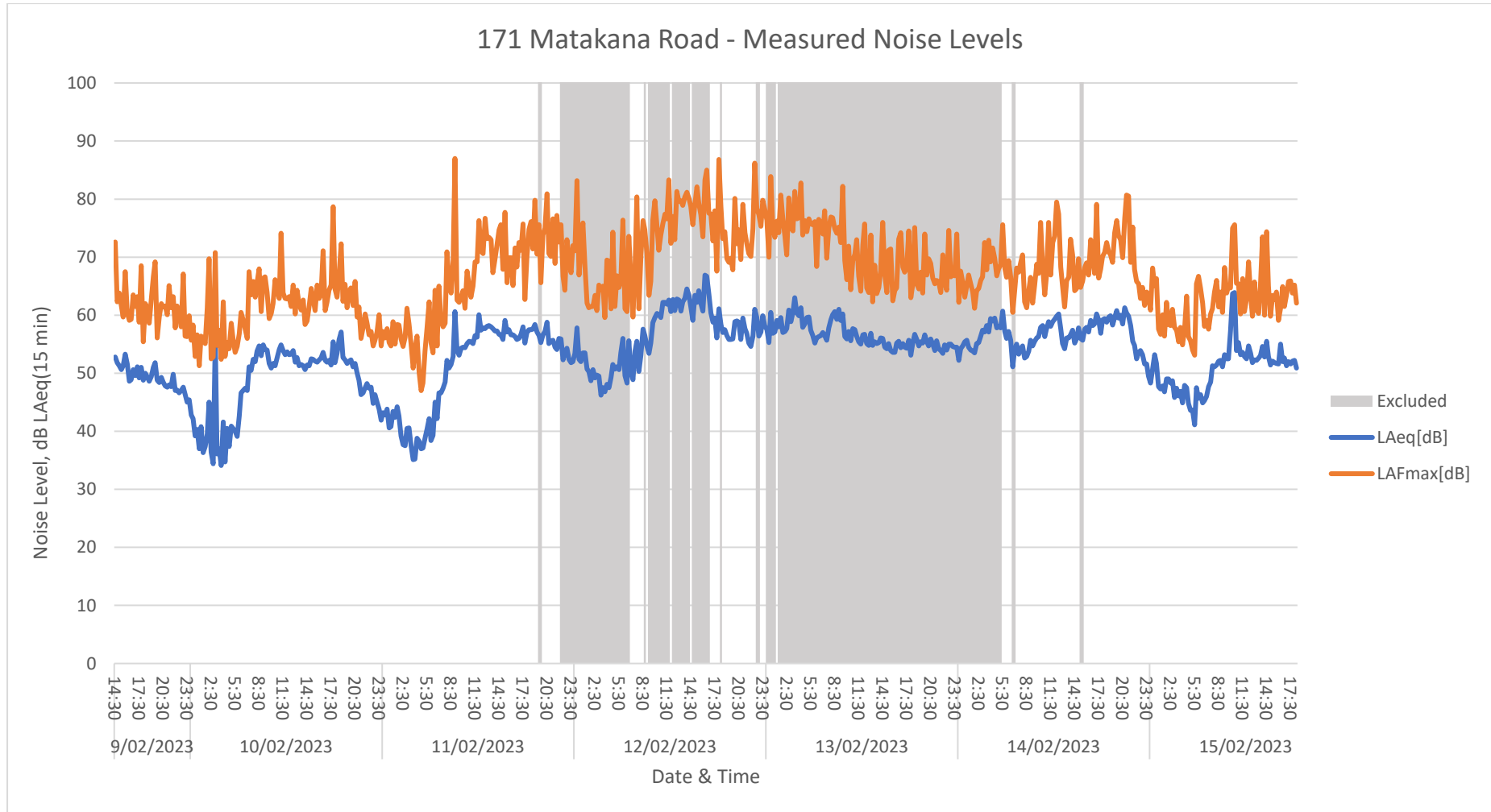
Package	Project(s)	Existing	Do Nothing	Do Minimum
Warkworth	New Northern Public Transport Interchange and Park and Ride (NoR 1)	x	√	√
	New Southern Public Transport Interchange	x	x	x
	New Southern Interchange on Ara Tūhono Puhoi to Warkworth Motorway	x	x	x
	SH1 Upgrade (NoR 3)	x	√	√
	Woodcocks Road Upgrade (NoR 2)	x	√	√
	Matakana Road Upgrade (NoR 4)	x	√	√
	Sandspit Road Upgrade (NoR 5)	x	√	√
	New Western Link Road – North (Mansel Drive to SH1)	x	x	x
	New Western Link Road – Central (Mansel Drive and Evelyn Street)	x	x	x
	New Western Link Road – South (Evelyn Street to SH1) (NoR 6)	x	x	x
	New Wider Western Link Road (Woodcocks Road to SH1) (NoR 8)	x	x	x
	New Sandspit Road Link (Between Matakana Road and Sandspit Road) (NoR 7)	x	x	x

Key	
√	Included
x	Excluded
*	Minimal Network Change

2 Appendix B: Noise Monitoring Results







3 Appendix C: Noise Monitoring Forms

NOISE MONITORING FORM – 10 Georgetti Way				
Summary				
Project name	Supporting Growth Alliance			
Project number	60558831			
Date / time	09/02/2023, 14:30pm			
Engineer(s)	Dhulkifl Ahmed			
Location (NZTM2000)	X	1747792	Y	5969208
Equipment				
Manufacturer	Rion			
Type	NL-52			
Serial number	00898330			
Date of last calibration	29/11/2021			
Calibration drift pre/post	N/A			
Noise Environment				
Which assessment method is applicable? <i>i.e.</i> NZS 6802:2008 Simple / Detailed or other.	Simple			
General description of measured noise: specific and residual levels including comments on k ₁ adjustment and contamination	Dominant noise source: Road noise from Georgetti Way			
Any special audible characteristics (tonality, impulsivity etc.) and comment on k ₂ adjustment	N/A			
Meteorological Conditions				
Wind speed and direction at microphone	3.6			
Wind speed and direction at dominant source(s)	3.6			
Precipitation	0			
Fog	N/A			
Temperature	18.6			
Humidity	43%			
Percentage cloud cover	60%			
Site Conditions				
Microphone height	1.5m			
Distance to dominant noise source(s)	8m			
Height of noise source(s)	Ground level			
Distance from any reflective surfaces	1.5m			
Intervening topography	N/A			
Hard, mixed or soft ground	Mixed			
Barriers between source(s) and microphone	N/A			
General comments and sketches				



Photo A: View toward the source

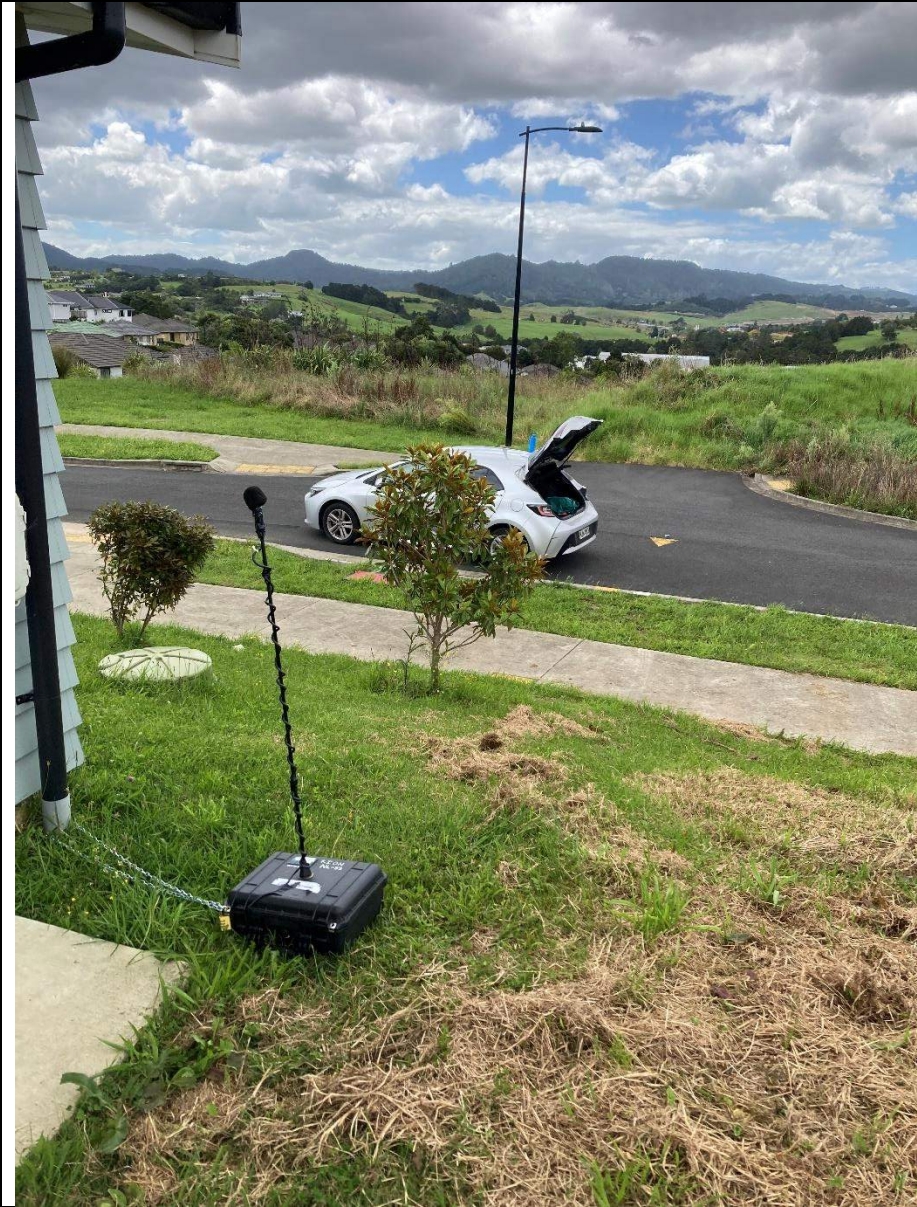


Photo B:

