



TE TUPU NGĀTAHI
SUPPORTING GROWTH

North

Assessment of Operational Noise and Vibration Effects

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Glossary of Defined Terms and Acronyms

Table 1: Glossary

Acronym/Term	Description
AC14	Asphaltic concrete
AEE	Assessment of Effects on the Environment report
AT	Auckland Transport
AUP:OP	Auckland Unitary Plan: Operative in Part
A-weighting	<p>A set of frequency-dependent sound level adjustments that are used to better represent how humans hear sounds. Humans are less sensitive to low and very high frequency sounds.</p> <p>Sound levels using an “A” frequency weighting are expressed as dB L_A. Alternative ways of expressing A-weighted decibels are dBA or dB(A).</p>
BPO	Best Practicable Option as defined in Section 2 of the Resource Management Act 1991
dB	Decibel. The unit of sound level.
FTN	Frequent Transit Network
FUZ	Future Urban Zone
L_{A90}	The A-weighted sound level exceeded for 90 % of the measurement period, measured in dB. Commonly referred to as the background noise level.
L_{Aeq}	The equivalent continuous A-weighted sound level. Commonly referred to as the average sound level and is measured in dB.
L_{Aeq(24h)}	The L _{Aeq} sound level averaged over a 24-hour period from midnight to midnight.
L_{Amax}	The A-weighted maximum sound level. The highest sound level which occurs during the measurement period. Usually measured with a fast time-weighting i.e. L _{AFmax}
MDRS	Medium Density Residential Standards
N/A	Not Applicable
Noise	A subjective term used to describe sound that is unwanted by, or distracting to, the receiver.
NPS	National Policy Statement
NPS:UD	National Policy Statement on Urban Development
NoR	Notice of Requirement
NZ	New Zealand
NZS6801	New Zealand Standard NZS 6801:2008 <i>Acoustics – Measurement of environmental sound</i>
NZS6802	New Zealand Standard NZS 6802:2008 <i>Acoustics - Environmental Noise</i>
NZS 6806	New Zealand Standard NZS 6806:2010 <i>Acoustics - Road-traffic noise - New and altered roads</i>

Acronym/Term	Description
PA10	Open graded porous asphalt
RMA	Resource Management Act 1991
SH1	State Highway 1
Te Tupu Ngātahi	Te Tupu Ngātahi Supporting Growth
THAB	Terraced House and Apartment Building zone
Waka Kotahi	Waka Kotahi New Zealand Transport Agency

Executive Summary

Assessment undertaken

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

Road traffic noise for any new or altered roads as well as a rapid transit corridor (assuming bus rapid transit) has been assessed against NZS6806 and other relevant guidance, including the Waka Kotahi “Guide to assessing road-traffic noise using NZS 6806 for state highway asset improvement projects”. In addition, we have assessed the change in noise level due to the Projects.

Station noise has been assessed against the underlying zone noise limits of the AUP:OP.

Active mode transport, i.e. walking and cycling, does not generate noise levels high enough to affect the ambient noise environment, particularly where the facilities are adjacent to busy roads, and has therefore not been assessed in this report.

The Projects will result in a redistribution of traffic across the wider area. This has been taken into consideration when assessing the individual Projects.

NoR1 New Rapid Transit Corridor

Results of assessment and recommended measures

The RTC (NoR1) consists of both New and Altered road sections. Since only a small number of buses is proposed to travel on the alignment, the RTC traffic noise levels are low overall. All PPFs are predicted to receive noise levels in Category A.

With other roads in the vicinity (including other NoRs of the North Projects) the RTC has nearly no effect on the overall noise level received at PPFs. With the anticipated improved road surface and lower speeds on other roads in the area, noise levels are predicted to remain similar or reduce at the vast majority of PPFs.

Conclusion

The RTC is predicted to have no material effect on most PPFs in the vicinity of its alignment and no mitigation is required or recommended.

NoR2 New Milldale Station

Results of assessment and recommended measures

The proposed Milldale Station will accommodate a kiss n ride area level with Ahutoetoe Road, and a bus layover area to the south of the site. Both are predicted to generate noise levels that are similar to or lower than those of local traffic and SH1.

The station is located halfway down the embankment between the residential area and SH1. The embankment will provide extensive shielding. We have predicted that the peak hour use of the station will comfortably comply with the most stringent night-time noise limit. Any PA system or mechanical

plant will need to be designed to also comply with the relevant noise limits, which can be done during detailed design.

Conclusion

The station is predicted to generate peak noise levels that can comfortably comply with the most stringent night time AUP zone noise limits. We do not recommend any additional mitigation. The PA system should be designed to comply with the relevant noise limits at all times.

NoR3 New Pine Valley East Station

Results of assessment and recommended measures

The proposed Pine Valley East Station will accommodate a park and ride for about 500 car park spaces, station and platforms as well as bus layover and a drop off and pick up area.

The station and surrounding sites are zoned FUZ. It is anticipated that the sites to the west and north will be rezoned for local centre/residential uses in the future, while sites to the east will likely be zoned for industrial use. Therefore, we have assessed both the noise levels at the notional boundary of existing surrounding houses and also noise levels at the potential future residential zone boundaries.

We predict that for peak hour use the station and associated facilities can comply with the most stringent night-time noise limit of 45 dB L_{Aeq} at all positions. It is likely that the peak hour use will not be within the night-time period, and that noise levels will be even lower at night-time.

Any PA system or mechanical plant will need to be designed to also comply with the relevant noise limits, which can be done during detailed design.

Conclusion

The station and associated areas are predicted to generate peak noise levels that can comply with the most stringent night time noise limits of current and potential future zone uses. We do not recommend any additional mitigation. The PA system and any mechanical plant should be designed to comply with the relevant noise limits at all times.

NoR4 SH1 Improvements

Results of assessment and recommended measures

The proposed SH1 improvements will result in a number of PPFs currently, and in the future, receiving noise levels in Category C. In order to reduce the noise levels at these PPFs, several potential mitigation options have been tested (e.g. the use of EPA7 50mm low noise road surface and 2 m barriers at positions along the road, the designation boundary or, in some places, along the RTC (NoR1) between SH1 and residential areas). This showed that barriers will not be effective for all PPFs. The best practicable option (BPO) mitigation beyond the use of low noise road surface will be determined at the time of detailed design, to achieve the noise criteria categories at PPFs set out in the conditions.

With mitigation in place, noise levels are predicted to be lower overall than without the Project. Similarly, noise levels are predicted to remain similar to, or lower than, those if the Project does not go ahead for the vast majority of PPFs.

The active mode transport that is part of NoR4 does not generate noticeable noise levels, especially adjacent to SH1, and has not been included in the assessment in accordance with NZS 6806.

Conclusion

Overall, the implementation of NoR4 will provide an improvement for the vast majority of PPFs.

NoR5 SH1 Crossing at Dairy Stream

Results of assessment and recommended measures

The new SH1 crossing at Dairy Stream for NoR 5 does not require assessment under NZS 6806 because traffic volumes using the crossing are predicted to be below 2000 AADT.

Noise levels at PPFs within 200m of this NoR are predicted to be dominated by the surrounding road network, in particular from SH1. Therefore, traffic noise from the SH1 crossing is not predicted to change the noise environment of the surrounding area.

Conclusion

The implementation of NoR 5 is predicted to have no material effect on PPFs in its vicinity and no mitigation is required or recommended.

NoR6 New Connection between Milldale and Grand Drive

Results of assessment and recommended measures

PPFs near NoR 6 have been assessed against the Altered roads criteria under NZS 6806. All PPFs are predicted to receive noise levels in Category A in the Do Minimum scenario.

With other roads in the vicinity (including other NoRs of the North Projects) noise levels are predicted to remain similar or reduce at most PPFs, with noticeable noise level increases at only two 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 of operation.

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.

Conclusion

Overall, the implementation of NoR6 will provide an improvement for the majority of PPFs.

NoR7 Upgrade to Pine Valley Road

Results of assessment and recommended measures

PPFs near NoR 7 have been assessed against the Altered roads criteria under NZS 6806. All PPFs are predicted to receive noise levels in Category A in the Do Minimum scenario.

With other roads in the vicinity (including other NoRs of the North Projects) noise levels are predicted to remain similar or reduce at all PPFs.

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.

Conclusion

Overall, the implementation of NoR7 will provide an improvement for the vast majority of PPFs.

NoR8 Upgrade to Dairy Flat Highway between Silverdale and Dairy Flat

Results of assessment and recommended measures

PPFs near NoR 8 have been assessed against the Altered roads criteria under NZS 6806. All PPFs are predicted to receive noise levels in Category A in the Do Minimum scenario.

With other roads in the vicinity (including other NoRs of the North Projects) noise levels are predicted to remain similar or reduce at all PPFs.

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.

Conclusion

Overall, the implementation of NoR8 will provide an improvement for the vast majority of PPFs.

NoR9 Upgrade to Dairy Flat Highway between Dairy Flat and Albany

Results of assessment and recommended measures

PPFs near NoR 9 have been assessed against the Altered roads criteria under NZS 6806. All PPFs are predicted to receive noise levels in Category A in the Do Minimum scenario.

With other roads in the vicinity (including other NoRs of the North Projects) noise levels are predicted to remain similar or reduce at the vast majority of PPFs.

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

Conclusion

Overall, the implementation of NoR9 will provide an improvement for the vast majority of PPFs.

NoR10 Upgrade to Wainui Road

Results of assessment and recommended measures

PPFs near NoR 10 have been assessed against the Altered roads criteria under NZS 6806. All PPFs are predicted to receive noise levels in Category A in the Do Minimum scenario.