NOISE MONITORING FORM – 171 Matakana Road				
Summary				
Project name	Supporting Growth Alliance			
Project number	60558831			
Date / time	09/02/2023, 13:30pm			
Engineer(s)	Dhulkifl Ahmed			
Location (NZTM2000)	X	1748825	Y	5971672
Equipment				
Manufacturer	01dB			
Type	Cube			
Serial number	00898331			
Date of last calibration	29/11/2021			
Calibration drift pre/post	N/A			
Noise Environment				
Which assessment method is applicable? <i>i.e.</i> NZS 6802:2008 Simple / Detailed or other.	Simple			
General description of measured noise: specific and residual levels including comments on k ₁ adjustment and contamination	Dominant noise source: Road noise from Matakana Rd, foliage, and insect noise from surrounding area			
Any special audible characteristics (tonality, impulsivity etc.) and comment on k ₂ adjustment	N/A			
Meteorological Conditions				
Wind speed and direction at microphone	3.1 m/s			
Wind speed and direction at dominant source(s)	3.1 m/s			
Precipitation	0			
Fog	N/A			
Temperature	19.5			
Humidity	38			
Percentage cloud cover	60%			
Site Conditions				
Microphone height	1.5m			
Distance to dominant noise source(s)	30m			
Height of noise source(s)	Ground level			
Distance from any reflective surfaces	1.5m			
Intervening topography	Slight hill between noise source and receiver			
Hard, mixed or soft ground	Mixed			
Barriers between source(s) and microphone	N/A			
General comments and sketches				





Photo A: View toward the source

NOISE MONITORING FORM – 153 Woodcocks Road				
Summary				
Project name	Supporting Growth Alliance			
Project number	60558831			
Date / time	09/02/2023, 12:15pm			
Engineer(s)	Dhulkifl Ahmed			
Location (NZTM2000)	X	1747278	Y	5969508
Equipment				
Manufacturer	Rion			
Type	NL-52			
Serial number	00898331			
Date of last calibration	29/11/2021			
Calibration drift pre/post	N/A			
Noise Environment				
Which assessment method is applicable? <i>i.e.</i> NZS 6802:2008 Simple / Detailed or other.	Simple			
General description of measured noise: specific and residual levels including comments on k ₁ adjustment and contamination	Dominant noise source: Road noise from Woodcocks Ave			
Any special audible characteristics (tonality, impulsivity etc.) and comment on k ₂ adjustment	N/A			
Meteorological Conditions				
Wind speed and direction at microphone	3.2 m/s			
Wind speed and direction at dominant source(s)	3.2 m/s			
Precipitation	0			
Fog	N/A			
Temperature	19.2			
Humidity	42%			
Percentage cloud cover	60%			
Site Conditions				
Microphone height	1.5m			
Distance to dominant noise source(s)	10m			
Height of noise source(s)	Ground level			
Distance from any reflective surfaces	1.5m			
Intervening topography	Foliage between source and receiver			
Hard, mixed or soft ground	Mixed			
Barriers between source(s) and microphone	N/A			
General comments and sketches				



Photo A: View toward the source



4 Appendix D: Predicted Road Traffic Noise Levels

NOR 2

Address	Existing	Do Nothing	Do Min
372 Woodcocks Road, Warkworth	56	56	49
371 Woodcocks Road, Warkworth	59	58	54
100 Woodcocks Road, Warkworth	48	52	52
2 Mason Heights, Warkworth	55	59	60
1 Mason Heights, Warkworth	51	56	56
18 Oliver Street, Warkworth	46	51	50
10 Oliver Street, Warkworth	45	52	49
12 Oliver Street, Warkworth	46	51	50
14 Oliver Street, Warkworth	46	51	50
16 Oliver Street, Warkworth	45	51	50
20 Oliver Street, Warkworth	46	51	52
3 Mason Heights, Warkworth	47	51	52
22 Oliver Street, Warkworth	40	47	44
8 Oliver Street, Warkworth	43	53	48
6 Oliver Street, Warkworth	43	56	49
4 Oliver Street, Warkworth	44	61	50
6 Evelyn Street, Warkworth	46	71	49
7 Evelyn Street, Warkworth	43	69	46
5 Evelyn Street, Warkworth	46	69	48
85 Woodcocks Road, Warkworth	52	57	37
83 Woodcocks Road, Warkworth	44	53	33
127 Woodcocks Road, Warkworth	49	52	54
317 Woodcocks Road, Warkworth	51	50	52
153 Woodcocks Road, Warkworth	52	55	56
172A Woodcocks Road, Warkworth	59	63	63
286 Woodcocks Road, Warkworth	58	60	59
326 Falls Road, Warkworth	53	54	56
314 Woodcocks Road, Warkworth	62	60	60
346 Woodcocks Road, Warkworth	62	60	55
12 Wyllie Road, Warkworth	53	52	52
125 Woodcocks Road, Warkworth	48	51	53
87 Woodcocks Road, Warkworth	56	66	53
86-94 Woodcocks Road, Warkworth	60	64	64
86-94 Woodcocks Road, Warkworth	60	65	64
86-94 Woodcocks Road, Warkworth	60	64	64
86-94 Woodcocks Road, Warkworth	60	65	64
86-94 Woodcocks Road, Warkworth	46	50	50
86-94 Woodcocks Road, Warkworth	43	47	48
86-94 Woodcocks Road, Warkworth	38	44	40
86-94 Woodcocks Road, Warkworth	37	42	41
86-94 Woodcocks Road, Warkworth	38	42	42
86-94 Woodcocks Road, Warkworth	39	45	40
86-94 Woodcocks Road, Warkworth	53	59	40
86-94 Woodcocks Road, Warkworth	60	65	64
86-94 Woodcocks Road, Warkworth	54	62	49
86-94 Woodcocks Road, Warkworth	41	46	44
86-94 Woodcocks Road, Warkworth	41	47	43
86-94 Woodcocks Road, Warkworth	37	43	41
105 Woodcocks Road, Warkworth	55	60	61
101-103 Woodcocks Road, Warkworth	58	62	63
111 Woodcocks Road, Warkworth	56	61	62

99 Woodcocks Road, Warkworth	58	62	63
97 Woodcocks Road, Warkworth	54	59	58

NOR 3

Address	Existing	Do Nothing	Do Min	Mitigation
1659 State Highway 1, Warkworth	59	56	59	54
1829 State Highway 1, Warkworth	60	57	59	55
1773 State Highway 1, Warkworth	61	58	60	56
1723B State Highway 1, Warkworth	53	50	51	47
1723 State Highway 1, Warkworth	66	63	66	61
1728 State Highway 1, Warkworth	60	56	60	55
1695 State Highway 1, Warkworth	52	49	50	46
1695 State Highway 1, Warkworth	49	46	50	45
1773 State Highway 1, Warkworth	53	50	52	47
15 Wech Drive, Warkworth	55	53	56	51
17A Wech Drive, Warkworth	47	48	48	45
1/6 Wech Drive, Warkworth	62	61	61	56
45 Campbell Drive, Warkworth	55	53	51	47
5 Wickens Place, Warkworth	58	55	55	51
7 Wickens Place, Warkworth	59	56	57	52
17 Wickens Place, Warkworth	61	58	58	54
10 Wickens Place, Warkworth	54	52	52	48
12 Wickens Place, Warkworth	54	52	53	48
16 Wickens Place, Warkworth	56	54	55	50
21 Wickens Place, Warkworth	64	61	62	57
24 Wickens Place, Warkworth	63	62	63	58
25 Wickens Place, Warkworth	58	56	58	53
18 Wickens Place, Warkworth	57	55	57	52
20 Wickens Place, Warkworth	58	57	58	54
22 Wickens Place, Warkworth	65	63	65	60
5 Wech Drive, Warkworth	56	54	55	50
2/6 Wech Drive, Warkworth	51	49	51	46
7 Wech Drive, Warkworth	56	54	54	49
7A Wech Drive, Warkworth	49	48	49	44
8A Wech Drive, Warkworth	57	56	56	51
8 Wech Drive, Warkworth	49	48	49	44
10 Wech Drive, Warkworth	60	58	60	55
9 Wech Drive, Warkworth	51	49	51	46
12A Wech Drive, Warkworth	49	48	49	44
11 Wech Drive, Warkworth	56	55	57	52
14 Wech Drive, Warkworth	55	53	57	52
16 Wech Drive, Warkworth	50	48	52	47

Address	Existing	Do Nothing	Do Min	Mitigation
2/18 Wech Drive, Warkworth	47	48	47	44
1/18 Wech Drive, Warkworth	54	53	58	53
17 Wech Drive, Warkworth	55	53	58	53
19 Wech Drive, Warkworth	56	54	58	54
21 Wech Drive, Warkworth	57	56	59	54
20 Wech Drive, Warkworth	48	51	50	49
22 Wech Drive, Warkworth	60	59	61	57
7 McKinney Road, Warkworth	58	61	62	61
6 McKinney Road, Warkworth	57	62	62	62
1848 State Highway 1, Warkworth	65	61	65	61
8C McKinney Road, Warkworth	56	53	56	51
8B McKinney Road, Warkworth	56	53	56	52
8D McKinney Road, Warkworth	56	53	56	52
8E McKinney Road, Warkworth	67	63	66	61
13A Campbell Drive, Warkworth	66	64	43	38
27B Campbell Drive, Warkworth	64	61	54	49
27 Campbell Drive, Warkworth	61	58	55	50
29 Campbell Drive, Warkworth	55	53	50	46
33 Campbell Drive, Warkworth	67	64	56	51
31 Campbell Drive, Warkworth	57	54	51	46
35 Campbell Drive, Warkworth	65	62	56	51
41 Campbell Drive, Warkworth	53	50	49	44
43 Campbell Drive, Warkworth	51	48	48	44
3 Wickens Place, Warkworth	59	56	56	51
37 Campbell Drive, Warkworth	66	63	58	53
39 Campbell Drive, Warkworth	55	52	51	46
9 Wickens Place, Warkworth	59	57	53	48
11 Wickens Place, Warkworth	67	64	58	53
22 Campbell Drive, Warkworth	54	51	51	46
20 Campbell Drive, Warkworth	56	54	51	47
18 Campbell Drive, Warkworth	56	54	51	46
16 Campbell Drive, Warkworth	56	54	50	45
14 Campbell Drive, Warkworth	53	51	46	42
1 Clegg Place, Warkworth	54	53	46	42
11B Campbell Drive, Warkworth	60	58	37	32
102 Hauti Drive, Warkworth	50	49	39	34
100 Hauti Drive, Warkworth	50	48	40	35
98 Hauti Drive, Warkworth	55	53	43	38
82 Hauti Drive, Warkworth	56	54	38	34
15 Campbell Drive, Warkworth	62	60	47	43
17 Campbell Drive, Warkworth	62	60	50	46
19 Campbell Drive, Warkworth	60	58	48	44
21 Campbell Drive, Warkworth	66	64	59	54
23 Campbell Drive, Warkworth	63	60	55	50
25 Campbell Drive, Warkworth	63	60	55	50
8F McKinney Road, Warkworth	65	62	65	61
4/6 Wech Drive, Warkworth	50	48	49	44
3/6 Wech Drive, Warkworth	50	48	49	44
4B Wech Drive, Warkworth	49	47	49	44
4A Wech Drive, Warkworth	50	48	49	44

Address	Existing	Do Nothing	Do Min	Mitigation
4 Wech Drive, Warkworth	55	53	54	49
3B Wech Drive, Warkworth	53	50	51	47
3 Wech Drive, Warkworth	55	53	54	49
1 Wech Drive, Warkworth	56	53	54	50
13 Wickens Place, Warkworth	67	64	59	54
14 Wickens Place, Warkworth	55	53	54	49
23 Wickens Place, Warkworth	62	60	61	56
7 Toovey Road, Warkworth	55	51	54	50
1673 State Highway 1, Warkworth	63	60	63	58
3 McKinney Road, Warkworth	62	61	64	61

NOR 4

Address	Existing	Do Nothing	Do Min	Mitigation
40 Clayden Road, Warkworth	59	57	54	51
190 Matakana Road, Warkworth	62	60	57	55
8 Clayden Road, Warkworth	58	56	54	51
6 Clayden Road, Warkworth	55	53	52	51
293 Matakana Road, Warkworth	63	60	61	58
295 Matakana Road, Warkworth	61	58	59	56
297 Matakana Road, Warkworth	67	64	64	61
299 Matakana Road, Warkworth	69	66	65	61
303 Matakana Road, Warkworth	67	64	65	62
4 Clayden Road, Warkworth	57	55	55	56
2 Clayden Road, Warkworth	65	62	63	60
223 Matakana Road, Warkworth	65	62	61	57
170 Matakana Road, Warkworth	68	65	65	61
165 Matakana Road, Warkworth	66	63	62	58
160 Matakana Road, Warkworth	65	62	61	58
211 Matakana Road, Warkworth	64	61	60	56
171 Matakana Road, Warkworth	57	54	52	48
185 Matakana Road, Warkworth	54	51	51	47
13 Northwood Close, Warkworth	50	47	45	40
19 Northwood Close, Warkworth	61	58	58	54
6 Melwood Drive, Warkworth	57	55	53	49
49 Matakana Road, Warkworth	60	58	62	58
74 Matakana Road, Warkworth	72	69	63	59
76 Matakana Road, Warkworth	63	61	60	57
98 Matakana Road, Warkworth	60	58	61	58
120 Matakana Road, Warkworth	64	61	61	58
130 Matakana Road, Warkworth	65	62	66	62
140 Matakana Road, Warkworth	59	56	57	53
1 Millstream Place, Warkworth	70	69	53	49
3 Millstream Place, Warkworth	58	58	54	49
5 Millstream Place, Warkworth	60	60	51	46
7 Millstream Place, Warkworth	58	58	50	46
14 Millstream Place, Warkworth	54	54	42	37

Address	Existing	Do Nothing	Do Min	Mitigation
12 Millstream Place, Warkworth	55	55	51	46
10 Millstream Place, Warkworth	53	53	53	49
4 Millstream Place, Warkworth	61	61	57	53
6 Millstream Place, Warkworth	60	61	56	52
8 Millstream Place, Warkworth	55	56	52	48
5 Matakana Road, Warkworth	63	63	61	57
1 Melwood Drive, Warkworth	67	67	63	61
3 Melwood Drive, Warkworth	58	57	56	52
4 Melwood Drive, Warkworth	59	58	59	55
3 Matakana Road, Warkworth	62	62	61	57
9 Millstream Place, Warkworth	52	52	48	45
15 Northwood Close, Warkworth	53	51	49	44
17 Northwood Close, Warkworth	53	51	50	45
23 Northwood Close, Warkworth	58	56	53	49
25 Northwood Close, Warkworth	55	53	49	44
27 Northwood Close, Warkworth	50	48	47	42
29 Northwood Close, Warkworth	55	52	48	44
31 Northwood Close, Warkworth	57	54	50	45
35 Northwood Close, Warkworth	54	51	48	44
33 Northwood Close, Warkworth	56	54	50	45
39 Northwood Close, Warkworth	56	54	50	45
233 Matakana Road, Warkworth	59	58	52	48
207 Matakana Road, Warkworth	52	50	48	44
44 Clayden Road, Warkworth	58	57	52	48
37 Northwood Close, Warkworth	55	52	48	44
43 Northwood Close, Warkworth	55	52	48	43
45 Northwood Close, Warkworth	58	55	50	46
47 Northwood Close, Warkworth	58	56	51	47
55 Northwood Close, Warkworth	58	55	51	47
61 Northwood Close, Warkworth	58	55	52	48
41 Northwood Close, Warkworth	58	55	50	46
57 Northwood Close, Warkworth	60	57	52	48
59 Northwood Close, Warkworth	60	57	54	49
96 Matakana Road, Warkworth	72	69	68	64
306 Matakana Road, Warkworth	67	65	61	57

NOR 5

Address	Existing	Do Nothing	Do Min
109 Sandspit Road, Warkworth	55	54	51
108 Sandspit Road, Warkworth	70	69	58
1 Millstream Place, Warkworth	69	59	60
3 Millstream Place, Warkworth	58	55	55
5 Millstream Place, Warkworth	60	42	50
7 Millstream Place, Warkworth	50	46	48
12 Millstream Place, Warkworth	54	49	47
10 Millstream Place, Warkworth	53	48	47

Address	Existing	Do Nothing	Do Min
4 Millstream Place, Warkworth	61	58	58
6 Millstream Place, Warkworth	60	59	57
8 Millstream Place, Warkworth	55	53	51
265 Sandspit Road, Warkworth	51	50	48
384 Sandspit Road, Warkworth	67	54	53
137 Sandspit Road, Warkworth	61	60	53
146 Sandspit Road, Warkworth	54	53	50
209 Sandspit Road, Warkworth	65	64	59
34 Sandspit Road, Warkworth	62	63	57
36 Sandspit Road, Warkworth	63	64	58

NOR 6 New Roads

Address	Existing	Do Min
13 Christopher Lane, Warkworth	37	46
12 Jamie Lane, Warkworth	37	47
10 Jamie Lane, Warkworth	37	48
8 Jamie Lane, Warkworth	37	49
6 Jamie Lane, Warkworth	38	52
4 Jamie Lane, Warkworth	38	53
2 Jamie Lane, Warkworth	39	62
3 Christopher Lane, Warkworth	38	50
9 Christopher Lane, Warkworth	38	45
7 Christopher Lane, Warkworth	38	45
1 Christopher Lane, Warkworth	40	62
8 Christopher Lane, Warkworth	39	45
10 Christopher Lane, Warkworth	38	45
6 Christopher Lane, Warkworth	39	47
4 Christopher Lane, Warkworth	39	48
2 Christopher Lane, Warkworth	42	60
1 Oliver Street, Warkworth	42	59
3 Oliver Street, Warkworth	40	51
5 Oliver Street, Warkworth	40	49
7 Oliver Street, Warkworth	39	46
10 Georgetti Way, Warkworth	39	46
8 Georgetti Way, Warkworth	37	43
3 Dunningham Street, Warkworth	38	44
5 Dunningham Street, Warkworth	38	45
7 Dunningham Street, Warkworth	38	45
9 Dunningham Street, Warkworth	38	47
5 Christopher Lane, Warkworth	38	48

NOR 6 Altered Roads

Address	Existing	Do Nothing	Do Min
6 Evelyn Street, Warkworth	40	71	46
7 Evelyn Street, Warkworth	43	69	41
5 Evelyn Street, Warkworth	40	69	45
19 Wech Drive, Warkworth	56	54	54
21 Wech Drive, Warkworth	57	56	54
22 Wech Drive, Warkworth	60	59	57
7 McKinney Road, Warkworth	58	61	62
6 McKinney Road, Warkworth	57	62	62
1848 State Highway 1, Warkworth	65	61	61
8F McKinney Road, Warkworth	65	62	61
3 McKinney Road, Warkworth	62	61	62

NOR 7 New Roads

Address	Existing	Do Min
169 Sandspit Road, Warkworth	47	46
195 Sandspit Road, Warkworth	48	48
95 Sandspit Road, Warkworth	46	46

NOR 7 Altered Roads

Address	Existing	Do Nothing	Do Min
137 Sandspit Road, Warkworth	61	60	54
245 Matakana Road, Warkworth	59	58	54