With other roads in the vicinity (including other NoRs of the North Projects) noise levels are predicted to remain similar or reduce at all PPFs.

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.

Conclusion

Overall, the implementation of NoR10 will provide an improvement for the vast majority of PPFs.

NoR11 New Connection between Dairy Flat Highway and Wilks Road

Results of assessment and recommended measures

PPFs near NoR 11 have been assessed against the New and Altered roads criteria under NZS 6806. The altered roads section does not meet the definition of an Altered Road under NZS 6806; therefore mitigation does not need to be considered further under the Standard. All PPFs in the New section of road meet the Category A noise criterion, therefore mitigation does not need to be considered further for the New road section under the standard.

With other roads in the vicinity (including other NoRs of the North Projects) noise levels are predicted to remain similar or reduce at almost all PPFs.

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

Conclusion

Overall, the implementation of NoR11 will provide an improvement for the vast majority of PPFs.

NoR12 Upgrade and Extension to Bawden Road

Results of assessment and recommended measures

PPFs near NoR 12 have been assessed against the Altered roads criteria under NZS 6806. All PPFs are predicted to receive noise levels in Category A in the Do Minimum scenario.

With other roads in the vicinity (including other NoRs of the North Projects) noise levels are predicted to remain similar or reduce at all PPFs.

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.

Conclusion

Overall, the implementation of NoR12 will provide an improvement for the vast majority of PPFs.

NoR13 Upgrade to East Coast Road between Silverdale and Ō Mahurangi Penlink (Redvale Interchange)

Results of assessment and recommended measures

PPFs near NoR 13 have been assessed against the Altered roads criteria under NZS 6806. The Project does not meet the definition of an Altered Road under NZS 6806; therefore mitigation does not need to be considered further under the Standard.

With other roads in the vicinity (including other NoRs of the North Projects) noise levels are predicted to remain similar or reduce at the vast majority of PPFs.

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.

Conclusion

Overall, the implementation of NoR13 will provide an improvement for the vast majority of PPFs.

1 Introduction

This operational noise assessment has been prepared for Te Tupu Ngātahi Supporting Growth Alliance, North Auckland Projects to support 13 Notices of Requirement (NoRs) for Auckland Transport (AT) and Waka Kotahi NZ Transport Agency (WK) as requiring authorities under the Resource Management Act 1991 (RMA). The notices are to designate land for future strategic transport corridors as part of Te Tupu Ngātahi Supporting Growth Alliance to enable the future construction, operation, and maintenance of transport infrastructure in the North area of Auckland. The North area extends from Albany to Ōrewa and via the growth areas of Dairy Flat, Silverdale West, Wainui East, and Redvale (refer Figure 2-1). The North Projects are summarised in Section 2.

This report addresses the operational (traffic) noise effects of the North Projects identified in section 2.

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

1.1 Purpose and Scope of this Report

This operational noise assessment forms part of the suite of technical reports prepared to support the AEE for the North Projects. Its purpose is to inform the AEE that accompanies the North NoRs for AT and Waka Kotahi .

This report considers the actual and potential effects associated with the operation of the North Projects on the existing and likely future environment as it relates to operational 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:

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

1.2 Report Structure

The report is structured as follows:

- a) Project overview with a summary of the North Projects in section 2;
- b) Overview of the methodology used to undertake the assessment and identification of the assessment criteria and any relevant standards or guidelines in section 3;
- c) The assessment methodology used to determine the traffic noise effects for the Projects in section 4
- d) Identification and description of the existing and likely future noise environment in section 5;
- e) Measures to avoid, remedy or mitigation traffic noise in section 6;
- f) Description of the actual and potential adverse traffic noise effects of the Projects, including recommended measures to avoid or mitigate those potential adverse effects, in section 7;

- g) Overall conclusion of the level of potential adverse traffic noise effects of the Projects after recommended measures are implemented in section 8.

Description of the actual and potential construction noise and vibration effects of the Projects are contained in the Construction Noise and Vibration Assessment Report.

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

2 North Projects Overview

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

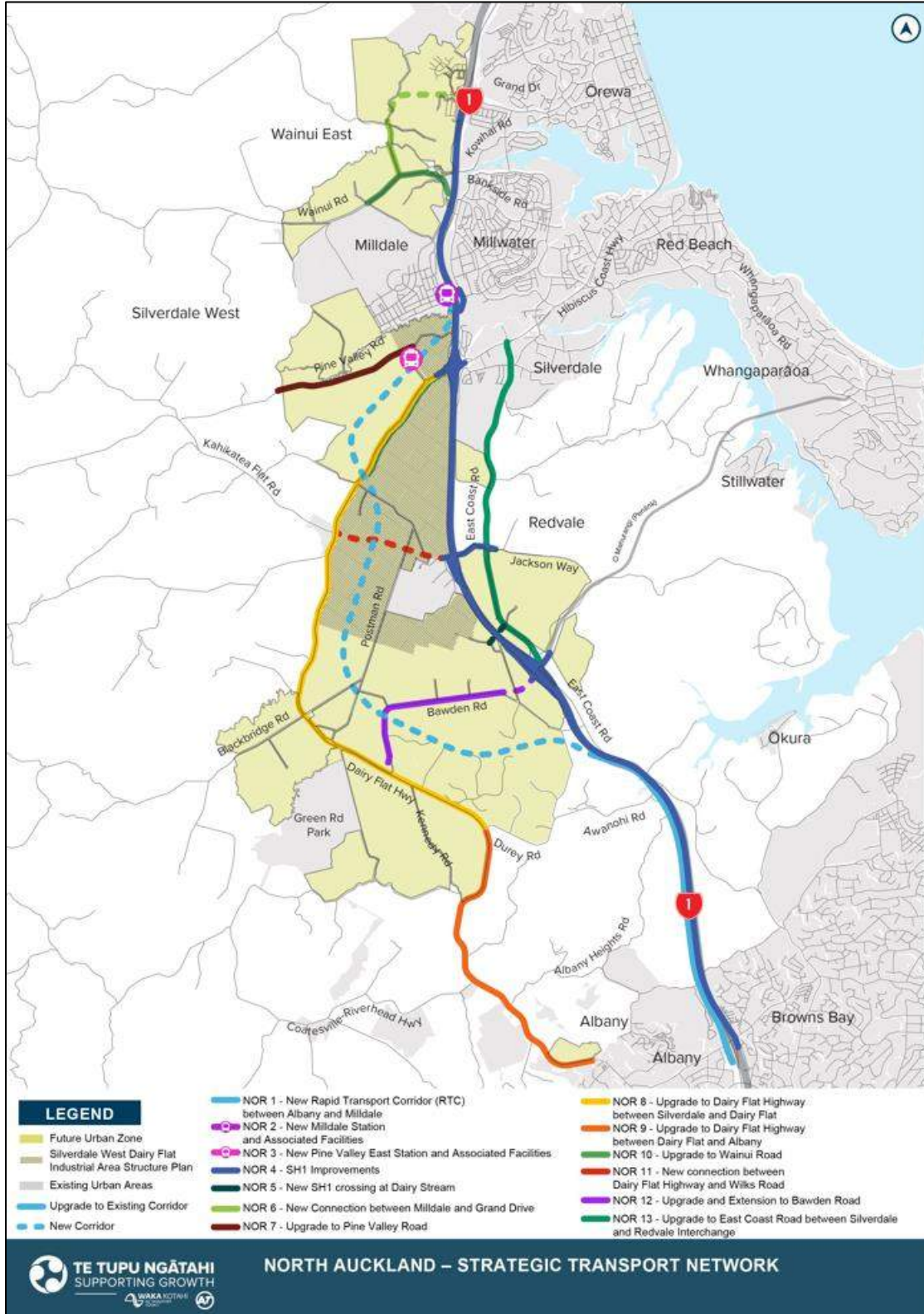


Figure 2-1: Map showing the location of each Project within the North growth area

Table 2-1: North Projects Summary

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

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

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

3 Performance standards

New designations are sought for the North Projects for all NoRs apart from NoR 4, which is an alteration to existing SH1 designations. Therefore, we have reviewed a variety of criteria and standards and have recommended the operational performance standards that in our opinion should apply to all Projects irrespective of the requiring authority implementing it.

3.1 Noise

3.1.1 Guidelines and Standards reviewed

We reviewed the following guidelines and standards for the assessment of traffic and operational noise:

- Auckland Unitary Plan Operative in Part (AUP:OP), specifically rule E25.6.33 relating to transport noise and referencing NZ 6806, and general zone noise limits related to any RTC station NoRs
- NZS 6806:2010 Acoustics – Road-traffic Noise – New and altered roads
- Waka Kotahi’s “Guide to assessing road-traffic noise using NZS 6806 for state highway asset improvement projects” (**Guide**), V1.1, August 2016.

We recommend applying the requirements of NZS 6806.

For the new road designations (as appropriate), we recommend that the additional information provided in the Guide is applied to these projects. The Guide describes how NZS 6806 should be implemented. While it describes some Waka Kotahi specific processes, such as the use of a Waka Kotahi internal matrix of project discipline feedback when determining the Best Practicable Option (BPO) for noise mitigation, the methodology and process set out in the Guide is considered best practice and should be applied to all Projects that involve new or altered roads. Overall, the Guide provides background on how to implement NZS6806, and is therefore a useful complimentary document to the Standard.

3.1.2 Road traffic noise

Road traffic noise is assessed in accordance with NZS6806. This Standard has been adopted by Waka Kotahi and is also required by the AUP:OP rule E25.6.33.