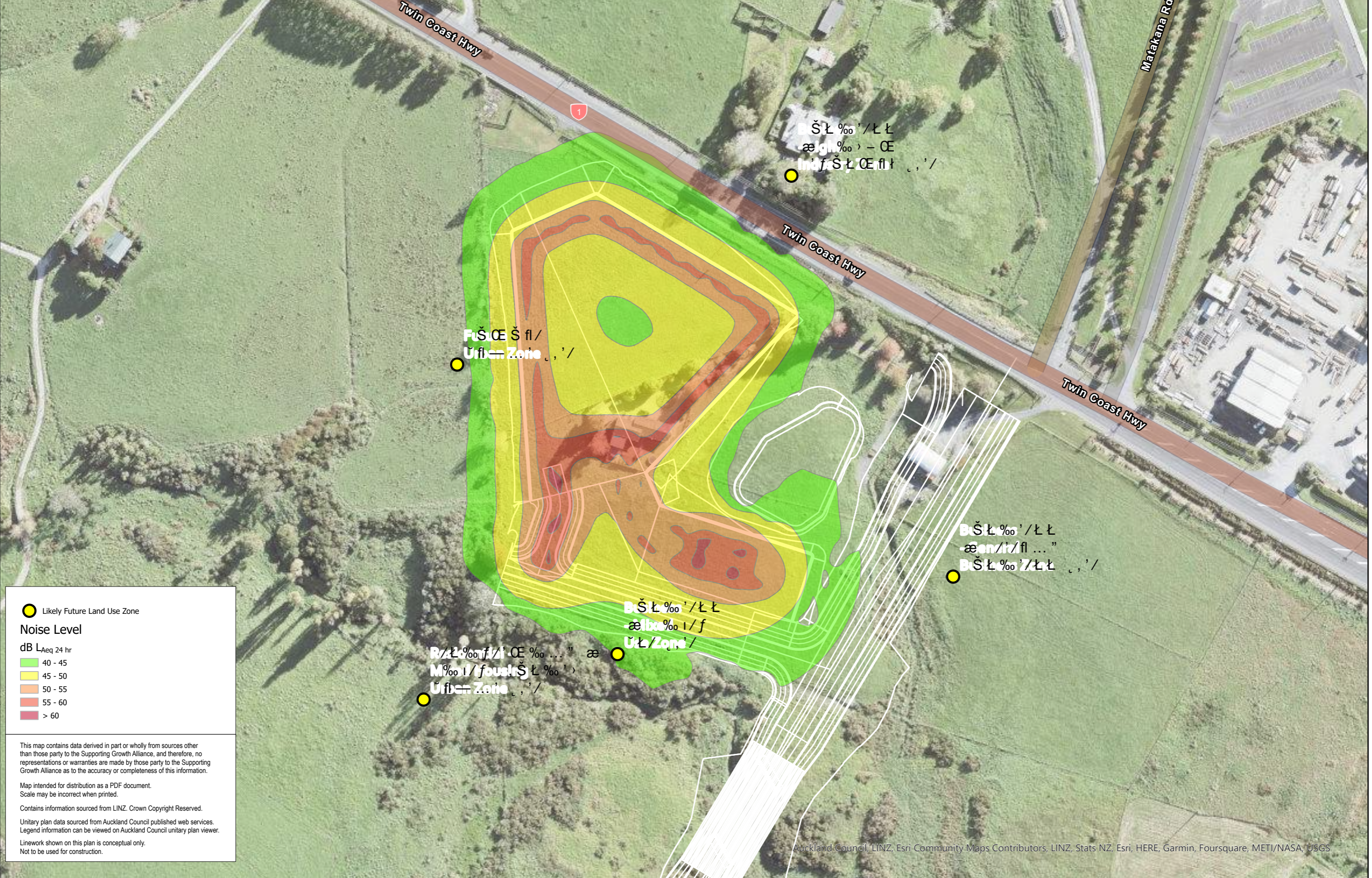
NOR 8 New Roads

Address	Existing	Do Min
123 Valerie Close, Warkworth	35	48

NOR 8 Altered Roads

Address	Existing	Do Nothing	Do Min
346 Woodcocks Road, Warkworth	62	60	54
12 Wyllie Road, Warkworth	53	52	56

5 Appendix E: Noise Contour Maps



- Likely Future Land Use Zone
- Noise Level**
- dB LAeq 24 hr
- 40 - 45
 - 45 - 50
 - 50 - 55
 - 55 - 60
 - > 60

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Map Scale @ A3:



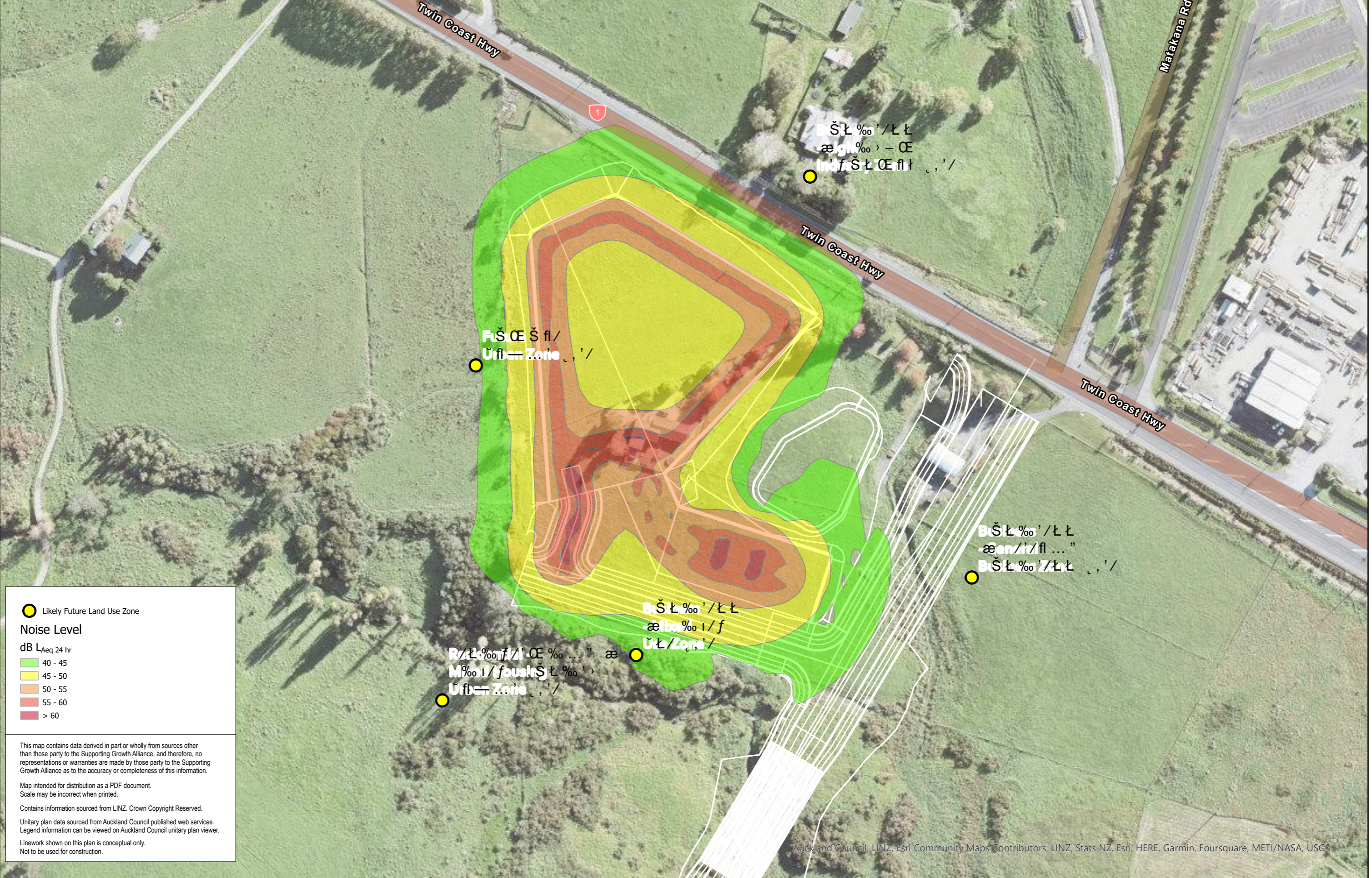
Revision	Author	Verified	Approved	Date
1	Author	DRAFT	DRAFT	dd/mm/yyyy

Supporting Growth
NoR 1 - Design 2028
 Working Plans of Te Tupu Ngatahi.
 For the purpose of INTERNAL workshops (not for wider distribution)

Client:	Supporting Growth
Project:	Warkworth



Discipline:	GIS
Drawing No:	SGA-NV-NW-013



Likely Future Land Use Zone

Noise Level

dB LAeq 24 hr

- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- > 60

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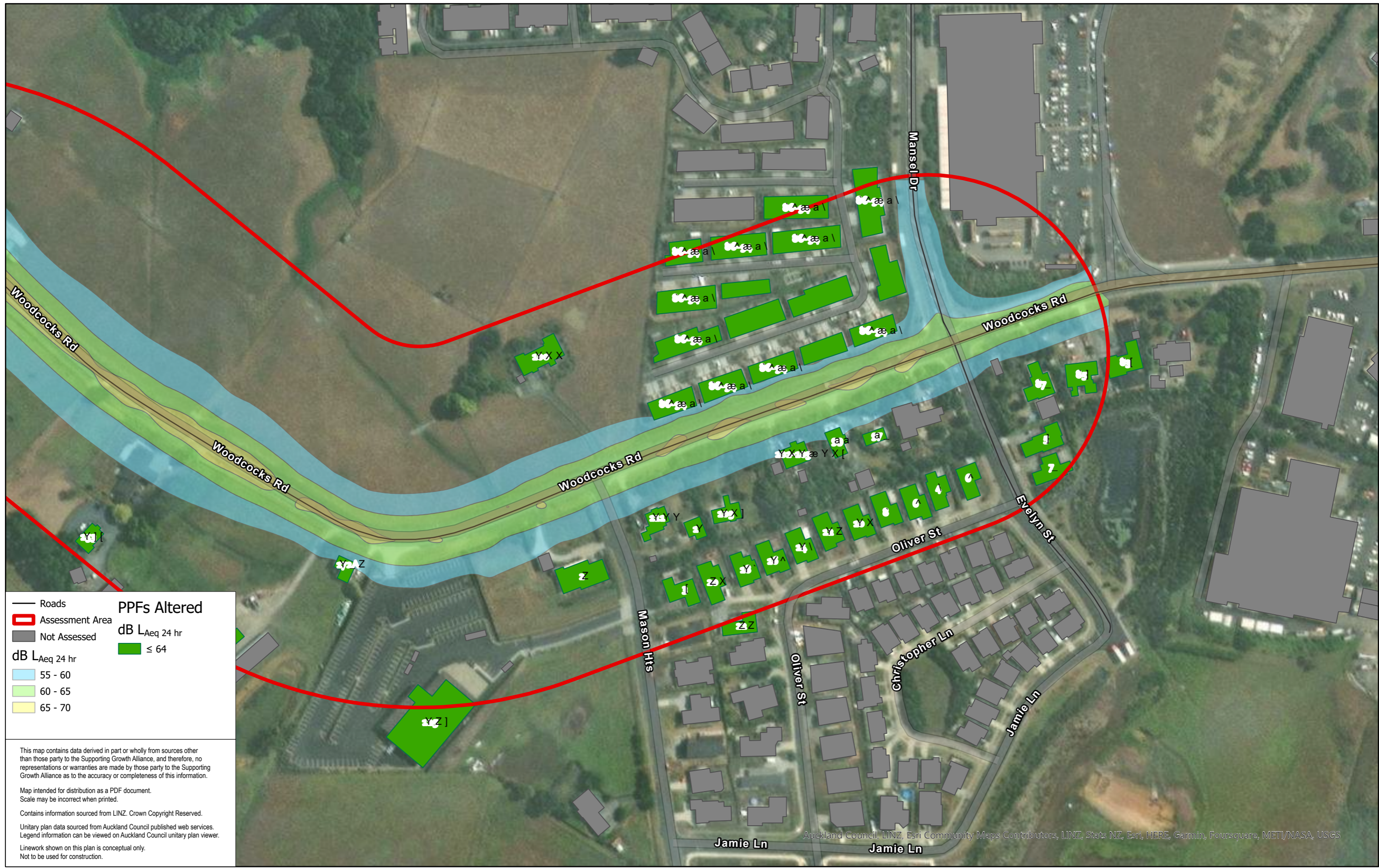
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		1	Author	DRAFT	DRAFT	dd/mm/yyyy		Project:	Warkworth		Drawing No:	SGA-NV-NW-013