We consider the intent of NZS6806 is to provide a pragmatic approach to the use of noise mitigation. This approach includes the requirement that a roading project needs to have a noticeable noise effect before mitigation is considered, and that any mitigation needs to achieve a noticeable reduction in noise level.

NZS6806 applies to traffic noise assessments where a project falls within its thresholds. The Standard and its thresholds are briefly explained below.

- **Assessment Positions** are described as “Protected Premises and Facilities” (**PPFs**). PPFs include dwellings (including those that have building consent but are not built yet), educational facilities and their playgrounds within 20m of any school building, boarding houses, retirement villages, Marae, hospitals with in-patient facilities and motels/hotels in residential zones.

Note that:

- Areas earmarked for future residential development are not PPFs as the location and specific type of the receiving buildings are not known. However, to provide information for the future developers, we have provided noise level predictions over vacant land also.
- Businesses are not PPFs as they are not considered noise sensitive and are often noise generators in their own right. This includes any potential future businesses that may be established through a Structure Plan.

As discussed, only those noise sensitive buildings that exist at the time of the assessment (or have building consent) are assessed in relation to mitigation. The reason is that structural mitigation such as barriers require knowledge of the positions to be assessed, including any site access, and building modification mitigation only applies to habitable rooms, so are specific to the receiving buildings. Should any noise sensitive buildings be constructed between designations being obtained and the construction of the Projects, these buildings can be constructed to take account of the future noise levels (provided in the noise level contours in Appendix 3). There is a shared

responsibility of the road controlling authorities providing mitigation in the form of low noise road surface (where appropriate) and developers providing appropriate building envelopes and planning any subdivisions to avoid a conflict at the interface.

- Assessment Extent** is 100m from the edge of the new carriageway for urban areas and 200m for rural areas, in accordance with NZS6806. Urban areas are defined by Statistics NZ and are independent from the underlying zoning. Different parts of the Projects are in Urban and Rural areas as indicated in Figure 3-1, with the darker blue indicating the Rural area while the lighter blue (showing more intensive settlements) indicate Urban areas. Overall, the majority of NoRs are located in the Rural area, with a 200m assessment area. Where a new road intersects with an existing road, all PPFs within 200m of the existing road will be assessed under the Altered Road criteria. This will only apply where the existing road is predicted to carry more than an annual average daily traffic (AADT) of 2000 vehicles per day at the design year under the Do Nothing scenario (as defined below). PPFs located beyond this distance but still within 200m of the New Road alignment will be subject to the New Road criteria (as defined below).

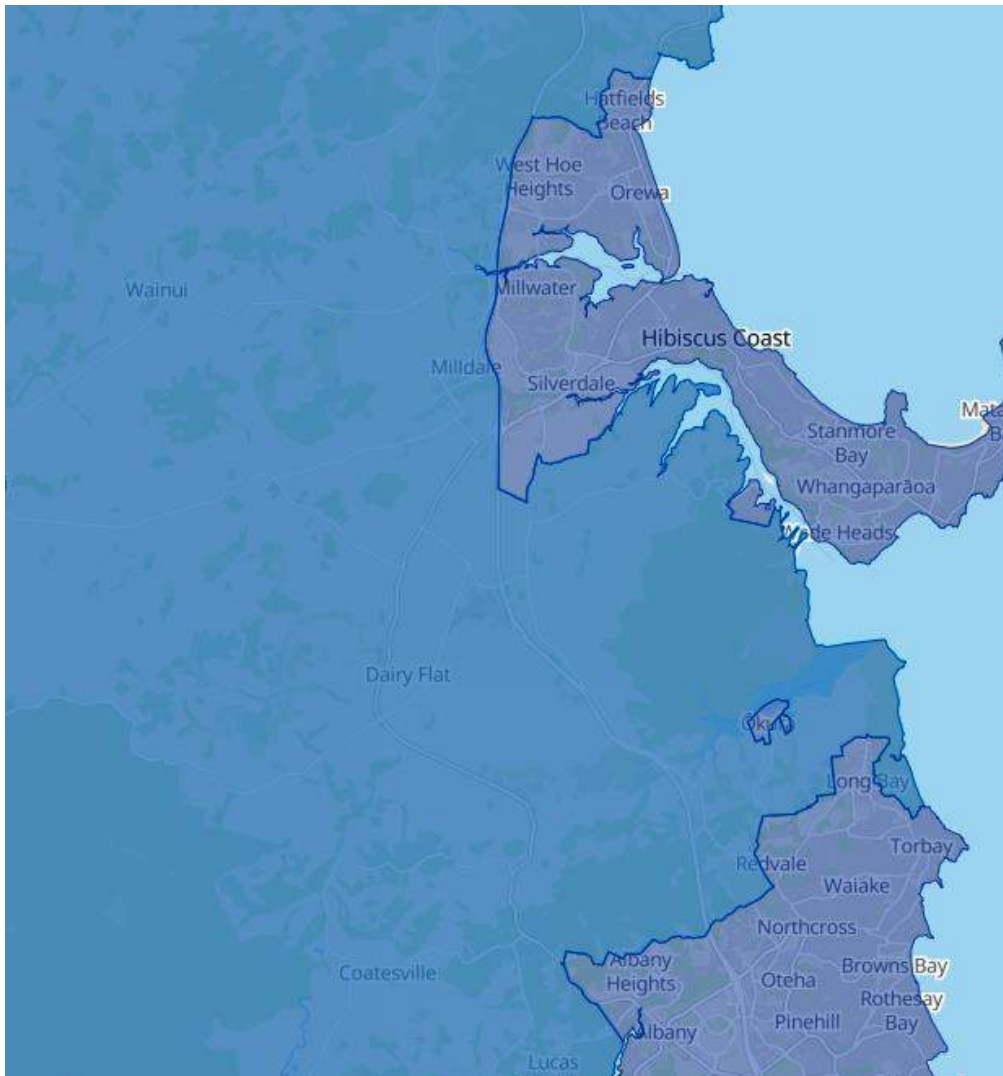


Figure 3-1: Urban/Rural classification by Statistics NZ

- Assessment Areas** are areas which combine PPFs that would benefit from the same mitigation (e.g. barrier). For these Projects, given the potential long implementation period, we have prepared an overview of proposed mitigation for each of the NoRs rather than dividing the areas further.

- **Design Year** is a year 10 to 20 years after opening of the Project. Since there are a number of NoRs assessed, without a defined implementation year, we chose the scenario for the latest traffic data available. The traffic data assumes that the area is developed to its fullest potential. The design year for this scenario is 2048+.
- **Noise Criteria Categories** are set out in the Standard for ‘new’ and ‘altered’ roads. This Project includes both new and altered roads, depending on the location of the proposed alignments. The Noise Criteria Categories are set out in Table 3-1 below.

Table 3-1: Traffic noise criteria categories

Category	New Road dB LAeq(24h)	Altered Road dB LAeq(24h)
A (primary external noise category)	≤ 57	≤ 64
B (secondary external noise category)	57 – 64	64 – 67
C (internal noise category)	40 (provided the external noise level is > 64)	40 (provided the external noise level is > 67)

The applicable category at any PPF depends on the BPO test, by progressively applying the noise criteria categories to determine which can practicably be achieved. NZS6806 is clear that preference is to be given to structural mitigation over building modification mitigation. NZS6806 also requires that the lowest external noise level is achieved with practicable structural mitigation, before considering building modification to mitigate residual internal noise levels.

- **Assessment Scenarios** are the various operational scenarios that we assess and compare. The Standard includes the following scenarios:
 - Existing noise environment: consists of the current road layout and traffic volume (for the North Projects we sourced traffic data to be as current as practical ranging from 2015 to 2021, while excluding data that was significantly affected by Covid restrictions). (Note that a significant change in traffic volume is required to affect a noticeable change in traffic noise – refer Section 3.1.4)
 - Future Do-nothing scenario: This scenario only applies to altered roads, though we also predicted these noise levels for new roads. It consists of the existing roads as for the existing noise environment, with traffic volume at the design year 2048. This scenario assumes that the full development of all surrounding areas has occurred, and traffic volumes have increased because of that development, but that traffic can only use the existing roads.
 - Future Do-minimum scenario: consists of all proposed transport corridors (the North NoRs) at the design year 2048, without any specific noise mitigation. This scenario means that the only barriers included are solid safety barriers, which are required for reasons other than noise mitigation. Where a low noise road surface such as AC14 or PA10 30mm is proposed as the “base” road surface (e.g. as is the case for NoR 4), this is also included in the Do-minimum scenario. Other roads that are not proposed to be altered by the Project (e.g. those crossing or connecting with the Projects) are not included in the assessment.
 - Future Project with mitigation: consists of the proposed Project transport corridors at the design year 2048, and includes mitigation that is designed specifically to reduce noise levels.
- **New and Altered Roads**: New roads are defined as those where no prior road has existed. Altered Roads require a vertical or horizontal realignment of an existing road. In addition, the noise level change due to the implementation of the project (i.e. comparing the Do-nothing and Do-minimum scenarios) must be more than 3 dB for noise levels above to 64 dB LAeq(24h) and more

than 1 dB for noise levels above 68 dB $L_{Aeq(24h)}$.

For Altered 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 NZS 6806 states that mitigation is only required for road traffic noise generated from the New or Altered road.

- **Mitigation Requirements** are set out in the Standard based on the BPO. Mitigation is split into structural (road surface, barriers, bunds) and building modification mitigation (improvement of building façades and ventilation, after the implementation of any structural mitigation, generally only considered for PPFs receiving noise levels within Category C). Any mitigation should achieve a noticeable noise level reduction of an average of 3 decibels within each assessment area or 5 decibels for standalone PPFs.