— Roads

▭ Assessment Area

▭ Not Assessed

dB LAeq 24 hr

▭ ≤ 64

▭ 55 - 60

▭ 60 - 65

▭ 65 - 70

PPFs Altered

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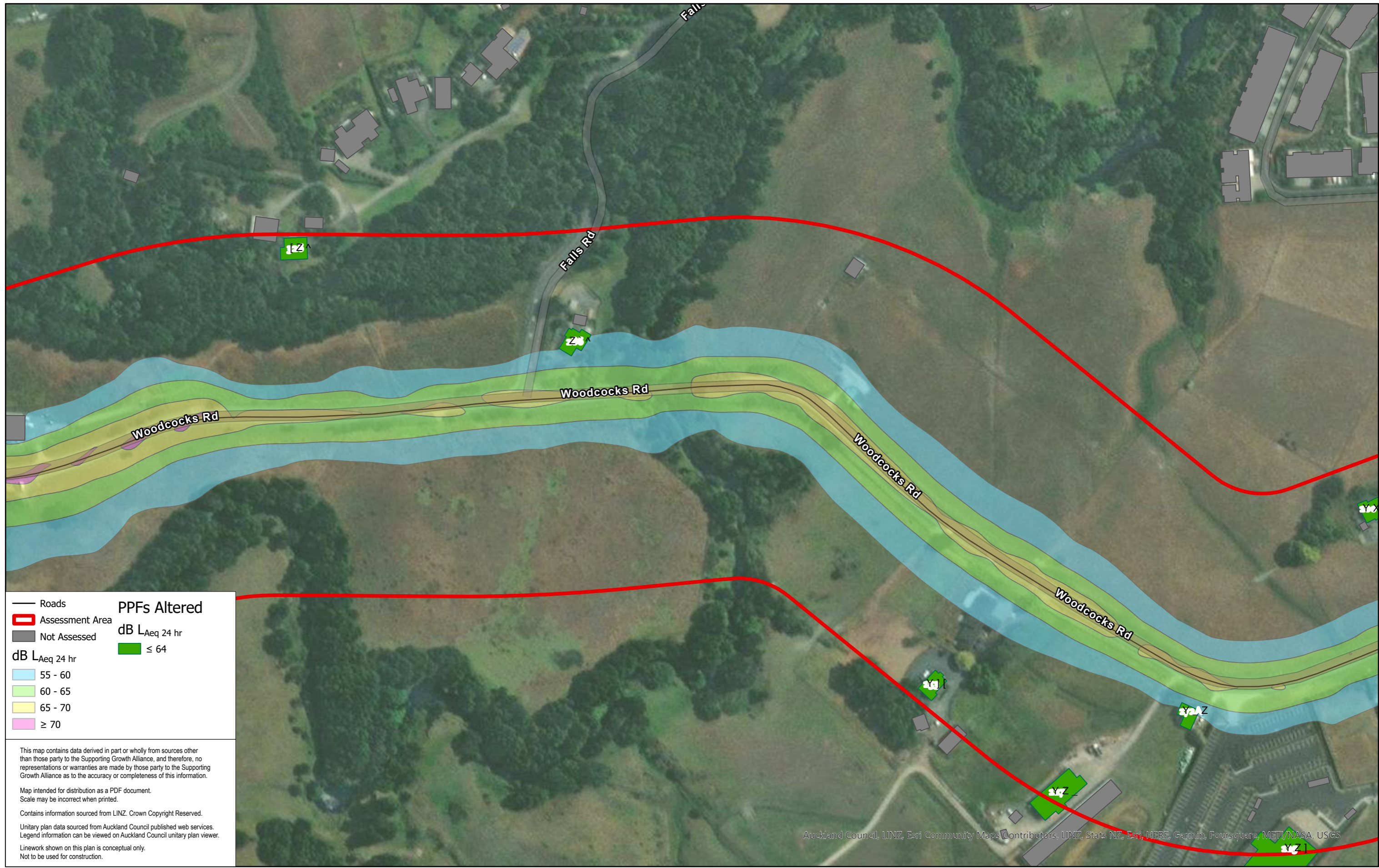
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		1	Author	DRAFT	DRAFT	dd/mm/yyyy		Project: Warkworth		Drawing No: SGA-NV-NW-013



Roads
 Assessment Area
 Not Assessed

PPFs Altered
 dB LAeq 24 hr
 ≤ 64

dB LAeq 24 hr
 55 - 60
 60 - 65
 65 - 70
 ≥ 70

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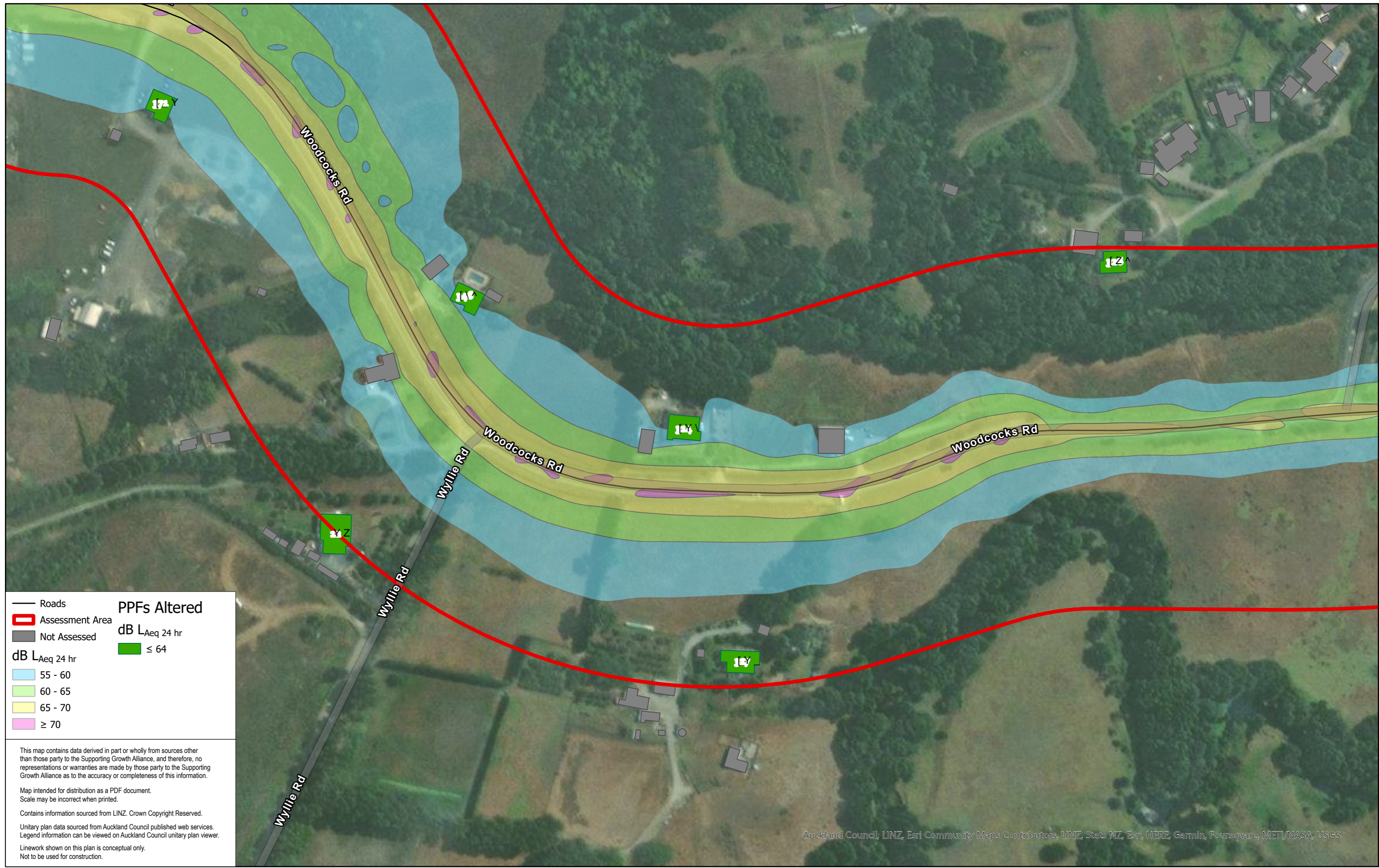
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Revision	Author	Verified	Approved	Date												
1	Author	DRAFT	DRAFT	dd/mm/yyyy												