3.1.3 Station noise

There are two stations proposed to be operated as part of the RTC in NoR1; NoR2 (Milldale Station) and NoR3 (Pine Valley East Station). While the vehicle noise from electric buses would normally be covered by the assessment criteria set out in Section 3.1.2, other noise sources associated with the stations, such as from public address systems should be assessed against the relevant underlying zoning noise rules of the AUP:OP. Therefore, we have assessed all noise sources at the Stations (i.e. vehicles and other sources) against the AUP:OP rules.

Noise from people using the stations is not controlled by the AUP zone noise limits. There is little control over people’s behaviour at a station unless it moves into antisocial behaviour, which is dealt with through other rules but not under the RMA. For that reason, people’s voices have not been assessed for the stations.

The Milldale Station is located in the Residential – Mixed Housing Suburban Zone and Residential Single House Zone. Other zones such as Open Space, Strategic Transport Corridor (SH1) and Business – Light Industry are not noise sensitive (or have no noise limits) and are therefore not further discussed.

The Pine Valley East Station is located in the Future Urban Zone.

The noise limits applicable to these zones in relation to neighbouring zones are set out in Table 3-2 below.

Table 3-2: AUP:OP noise limits for RTC Station locations

Station zone	Receiving zone	AUP:OP section	Assessment location	Noise limits
Residential – Mixed Housing Suburban (Milldale Station)	Residential – Mixed Housing Suburban and Residential – Single House	E25.6.2	Receiving site boundary	Mon – Sat 7am – 10pm 50 dB L_{Aeq} Sun 9am – 6pm 50 dB L_{Aeq} All other times 40 dB L_{Aeq} 75 dB L_{AFmax}
Future Urban (Pine Valley East Station)	Future Urban	E25.6.3.1	Notional boundary	Mon – Sat 7am – 10pm 55 dB L_{Aeq} Sun 9am – 6pm 55 dB L_{Aeq} All other times 45 dB L_{Aeq} 75 dB L_{AFmax}

Station zone	Receiving zone	AUP:OP section	Assessment location	Noise limits
	Residential (Future)	E25.6.15	Receiving site boundary	Mon – Sat 7am – 10pm 55 dB LAeq Sun 9am – 6pm 55 dB LAeq All other times 45 dB LAeq 75 dB LAFmax

3.1.4 Subjective perception of noise level changes

The subjective impression of changes in noise can generally be correlated with the numerical change in noise level. While every person reacts differently to noise level changes, research shows a general correlation between noise level changes and subjective responses. Table 3-3 shows indicative subjective responses to explain the noise level changes discussed in this report.

The perception of these noise level changes generally applies to immediate changes in noise level, so may be slightly differently when applied to more gradual changes as would be the case for a new road opening. However, people may subjectively have an annoyance reaction to a greater or lesser degree, depending on their perception of the Project.

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

Noise level change	General subjective perception ¹
1–2 decibels	Insignificant/imperceptible change
3–4 decibels	Just perceptible change
5–8 decibels	Appreciable to clearly noticeable change
9–11 decibels	Halving/doubling of loudness
>11 decibels	More than halving/doubling of loudness

Noise is measured on a logarithmic scale, meaning that a doubling in traffic volume (e.g. from 10,000 vehicles per day (vpd) to 20,000 vpd) results in a noise level increase of 3 decibels, a just-perceptible change. A tenfold increase in traffic volume (e.g. from 10,000 to 100,000 vpd) would result in a noise level increase of 10 decibels, which would sound twice as loud.

While for the assessment in accordance with NZS 6806 only the Project roads are included, when discussing the effect on people, in relation to the change in noise level, the surrounding road network was included in the noise predictions. This provides a more realistic representation of the level of effects, particularly for a suite of Projects that are proposed for a similar geographic region which influence each other and the wider environment.

3.2 Vibration

The AUP:OP does not contain applicable vibration criteria for transport infrastructure. However, Waka Kotahi references the Norwegian Standard NS 8176.E:2005 in its reverse sensitivity guidelines.

¹ Based on research by Zwicker & Scharf (1965); and Stevens (1957, 1972).

3.2.1 Norwegian Standard NS 8176:2017

The Norwegian Standard NS 8176:2017 specifically addresses transportation vibration, both in relation to road and rail. The Standard's criteria (shown in Table 3-4 below) are based on studies of vibration annoyance in residences, and it provides guideline values for four vibration "classes".

Waka Kotahi allows for Class C to be achieved for new infrastructure. According to the Annex E of the Standard, at this level of vibration about 20% of the affected persons in Class C dwellings can be expected to be highly or moderately annoyed by vibration and this is deemed by the Standard to be acceptable.

Table 3-4: Human response criteria for transport sources in NS 8176.E:2005

Type of vibration value	Class A	Class B	Class C	Class D
Statistical maximum value for weighted velocity, $V_{w,95}$ (mm/s)*	0.1	0.2	0.3	0.6

* $V_{w,95}$ = value exceeded for 5% of events (equivalent to L_{05} centile level in noise terminology)

3.2.2 Road traffic

Traffic vibration is usually only generated when heavy commercial vehicles (**HCV**) drive over bumps or dips in the road. We have determined the road traffic vibration risk by reviewing data of HCVs travelling on existing roads with a range of surface conditions. Assessing this data against the Waka Kotahi recommended traffic vibration criterion (Class C of the Norwegian Standard NS 8176:2017) indicates that compliance with the criteria can be achieved at 25 metres from the road edge, even for roads in a degraded state. Other factors such as underground services may also affect vibration levels from the road, and the road design will need to take account of any such issues.

Road maintenance is the responsibility of Waka Kotahi and AT, and the resurfacing guidelines of both organisations take account of the fact that road surfaces need to be replaced before they degrade too much.

For a newly sealed pavement, the risk contour is less than 2 metres from the road edge. There will be no receivers this close to any traffic lane edge. Therefore, we do not consider that traffic vibration needs to be assessed for the Projects.

4 Assessment Methodology

We have assessed the operational noise effects on people based on:

- The noise criteria categories of NZS 6806; and
- Noise effects (both beneficial and adverse) through determination of noise level changes.

The reason for the two-pronged approach is that in some circumstances, compliance with a Standard does not necessarily mean that the effects of a project would be minor, and vice versa.

Potentially, the effects of a noise level increase can be small (e.g. a noise level increase of less than 3 decibels). At the same time, the resulting noise environment can be very high, particularly adjacent to existing state highways, and cause (potentially further) adverse effects for residential use.

These Projects are intended to respond to development of land surrounding the transport corridors. The proposed extensive urban development of land in the vicinity is predicted to result in traffic volumes increasing, thus resulting in significant noise level increases for some areas when comparing current and future 2048 traffic volumes.

The assessment in accordance with NZS 6806 is undertaken for each Project road individually, excluding other roads in the area. The reason is that the only effects that can be mitigated by a project are those of the roads that are directly affected by that project, i.e. excluding other roads that may contribute to the overall noise levels but are not being changed by a project.

On the other hand, the assessment of traffic noise change takes account of all major roads in the vicinity of the Project road. In this instance, the traffic noise levels that may be experienced at PPFs from all traffic in the area is assessed to gain a good understanding of:

- whether a Project road has an effect on the overall noise level received at individual PPFs; and
- The change in noise level assuming all NoRs have been implemented (refer Section 4.2 below).

This means that the change in noise level takes account of the cumulative effect of all existing and future roads being used.

4.1 Preparation for this Report

Work undertaken for this Report commenced in December 2022. In summary, the preparation for this report has included:

- Review of information from other experts, namely traffic, construction, design and planning amongst others;
- A site visit of all NoRs on 21 September 2022;
- Ambient noise level surveys in the Project areas (refer section 5.2);
- Computer noise modelling of traffic noise levels from the RTC and general road traffic; and
- Where information we relied on was provided by other experts, this is noted in the report.

4.2 Assumptions

Assessment of operational noise and vibration effects is based on information provided by other experts, specifically the team's traffic specialists.

Since we have assessed 13 NoRs, without a defined implementation year, we chose a scenario where all NoRs are implemented, and the area is developed to its fullest potential. The design year for this scenario is 2048.

The assessment of the Do-nothing scenario (refer Section 3.1.2) is that the surrounding environment is fully developed, but without any changes to the transport corridors. We understand from the traffic specialists that a sensitivity factor is included in these traffic volumes that does not allow for impractically high traffic volumes on existing roads. The assumption is that peak traffic would occur for more hours of the day.

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

Table 4-1: Buildings inside designation (not assessed)

NoR	Address
1	28 Awanohi Road 86, 91, 262, 390, 392 Bawden Road 64, 69 Crossbridge Road 1318, 1546, 1559, 1561, 1591, 1595 Dairy Flat Highway 53 Dairy Steam Road 133, 135 Goodland Drive 49, 65, 71, 81, 88 Grave Hill Drive 25 Kewa Road 72, 78, 86 Kingscliff Rise 84, 93, 95 Postman Road 26 Redvale Rise 9, 42, 2/44, 46, 49, 59, 98 and 98A Wilks Road 29 Wilson Road
2	N/A
3	36 Old Pine Valley Road
4	28 Awanohi Road 1268, 1764, 1776, 1897 East Coast Road 141, 145, 152, 154, 158 Lonely Track Road 59 Sidwell Road 193, 228, 244 Wilks Road 29 Wilson Road
5	138, 146 Top Road 1764 East Coast Road

NoR	Address
6	2, 37, 85, 88 Upper Ōrewa Road 6 Russell Road
7	240, 245 Pine Valley Road
8	2, 9 Wilks Road 1 Green Road 796, 960 1270, 1350, 1368, 1373, 1397, 1579, 1638 Dairy Flat Highway
9	1 Albany Heights Road 318, 329, 402, 444, 526, 737, 759, 774, 796 Dairy Flat Highway
10	348, 401 Wainui Road 2 Upper Ōrewa Road
11	1436 Dairy Flat Highway 336, 337 Postman Road 193 Wilks Road
12	9, 25, 54, 229, 267 Bawden Road 6, 13, 18, 19, 26, Top Road
13	1726, 1764, 1780, 1852, 1857, 1862, 1942, 2020, 2036, 2076, 2150 East Coast Road

Some of the buildings may be affected by more than one NoR. We have identified them in relation to each of the NoRs that may affect those buildings (either through removal or assessment of effects).