— Roads

▭ Assessment Area

▭ Not Assessed

dB LAeq 24 hr

▭ ≤ 64

▭ 55 - 60

▭ 60 - 65

▭ 65 - 70

▭ ≥ 70

PPFs Altered

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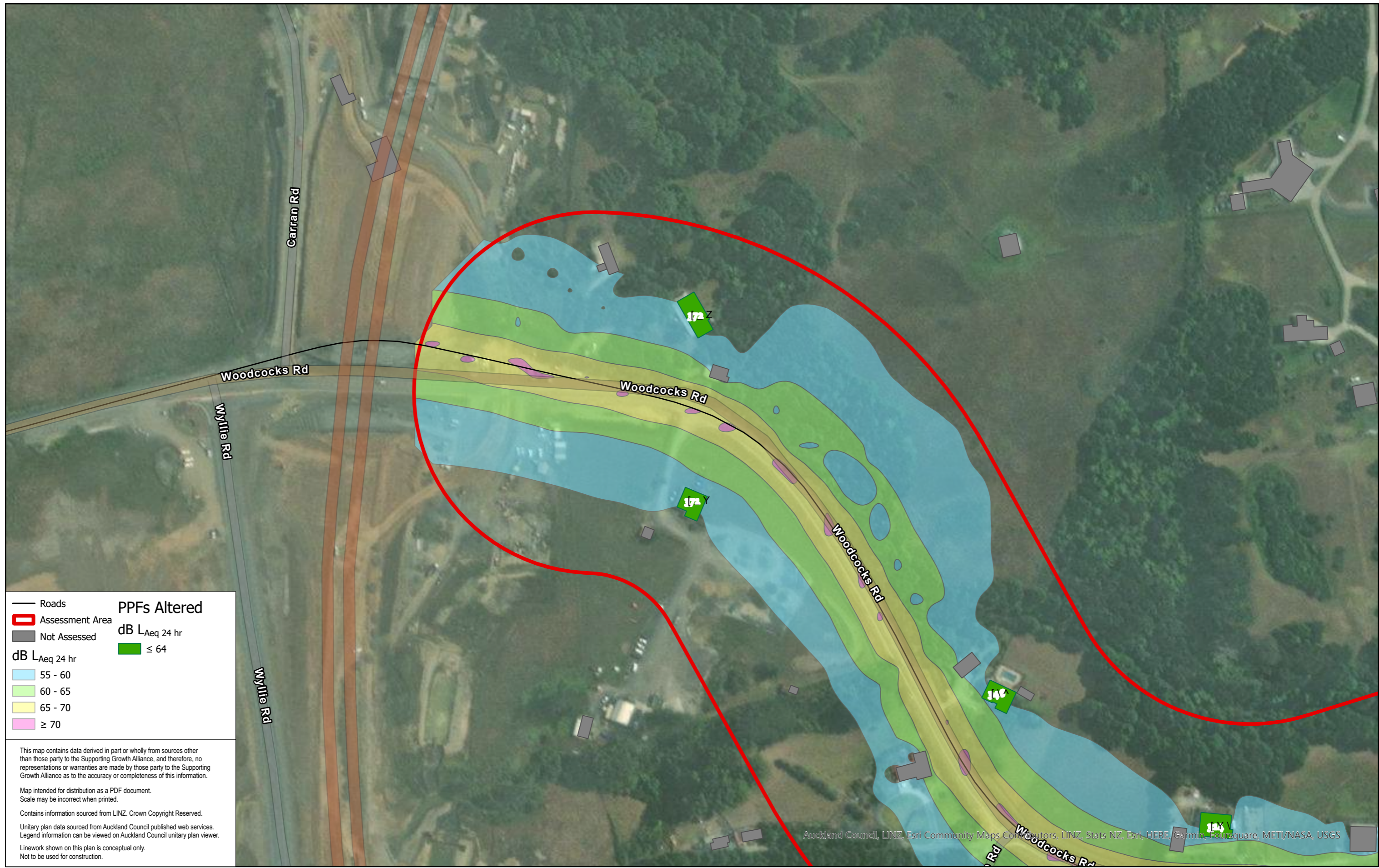
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Map Scale @ A3:		Revision	Author	Verified	Approved	Date	Title:	Supporting Growth NoR 2 - Existing <i>Working Plans of Te Tupu Ngatahi.</i> <i>For the purpose of INTERNAL workshops (not for wider distribution)</i>	Client:	Supporting Growth		Discipline:	GIS
		1	Author	DRAFT	DRAFT	dd/mm/yyyy			Project:	Warkworth		Drawing No:	SGA-NV-NW-013



Roads
 Assessment Area
 Not Assessed

PPFs Altered
 dB LAeq 24 hr
 ≤ 64
 55 - 60
 60 - 65
 65 - 70
 ≥ 70

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Scale may be incorrect when printed.

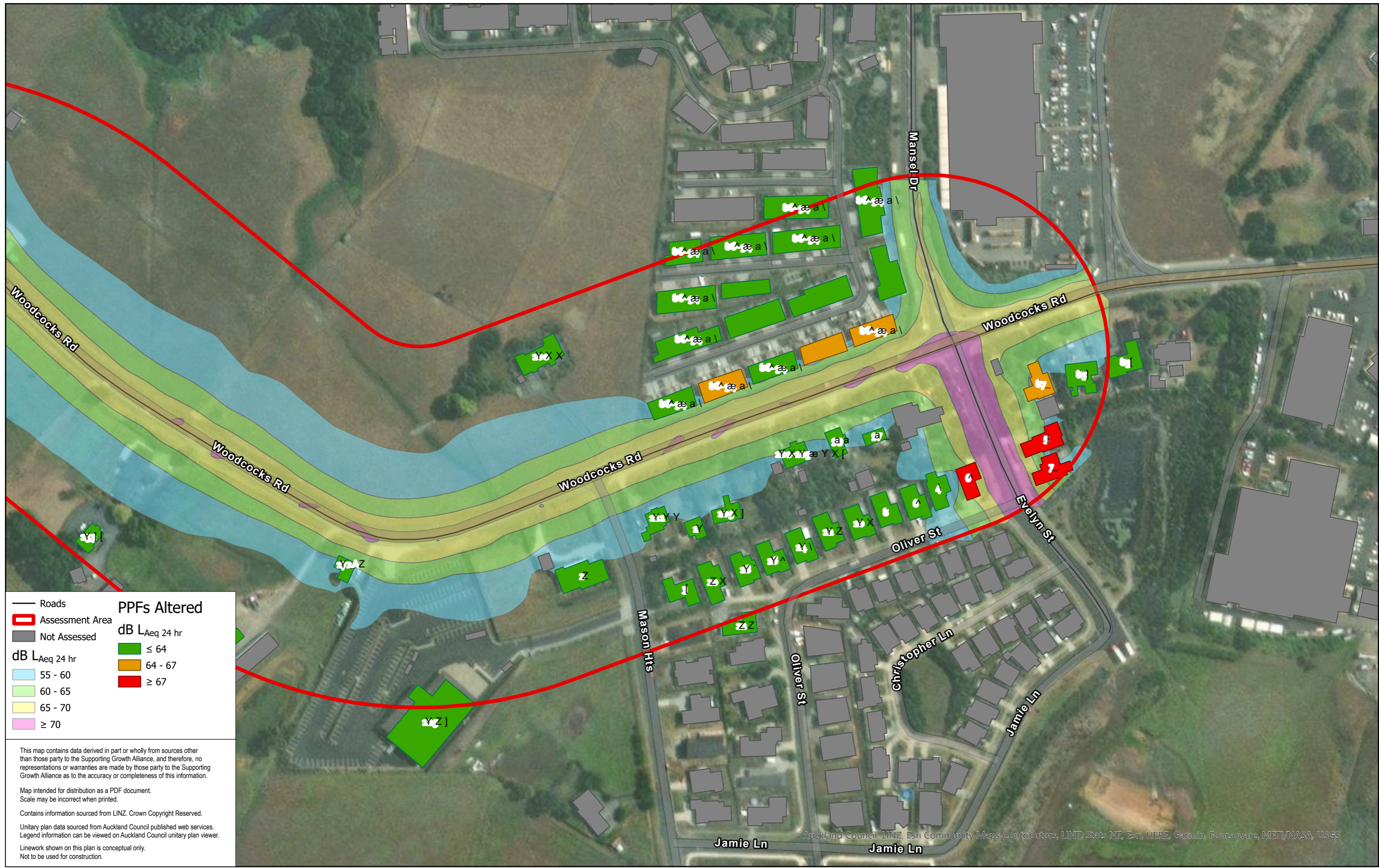
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		1	Author	DRAFT	DRAFT	dd/mm/yyyy		Project: Warkworth		Drawing No: SGA-NV-NW-013



— Roads

▭ Assessment Area

▭ Not Assessed

PPFs Altered

dB LAeq 24 hr

55 - 60

60 - 65

65 - 70

≥ 70

dB LAeq 24 hr

≤ 64

64 - 67

≥ 67

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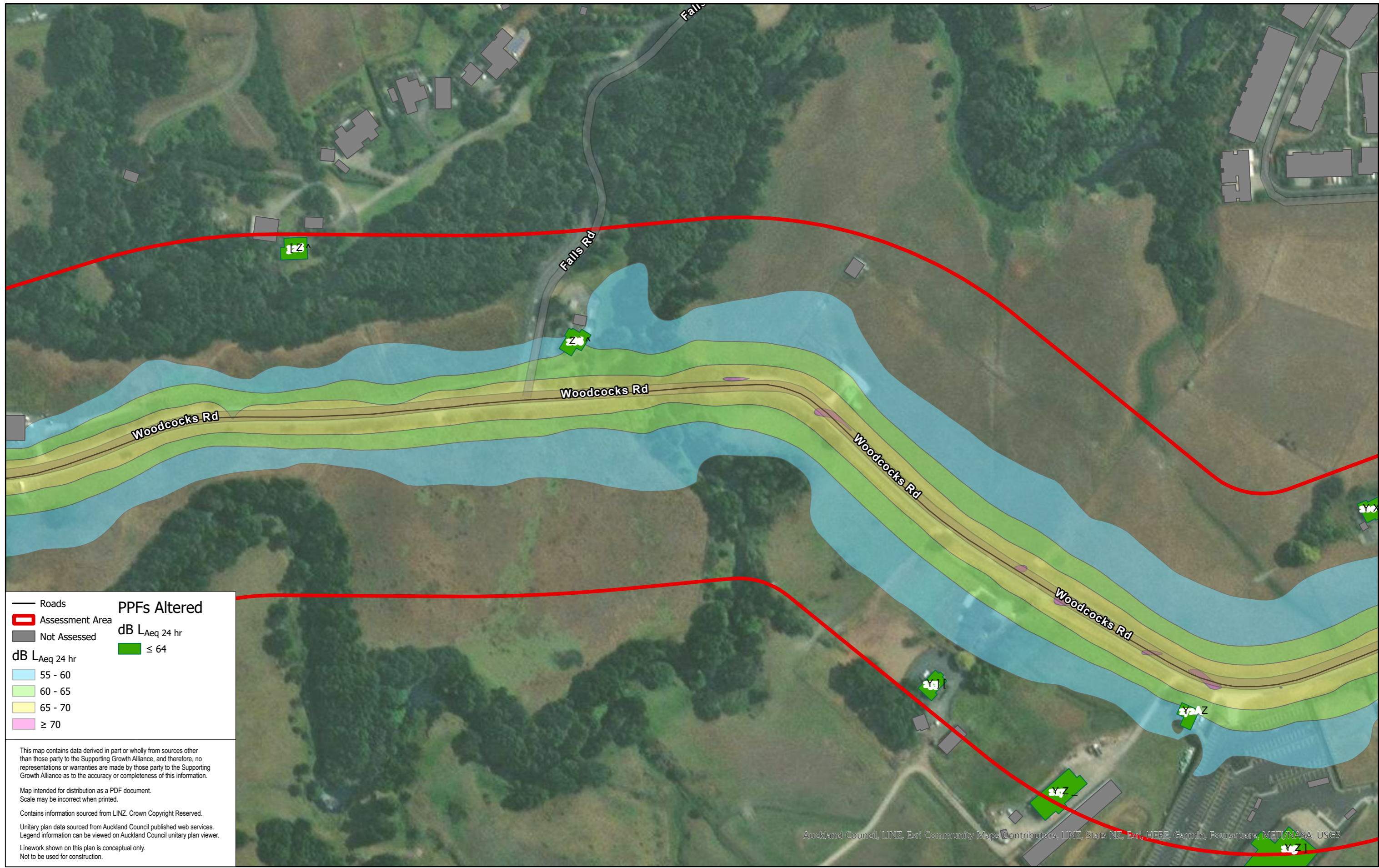
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		1	Author	DRAFT	DRAFT	dd/mm/yyyy		Project: Warkworth		Drawing No: SGA-NV-NW-013



— Roads

▭ Assessment Area

▭ Not Assessed

dB L_{Aeq} 24 hr

▭ ≤ 64

▭ 55 - 60

▭ 60 - 65

▭ 65 - 70

▭ ≥ 70

PPFs Altered

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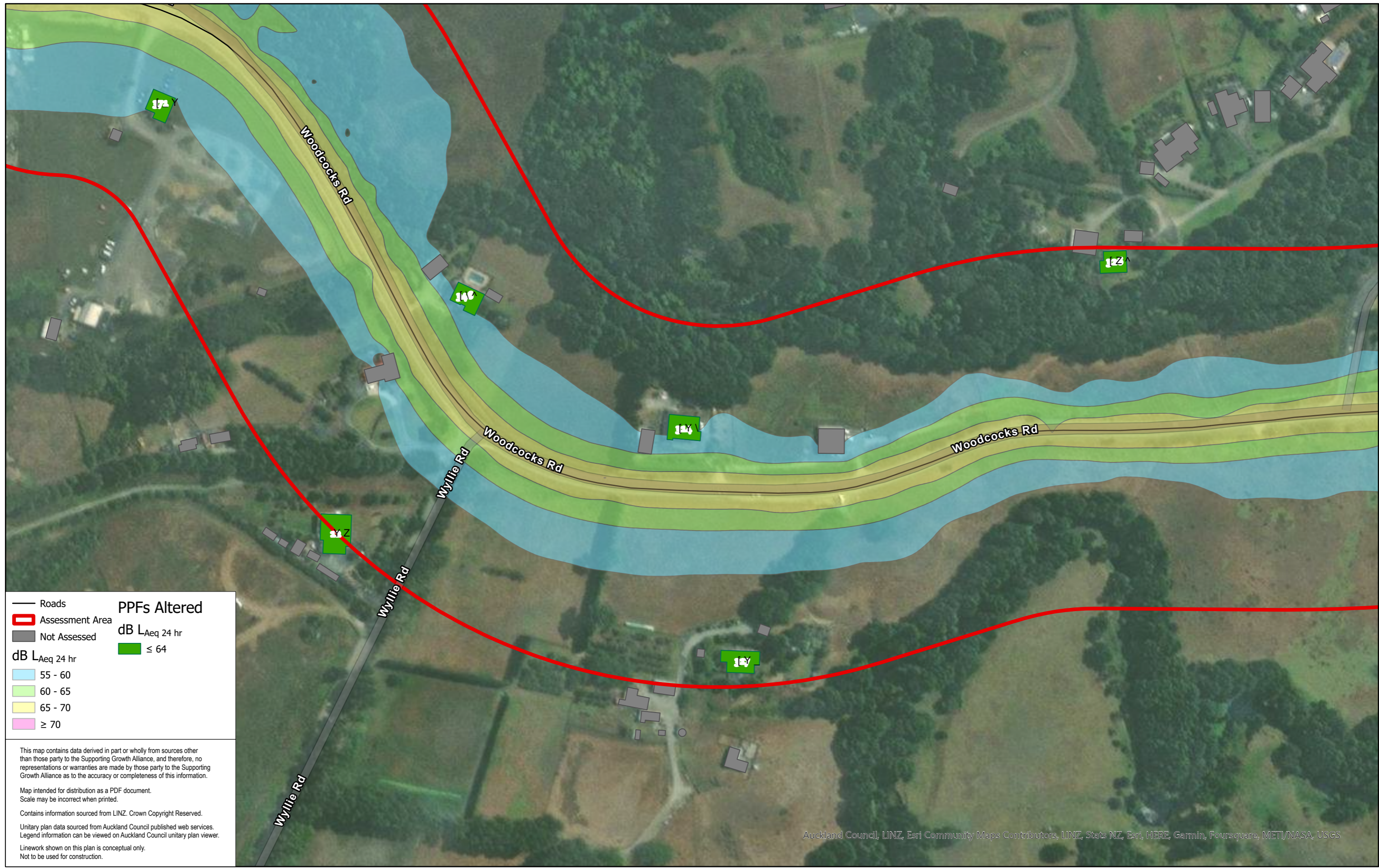
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Roads
 Assessment Area
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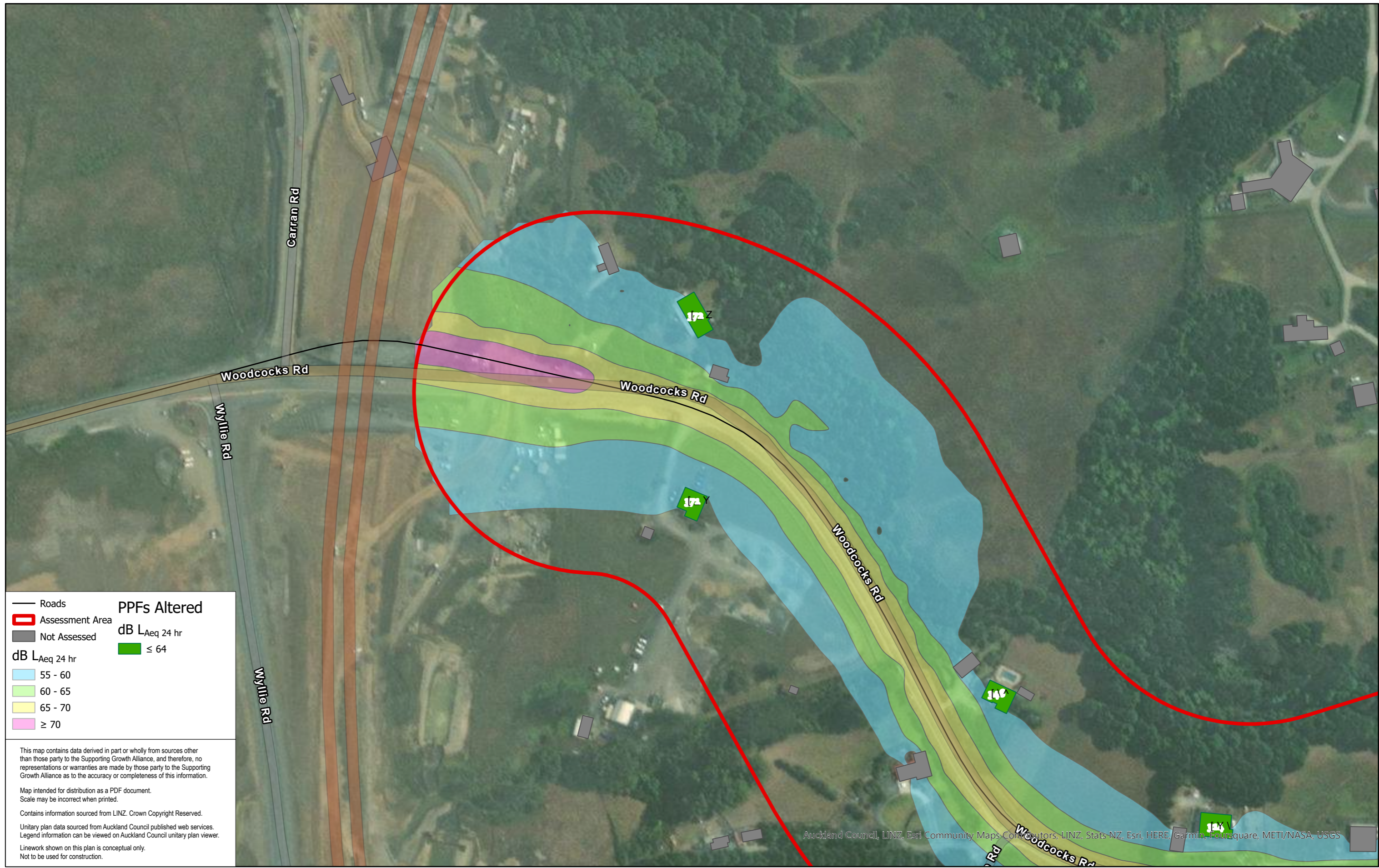
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Roads
 Assessment Area
 Not Assessed