4.3 Assessment basis

The NoRs represent different transport modes and different extents of change. Therefore, each NoR must be assessed according to its relevant changes and associated effects:

- **Rapid transit:** NoR 1 is intended to establish a rapid transit and active mode transport corridor. We have assessed the operational noise against the noise criteria of NZS6806 and change in noise level.
- **New and altered roads:** A combination of New and Altered roads are proposed in NoR 6, 11 and 12, and altered roads are proposed for NoRs 4, 7, 8, 9, 10, and 13. All these NoRs are assessed against NZS6806 and in relation to the change in noise levels.
- **Stations:** NoRs 2 and 3 are intended to establish new RTC stations. The station noise is assessed against the underlying AUP:OP zone noise limits. The Pine Valley East Station also provides for Park and Ride facilities, which are also assessed against the AUP:OP zone noise rules.
- **Walking and Cycling:** Most NoRs allow for some form of active mode transport, i.e. walking and cycling. Walking and cycling facilities do not cause any significant noise levels that would be consistently noticeable adjacent to the integrated major transport corridors that they are located at. Therefore no specific operational noise assessment of walking and cycling facilities was undertaken.

4.4 Computer noise modelling

The propagation of transport noise is affected by multiple factors, amongst them:

- Terrain elevations, including shielding from intervening terrain and exposure due to elevation
- Ground condition, including absorptive ground such as meadows or hard reflective ground
- Atmospheric conditions, including wind or temperature inversions
- Road parameters, including road surface, traffic speed, vehicle types and gradient.

Because of the multiple factors and their interaction, computer noise modelling is a vital tool in predicting traffic noise impacts in the vicinity of major roads and for the determination of mitigation measures. Modelling enables a comprehensive and overall picture of noise impacts to be produced, taking into consideration all factors potentially affecting noise propagation.

We used the software SoundPLAN V8.2, which is an internationally recognised computer noise modelling programme. SoundPLAN uses a three-dimensional digital topographical terrain map of the area as its base. In addition, we entered data into the model for existing buildings, proposed earthworks edges and ground absorption within the assessment area. We digitised road traffic noise sources, with road lanes located on the terrain file, for the existing/Do-nothing scenarios and the Do-minimum scenario.

The model settings are described in Table 4-2 below.

Table 4-2: Road traffic noise modelling parameters

Parameter	Setting/source
Software	Sound Plan 8.2
Algorithm	CoRTN
Reflection	CoRTN
Ground absorption	0.6 for urban areas; 1 for rural areas
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 SoundPLAN model implements the calculation algorithms of the “Calculation of Road Traffic Noise” methodology which is referenced in NZS6806 in Section 3.1.2.

The calculation algorithms take account of the factors set out above, including relevant atmospheric and ground conditions within appropriate parameters.

For road noise, we have used the adjustments for New Zealand road conditions, specifically road surface types, as set out in the Waka Kotahi “Guide to state highway road surface noise”, V1.0, January 2014, Table 2.1. Therefore, modelling results can be compared with the relevant criteria without further adjustment.

4.4.1 Model verification

The accuracy of the computer model needs to be verified. We used the measurement results set out in section 5.2.1 to verify that the computer model operates within satisfactory tolerances.

Table 4-3: Computer noise model verification

Measurement position	Location	Measured Level	Predicted Level	Difference	Comment
		dB LAeq(24h)	dB LAeq(24h)	decibels	
MP1	146 Pine Valley Road, Dairy Flat	53	56	+3	Generally acceptable discrepancy.
MP2	40 Top Road, Dairy Flat	58	59	+1	Good agreement.
MP3	13 Top Road	50	51	+1	Good agreement.
MP4	112 Top Road	56	61	+5	Lower noise level measured than predicted. Potentially due to lower AADT along Top Road in reality than used in the model (since this is a dead-end street). Could also be due to vehicles travelling at a lower speed than the 80 km/h speed limit considered in the noise model.
MP5	28 Lascelles Drive	55	57	+2	Within tolerance.

A comparison of the measured and predicted levels shows that there is generally good agreement between measured and predicted levels, with a difference of no more than 2 decibels, for those positions where traffic on existing roads is the controlling noise source. This accuracy fulfils the requirements of NZS 6806 which states in Section 5.3.4.2: *“The difference between measured and predicted levels should not exceed ± 2 dB.”*

4.4.2 Individual receiver noise levels

We have assessed noise effects at all PPFs. We have included predicted noise levels for all PPFs, for all scenarios, in the tables in Appendix B. The locations of these dwellings are shown in the drawings in Appendix 3.

Noise criteria categories for the PPFs are shown as a graphic representation by colouring the buildings with a colour scale, showing NZS6806 Category A buildings in green, Category B buildings in orange and Category C buildings in red. Any buildings not shown in these three colours on the figures are outside the assessment area, or are not PPFs, e.g. garages, sheds or business premises.

The noise levels from the RTC stations within NoRs 2 and 3 are predicted in sections 7.2 and 7.3 against the AUP:OP underlying zone noise limits. They are not shown specifically on the figures but are included in the overall predictions for NoR 1 as they fall within the assessment radius of the RTC.

4.4.3 Noise contour plans

Noise contour plans are a useful tool to obtain a graphical overview of a project area including currently vacant land that may be developed in the future. The contours are calculated in SoundPLAN by interpolating a large number of individual points. Therefore, noise contour maps should not be used to “read” noise levels for specific locations. For individual noise levels for each PPF, the receiver noise levels in the tables in Appendix B should be used.

Noise contour plans are contained in drawings in Appendix C. These plans show interpolated noise level bands at 5 decibel intervals from 55 dB to 70 dB $L_{Aeq(24h)}$.

4.4.4 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. Uncertainties in the modelled noise levels can occur for several reasons and are typically related to the effects of the input data such as topographical screening, traffic details (e.g. light vs heavy vehicles), speeds (observed vs posted) and road surface type.

The terrain model was developed by using LIDAR points for the wider area from LINZ, and inserting the Project terrain data provided by the Project GIS team based on 1m vertical terrain resolution. This methodology provides sufficient detail to accurately account for any acoustic shielding from localised topographical features.

The traffic data was provided by the Project Transport team. Forecasting of future traffic flows may not necessarily reflect the actual flows when the Design Year is reached. However, as discussed in section 3.1.4, the sensitivity of the noise predictions to changes in traffic data is not as significant as the effects of topographical screening.

Nevertheless, an uncertainty remains as to 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.

4.5 Assessment of operational vibration

As noted in section 3.2.2, vibration from well-constructed and maintained roads is not an issue that causes adverse effects. As such vibration effects are not anticipated and we have therefore not assessed road traffic vibration further.

Only a small number of heritage listed buildings are noted in the Archaeology report as discussed below.

4.5.1 NoR4

22214 – Sainsbury Villa lies within 200m of the proposed designation and will therefore not be affected by traffic vibration.

22215 – Small Homestead is at 1732 Dairy Flat Highway, relatively close to the road. However, as discussed, for a well-constructed road vibration levels will be low and would not cause adverse effects on the structure.

4.5.2 NoR8

22215 – The house at 1732 Dairy Flat Highway is relatively close to the road. However, as discussed, for a well-constructed road vibration levels will be low and would not cause adverse effects on the structure.

16095 – The house at 1338 Dairy Flat Highway is relatively close to the road. However, as discussed, for a well-constructed road vibration levels will be low and would not cause adverse effects on the structure.

5 Existing and Future Receiving Environment

5.1 Planning and Land Use Context

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

In relation to traffic noise, the assessment of effects and design of mitigation relates to any PPFs existing at the time of consenting (refer section 3.1.2). Any future sensitive developments will need to share the responsibility of providing a suitable noise environment for future residents. This is discussed later in the report.

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

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

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

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

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

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

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

5.2 Existing noise environment

The existing noise environment provides a baseline for assessing noise effects. Effects can be assessed by quantifying the noise levels and noise level changes that people would experience due to the implementation of a project. The change in noise environment can be interpreted in relation to subjective responses of people (refer section 3.1.4). In addition, measured noise levels are used to verify the computer noise model.

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

5.2.1 Surveys

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



Figure 5-1: Noise survey locations

All noise level survey results are shown in Table 5-1.

Table 5-1: Noise survey results

Meas. Position	Location	NoR	Ambient noise level	Background noise level
			dB L _{Aeq(24h)}	dB L _{A90}
MP1	146 Pine Valley Road, Dairy Flat	1	58	43
MP2	40 Top Road, Dairy Flat	4	53	47
MP3	13 Top Road	12	50	37
MP4	112 Top Road	12	56	49
MP5	28 Lascelles Drive	8	55	46

5.2.2 Modelling

In addition to measuring the noise levels at a number of representative locations close to the Projects, computer noise modelling enables the prediction of existing noise levels at all PPFs. The model of the existing situation reflects the roads as they currently are, including the current posted speed limits.

The PPFs for each Project have been assessed separately. Where a PPF would be affected by more than one NoR, this is noted in the report. For each NoR, we have calculated the noise levels received by all PPFs.

The number of PPFs for each NoR are shown in Table 5-2.

Table 5-2: Number of PPFs in each NoR

NoR	Number of PPFs
1	231
4	161
5	0
6	12
7	17
8	154
9	90
10	21
11	35

NoR	Number of PPFs
12	55
13	132

6 Measures Available to Avoid, Remedy or Mitigate Transport Noise Effects

Traffic on the road (including electric buses on the RTC) and stations generate noise that may require mitigation. The sections below discuss road and station noise. The below noise mitigation measures have been applied to the NoRs as required and are described in more detail for each NoR in section 7.

6.1 Road traffic noise

There are broadly three mitigation options that can be applied to manage road traffic noise, and are discussed in NZS6806:

- The choice of **road surface material**: a mitigation option that reduces noise at the source (especially for roads with speeds above 40-50 km/h where the road-tyre interaction is the controlling noise source rather than engine noise);
- The installation of **noise barriers** either on the roadside or on the property boundary; and
- The inclusion (for new builds) or retrofitting (for existing buildings) of **Building Modification Mitigation** (e.g., alternative ventilation to enable windows and doors to remain closed, improved joinery and/or glazing, or, in rare cases, the installation of additional wall and ceiling lining).

NZS6806 states:

The noise criteria are intended to address the adverse effects of road-traffic noise on people. Land-use planning is the preferred method of avoiding these effects. Where this is impracticable, the Standard sets out procedures and methods of the prediction, measurement and assessment, and guidelines for mitigation of road-traffic noise in accordance with the duty to adopt the best practicable option.²

This indicates that NZS6806 deals with the residual noise effects after land-use planning has been implemented (or where it has been omitted in the planning stage).

Generally, mitigation is implemented from source to receiver. This means that the road surface is the first choice of mitigation measure as it protects the largest extent of receivers. Second are barriers placed either on the road edge or the property boundary. Barriers protect the area behind them, so are not suitable to shield upper floors of multi storey buildings; however, they are suitable to protect ground floors and outdoor living areas where these are facing a road. Barriers may also not be appropriate in suburban and urban environments for urban design reasons – this would be discussed when the BPO is confirmed. Lastly, building modification can be implemented to existing PPFs where these are not sufficiently designed to reduce internal noise levels. Building modification is the last choice as it only protects individual living areas and has no benefit to the wider community.

Where future developments are not yet implemented, the road controlling authorities and developers have a shared responsibility to implement reasonable and appropriate mitigation. This is normally achieved:

² NZS6806, Section 1.1.1

- by the road controlling authority through the use of low noise road surface materials in suburban and urban areas, and
- by the developers through appropriate placement, orientation and design of noise sensitive activities to achieve reasonable internal and as far as practicable, external noise levels.

6.2 Station noise

At the time of construction of these Projects, we anticipate that all buses will be electric. Electric buses do not cause significant noise levels at low speed or when stationary. Therefore, bus noise is likely to be unnoticeable in the stations given their location in relation to neighbouring major roads.

Therefore, the main noise source at stations would be the PA system, should these be planned for. These systems can be designed to comply with the relevant noise limits. In addition, the park and ride and bus layovers have the potential to generate noise levels which have been assessed.

We would recommend that PA systems are turned down or off at night-time in the vicinity of residential sites, or that highly directional speakers are used that avoid noise spill to neighbouring sites.

7 Assessment of Operational Noise Effects

7.1 NoR1 New Rapid Transit Corridor (RTC) between Albany and Milldale

NoR1 supports a proposed Rapid Transit Corridor (Albany to Milldale) (RTC) with Waka Kotahi being the requiring authority. The RTC will also feature a separated walking and cycling along some of the length. The NoR will overlap with the existing motorway designation and SH1 improvements project (NoR 4) over some of the length.

7.1.1 NZS6806

The use of the RTC, particularly in the vicinity of SH1, would not cause any appreciable noise levels at neighbouring PPFs. The RTC has been assessed as operating as a bus system. We understand that only electric buses will be used in line with the Auckland Transport “Low Emission Bus Roadmap”³. Electric buses emit significantly lower noise levels than diesel buses at lower speeds, but at speeds at and above 50 km/h noise levels are approximately the same as for diesel buses. Speeds of up to 80 km/h are proposed for the RTC. Therefore, the modelling results are also representative of diesel buses.

Based on information provided by the Transport specialist, we have conservatively assumed that 400 buses per day will use the RTC corridor. This number allows for buses not to be at capacity while transporting the intended 51,800 passengers per day.

While NZS 6806 is not applicable to New and Altered Roads predicted to carry less than an Annual Average Daily Traffic (AADT) of 2,000 at the design year, we have still applied it to enable assessment of the many new PPFs that are currently largely unaffected by traffic noise (refer Figure 7-1 below, yellow markers). However, traffic volumes below 2,000 vehicles per day require an adjustment in accordance with the CoRTN method, which has been included in our model. This is called a “low flow correction” which slightly adds to the calculated noise level, making allowance for non-continuous traffic flows.

The RTC traverses both greenfield and brownfield areas. Where the RTC is adjacent, or close to, existing major roads such as SH1 and Dairy Flat Highway, PPFs have been assessed against the Altered road criteria (refer Section 3.1.2). For all other parts of the alignment, the PPFs have been assessed against the New road criteria.

³ <https://at.govt.nz/media/1985010/aucklands-low-emission-bus-roadmap-version-2-october-2020.pdf>

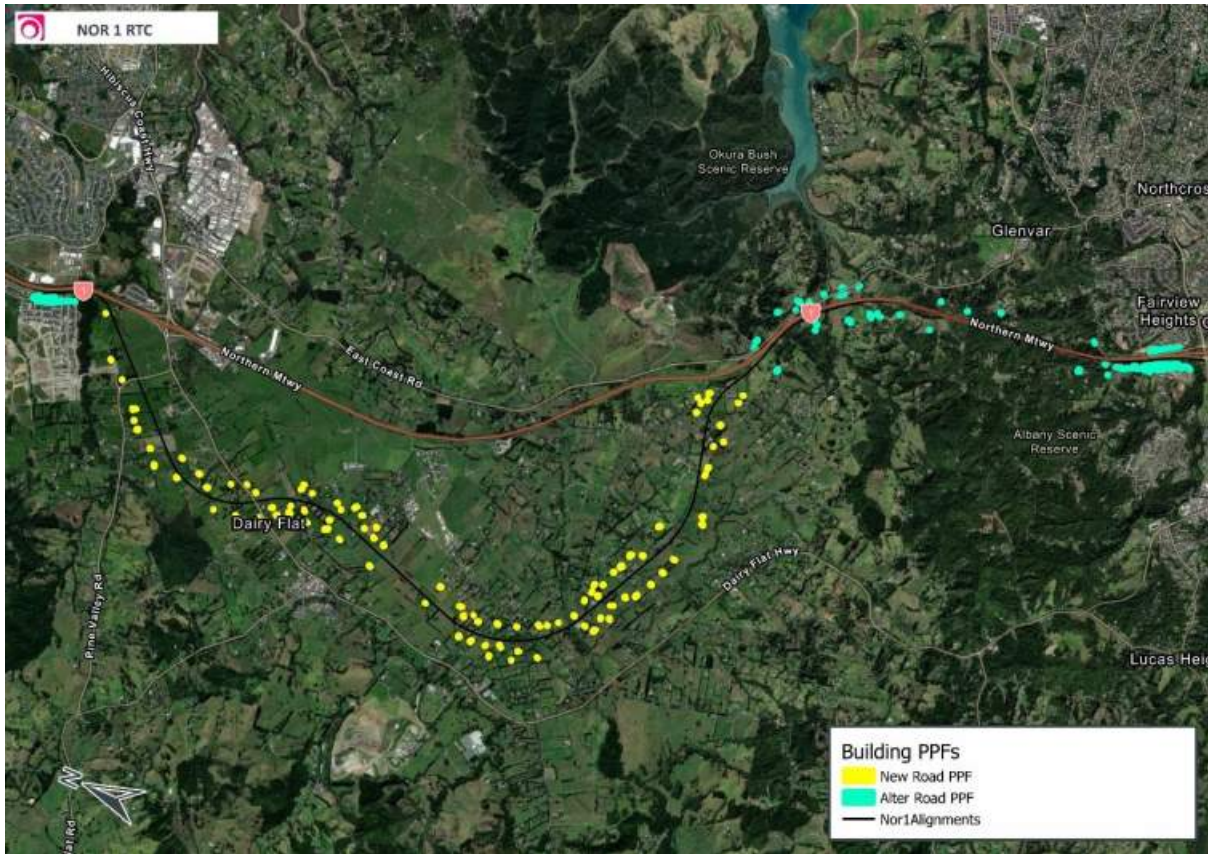


Figure 7-1: NoR1 showing PPFs assessed against New (yellow) and Altered (turquoise) road criteria

There are a total of 231 PPFs, of which 96 have been assessed against the New road criteria and 135 against the Altered road criteria.

7.1.1.1 Altered Road

Where the RTC is located adjacent to existing major roads, it makes no contribution to the overall noise level. For the vast majority of PPFs, the noise level from the RTC is more than 10 dB below that of the neighbouring roads. That means that the RTC would not contribute to the overall received noise level and will likely be inaudible for most of the time.