PPFs Altered
 dB LAeq 24 hr
 ≤ 64
 55 - 60
 60 - 65
 65 - 70
 ≥ 70

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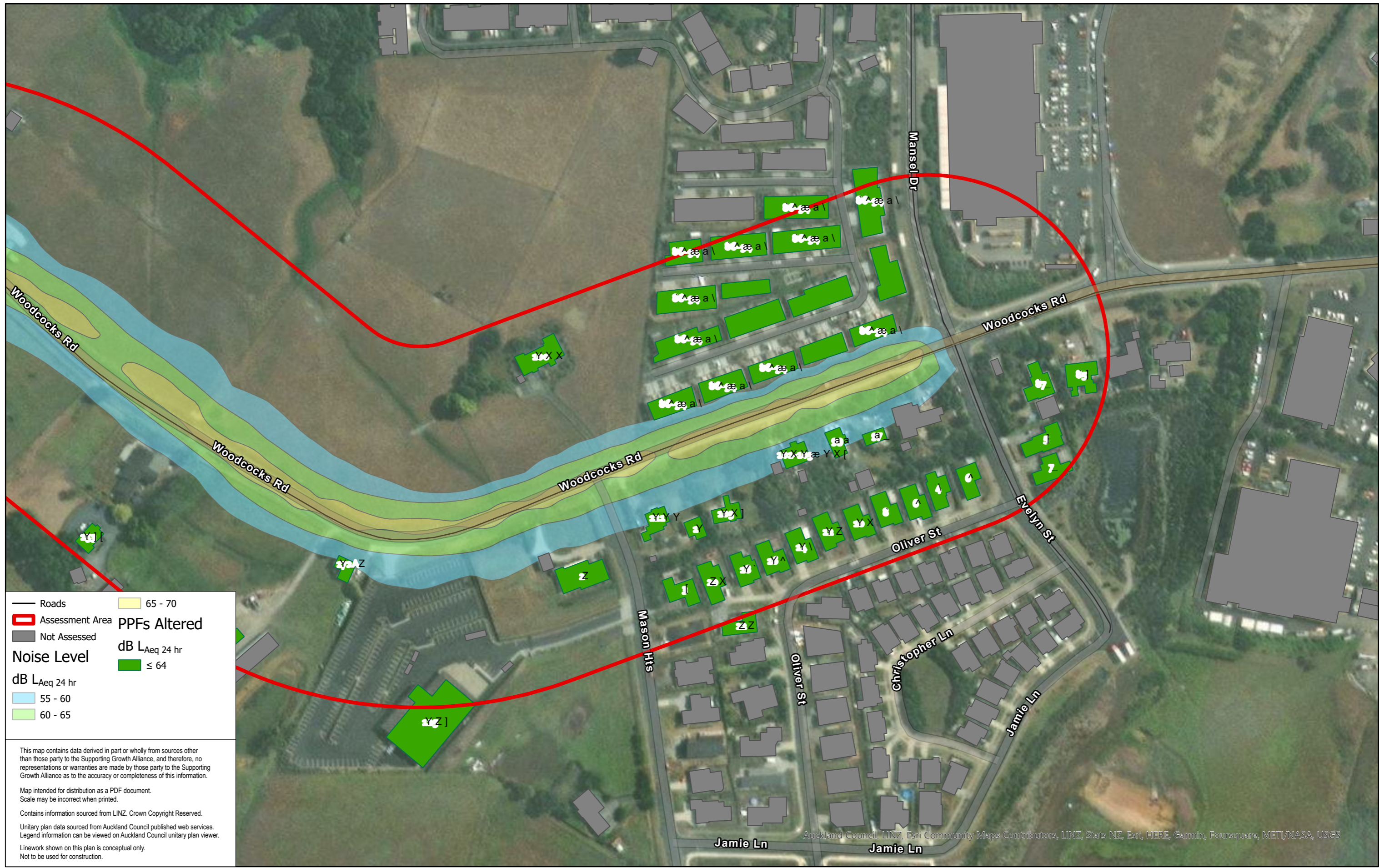
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Roads
 Assessment Area
 Not Assessed

65 - 70
 PPFs Altered
 dB LAeq 24 hr ≤ 64

Noise Level
 dB LAeq 24 hr
 55 - 60
 60 - 65

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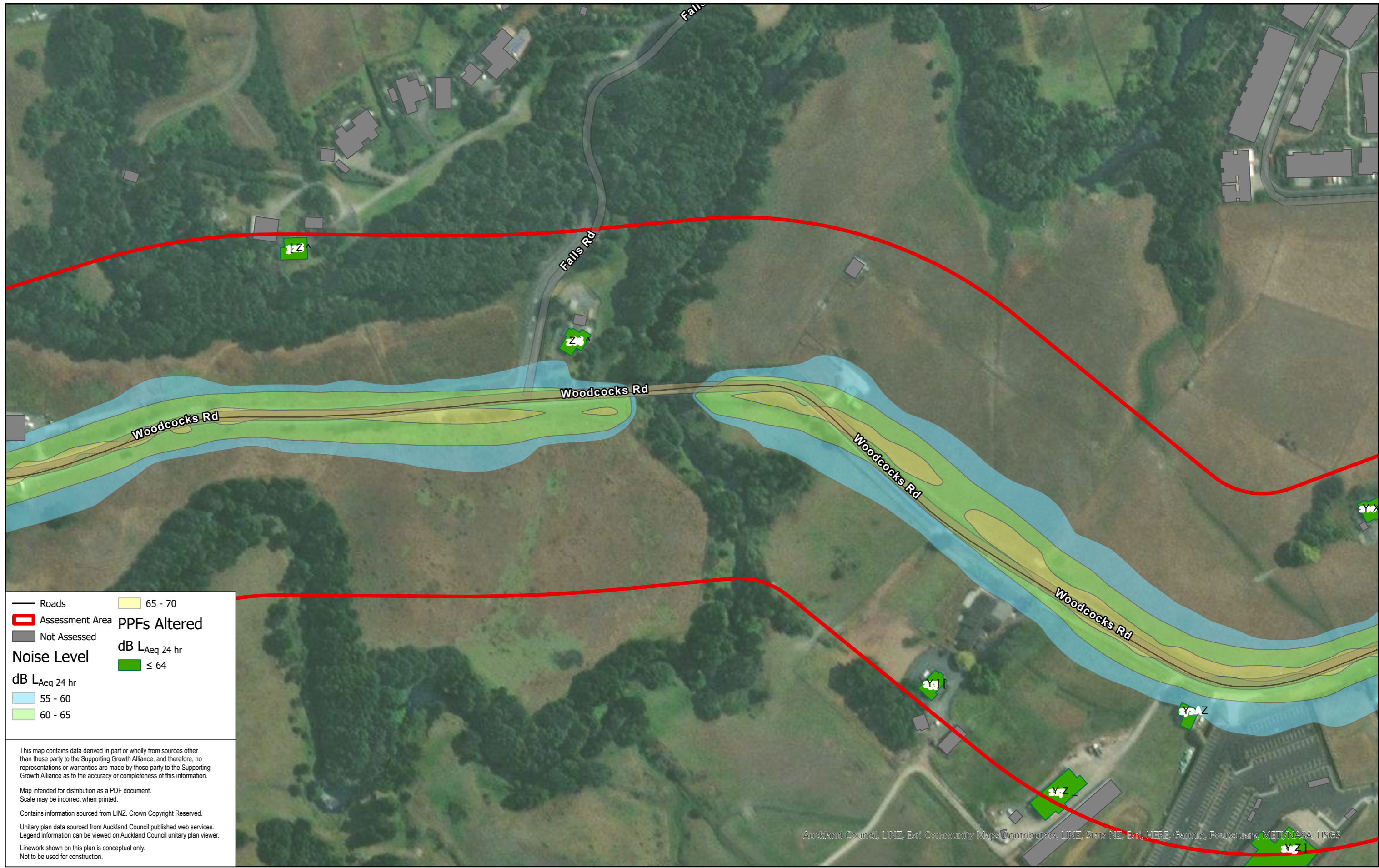
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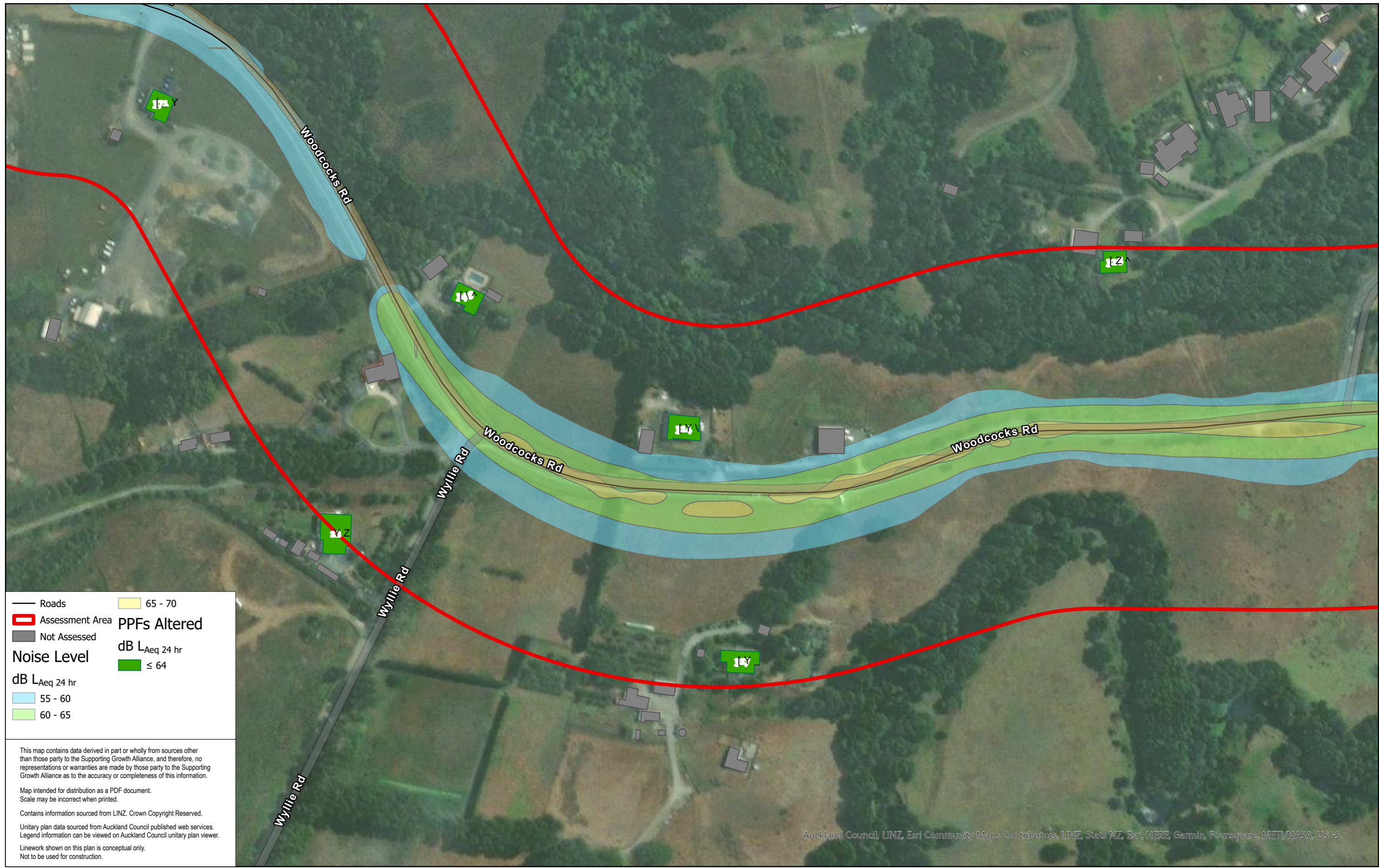


Roads
 Assessment Area
 Not Assessed
Noise Level
 dB L_{Aeq} 24 hr
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