Therefore, while we show existing and Do-nothing scenario noise levels, these are of the existing roads only as the RTC does not exist. The RTC alone (shown in the Do-minimum scenario) is predicted to generate noise levels within Category A only at all PPFs.

Noise levels from the RTC (excluding any other local roads) range from 30 to 54 dB $L_{Aeq(24h)}$. No mitigation for the RTC is required or necessary.

Table 7-1: Summary of NZS 6806 assessment – Altered Road - NoR 1

Scenario	Number of PPFs		
	NZS 6806 Categories		
	Category A	Category B	Category C
Existing	118	12	5
Do-nothing	105	15	15
Do-minimum	135	0	0

7.1.1.2 New Road

Where the RTC diverges from existing roads and traverses green field (FUZ) areas, the new road criteria have been used to assess noise levels. Here, the existing (from existing local roads) and Do-minimum scenarios are compared. The existing scenario does not include the RTC as that does not exist and reflects existing local roads only. The Do-minimum scenario shows only the noise from the RTC as this is the only source that is assessed and can be mitigated through this Project.

As for the Altered road section of the RTC, for the New road sections the vast majority of PPFs would receive noise levels from local roads that are more than 10 dB higher than the RTC noise level. That means that the RTC would not contribute to the overall received noise level and will likely be indistinguishable for most of the time.

Noise levels from the RTC (excluding any other local roads) range from 33 to 53 dB $L_{Aeq(24h)}$. No mitigation for the RTC is required or necessary.

Table 7-2: Summary of NZS 6806 assessment – New Road - NoR 1

Scenario	Number of PPFs		
	NZS 6806 Categories		
	Category A	Category B	Category C
Existing	90	6	0
Do-minimum	96	0	0

7.1.2 Change in noise level

Noise effects can be described based on the change in noise level with and without the Project. For PPFs assessed against the Altered road criteria, the Do-nothing and Do-minimum scenarios are compared; while for PPFs assessed against the New road criteria, the existing and Do-minimum scenarios are compared. For the change in noise level assessment, all roads in the vicinity of the RTC have been included to provide a fuller picture of actual noise level changes.

7.1.2.1 Altered Road

For the PPFs assessed against the Altered road criteria, we predict that the vast majority of PPFs (122 of the 135 assessed) will receive an unnoticeable change to their noise levels with the Project. A small number (6 PPFs) are predicted to receive a just noticeable noise level change.

However, all PPFs are predicted to receive noise levels in Category A (refer above).

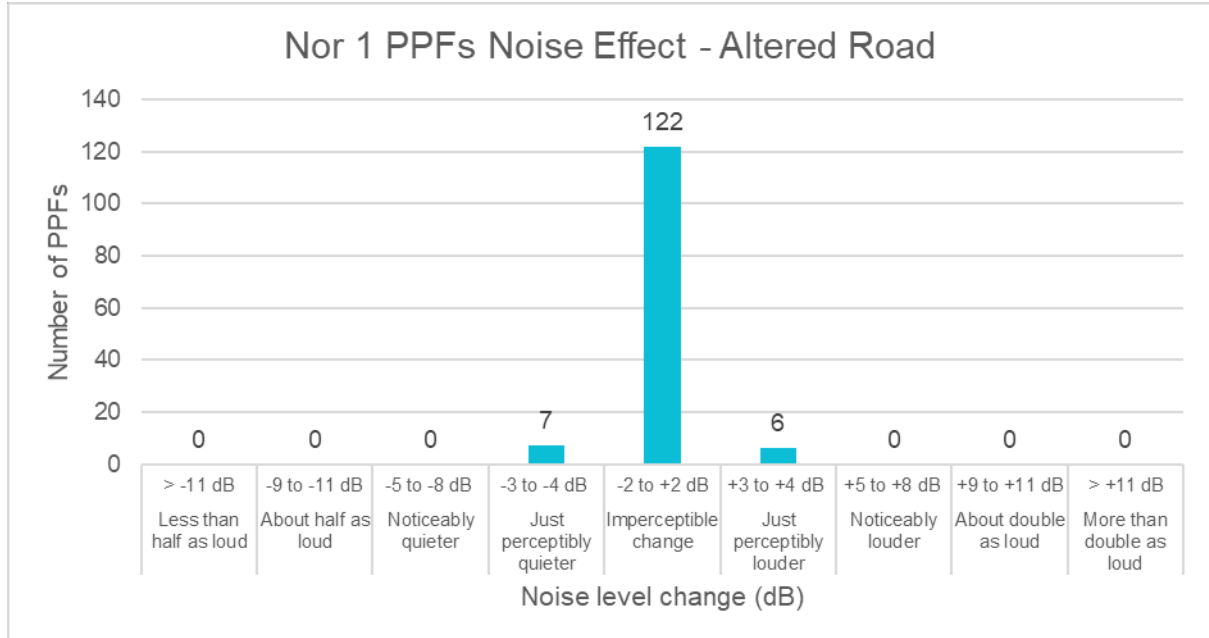


Figure 7-2: Change in noise level – NoR 1, Altered road

7.1.2.2 New Road

PPFs assessed against the New road criteria are generally in areas that are less affected by existing traffic noise on local roads. When comparing the existing and Do-minimum scenarios, the introduction of a new noise source generally would result in noticeable noise level increases.

However, since the RTC only generates relatively low noise levels due to the low traffic volume, most of the noise level changes are due to other roads in the area, including other NoRs discussed in this report. It is proposed to use a lower noise road surface (AC instead of chip seal) for the RTC and for some other Project roads in the network the speed limit will be reduced also, both of which have a noticeable effect on the noise generation. Since traffic volumes appear to remain relatively stable, the noise levels are predicted to reduce for most PPFs.

The majority of PPFs will receive a perceptible to noticeable noise level reduction. For most PPFs, the RTC noise level will be 10 decibels or more below the noise level from other roads, which means that the RTC has no perceptible impact of the overall noise levels received by PPFs.

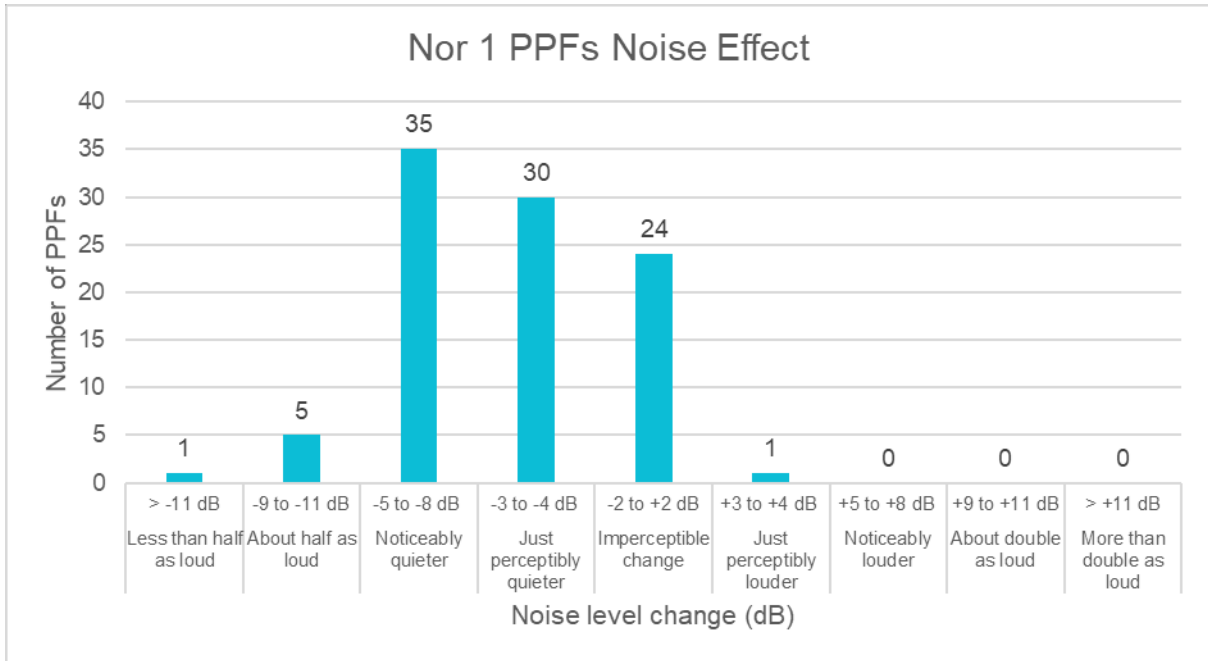


Figure 7-3: Change in noise level – NoR 1, New road

7.1.3 Summary

The RTC (NoR1) consists of both New and Altered road sections. Since only a small number of buses is proposed to travel on the alignment, the RTC traffic noise levels are low overall. All PPFs are predicted to receive noise levels in Category A.

With other roads in the vicinity (including other NoRs of the North Projects) the RTC has nearly no effect on the overall noise level received at PPFs. With the anticipated improved road surface and lower speeds on other roads in the area, noise levels are predicted to remain similar or reduce at the vast majority of PPFs.

7.2 NoR2 New Milldale Station

The Milldale Station and associated facilities project is a proposed Waka Kotahi designation for a new rapid transit station located between the SH1 corridor and the recently developed/developing Milldale residential area.

An indicative layout is shown in Figure 7-4.



Figure 7-4: Indicative Milldale Station layout

The proposed site for the Milldale Station is located halfway down the embankment between the residential sites in Ahutoetoe Road and SH1. While the Kiss n Ride and local bus layover areas will be located at street level with Ahutoetoe Road, the station itself will be at a lower level and well shielded from residential sites.

The station site is located in a mix of zones, with residential sites to the west and north, Open Space to the south, with FUZ beyond that, and to the east, beyond SH1, a Light Industrial zone. The only relevant receiving zone is the residential zone to the west and north. This is the only sensitive receiver that is sufficiently close to potentially be affected. Our assessment has focused on this zone.

The surrounding residential zone is a new subdivision, with some houses still under construction. While intensification may be permitted, it is unlikely that these new houses will be replaced in the near to medium future. We have therefore assumed that the receiving environment remains largely unchanged.

7.2.1 Assessment of station noise

Predicted bus noise levels for peak hour use are shown in Table 7-3. It is possible that the station will be operational for most of the 24-hour day. Therefore, predicted noise levels have been assessed against the most stringent night-time noise criterion of 40 dB L_{Aeq}. The levels have been predicted at the closest residential boundaries.

It is likely that the peak hour use of the station will not occur during night-time, and that night-time noise levels will be lower than predicted.

Table 7-3: Predicted peak bus noise levels – Milldale Station

Receiving zone	Daytime noise limit dB LAeq	Night-time noise limit dB LAeq	Highest predicted peak hour noise level dB LAeq
Residential	50	40	34

We predict that the station use can comfortably comply with the most stringent noise criteria at all times.

As noted previously, any PA system will need to be designed to achieve compliance with the relevant noise limits. This is an issue that can be resolved during detailed design. With standard acoustic input, compliance will be able to be achieved. Similarly, any mechanical plant located within the station will need to be designed to comply with the relevant AUP limits as discussed above.

The bus layover area is located to the south of the site. Several buses are likely to enter the site per day and some could remain in place for several hours. Noise levels from the layover area are predicted to be negligible given the low-speed buses would travel, as electric buses do not generate high noise levels at low speeds.

The kiss n ride area is located to the east of the station level with Ahutoetoe Road. There are a small number of spaces for drop off and pickup. Assuming a conservative 57 vehicle movements during the peak hour, we consider that the noise levels will be similar to, and lower than, existing traffic noise levels from SH1 (shielded from the site) and local traffic on Ahutoetoe Road (on which the vehicles would travel to reach the kiss n ride area). We also note that the area is still developing and that with increased building density, more vehicles will use local roads. The character of noise from the local road and the kiss n ride area will be similar.

Our predictions show that the station operation, kiss n ride and bus layover operations will have no effect on the noise levels received at any of the nearby PPFs.

Therefore, no significant adverse noise effects are predicted.

7.2.2 Summary

The proposed Milldale Station will accommodate a kiss n ride area level with Ahutoetoe Road, and a bus layover area to the south of the site. Both are predicted to generate noise levels that are similar to or lower than those of local traffic and SH1.

The station is located halfway down the embankment between the residential area and SH1. The embankment will provide extensive shielding. We have predicted that the peak hour use of the station will comfortably comply with the most stringent night-time noise limit. Any PA system will need to be designed to also comply with the relevant noise limits, which can be done during detailed design.

7.3 NoR3 New Pine Valley East Station

The Pine Valley East Station and associated facilities Project is a proposed Waka Kotahi designation for a new rapid transit station located along the RTC corridor adjacent to Pine Valley Road.

An indicative layout of the station is shown in Figure 7-5 below. The park and ride area is located north-east of the New Pine Valley Road.



Figure 7-5: Indicative Pine Valley East Station layout

The Station will be located in the FUZ, with all surrounding areas also in the FUZ. We understand that sites to the east of the New Pine Valley Road and station will likely be zoned Industrial in the future, while sites to the north and west of the station will likely be zoned residential with the potential for local centre uses and high density multi storey dwellings.

While the closest houses are at a significant distance at present, more intensive development may occur in the future. Therefore, in addition to predicting the noise level to the notional boundary of existing houses, we have also predicted the noise level at the designation boundary of the NoR towards the potential future residential use sites. This reflects the future development potential and associated rezoning, which may result in the compliance location moving to the station boundary.

7.3.1 Assessment of station noise

Predicted noise levels for peak hour use are shown in Table 7-4. It is possible that the station will be operational for most of the 24-hour day. However, it is likely that the peak hour use of the station will not occur during night-time (i.e. before 7am Monday to Saturday), and that night-time noise levels will be lower than predicted. We have predicted combined noise levels from the park and ride, station and RTC within the station, and drop off and pick up areas.

The levels have been predicted at the closest existing notional boundaries and at the designation boundaries surrounding the station site towards the potential future residential zones.

Table 7-4: Predicted peak noise levels – Pine Valley East Station

Receiving zone	Receiver	Daytime noise limit dB L _{Aeq}	Night-time noise limit dB L _{Aeq}	Highest predicted peak hour noise level dB L _{Aeq}
FUZ (existing notional boundaries)	Most affected existing notional boundary	55	45	34
Residential (future potential site boundaries)	North of NoR3	55	45	39
	East of NoR3	55	45	38
	South of NoR3	55	45	42

We predict that the station use can comfortably comply with the most stringent noise criteria at all times.

Our predictions show that the station operation, park and ride and bus layover operations will have no effect on the noise levels received at any of the existing PPFs or potential future dwellings as their existing noise levels are all predicted to be higher than 55 dB L_{Aeq(24h)}.

As discussed, the PA system will need to be designed to achieve compliance with the relevant noise limits. This is an issue that can be resolved during detailed design. With standard acoustic input, compliance will be able to be achieved. Similarly, any mechanical plant located within the station will need to be designed to comply with the relevant AUP limits as discussed above.

Therefore, no significant adverse noise effects are predicted.

7.3.2 Summary

The proposed Pine Valley East Station will accommodate a park and ride for about 500 car park spaces, station and platforms as well as bus layover and a drop off and pick up area.

The station and surrounding sites are zoned FUZ. It is anticipated that the sites to the west and north will be rezoned for local centre/residential uses in the future, while sites to the east will likely be zoned for industrial use. Therefore, we have assessed both the noise levels at the notional boundary of existing surrounding houses and also noise levels at the potential future residential zone boundaries.

We predict that for peak hour use the station and associated facilities can comply with the most stringent night-time noise limit of 45 dB L_{Aeq} at all positions. It is likely that the peak hour use will not be within the night-time period, and that noise levels will be even lower at night-time.

Any PA system will need to be designed to also comply with the relevant noise limits, which can be done during detailed design.

7.4 NoR4 SH1 Improvements

An NoR will be submitted for an alteration to an existing WK designation for a widened SH1 carriageway and three interchange projects. The designations to be altered are numbers 6761, 6760, 6759 and 6751.

From the south, the Project crosses through residential and Countryside living land, then FUZ before aligning with the boundary between the FUZ to the west and Rural – Countryside living and business zones to the east.

SH1 is the major traffic route through this area and controls the noise environment in the area at present. Most of SH1 is a cut, meaning that existing dwellings on surrounding land are often elevated above the road with clear visibility in either direction.

Most of the alignment is within the existing designations. However, as some of the works will be outside the existing designation boundaries, an alteration to the designations is sought. While generally only the noise from outside the existing designation boundary is assessed, this is difficult to put into practice for road traffic noise. Where a traffic lane moves outside the existing designation, the noise cannot be separated from that inside the existing designation. For the most part, the alteration to the designations accommodates the walking and cycling facilities (which do not generate appreciable noise levels adjacent to SH1) and some of the interchange ramps and connections.

As the traffic inside and outside the existing designations cannot be simply differentiated, we have assessed the combined traffic noise both inside the existing designation areas and the alterations to the designations.

7.4.1 NZS6806

The entire Project is defined as an Altered road. This means that the altered road criteria apply (refer Section 3.1.2). As discussed, the assessment in accordance with NZS 6806 is undertaken based only on the Project roads, excluding local roads in the area.

A total of 161 PPFs have been assessed. For NoR4, the northern and southern part of the road are in the urban area (as defined by Stats NZ), where PPFs are within 100m from the road, while the middle is in the rural area, where PPFs are up to 200m from the road edges of the proposed upgraded alignment.

We note that the active mode transport (walking and cycling) extends beyond the widening of SH1. As active mode transport does not generate noticeable noise levels (particularly when adjacent to the existing SH1) and is not covered by the assessment of NZS 6806, we have excluded receivers past the SH1 widening from the assessment. This means that NoR4 extends further than the PPFs assessed.

Currently, the vast majority of PPFs receive noise levels within Category A. This is due to SH1 being shielded from PPFs by terrain, the distance of PPFs from the road and (for more intensively developed areas) structures closer to SH1 providing shielding to PPFs behind.

The traffic volume in the Do-nothing scenario is proposed to increase significantly, resulting in an average 3 decibel noise level increase for most PPFs, and therefore resulting in noise levels in less stringent noise criteria categories.

With the SH1 improvements in place, noise criteria categories remain generally similar at most PPFs as traffic volumes remain reasonably steady and most PPFs are at a reasonable distance from the road. Some PPFs are close to other project roads that will experience a significant change to their traffic volumes in the Do-minimum scenario as part of the implementation of all North Projects.

A small number of PPFs (mostly in East Coast Road, Kewa Road and Paikea Street) are predicted to receive noise levels in Categories B and C. Therefore, we have investigated potential traffic noise mitigation options.

Given that the base surface on SH1 is PA10 30mm (a low noise absorptive road surface), there are limited options to further improvement. However, noise mitigation options we have investigated include the use of lower noise road surface (EPA7 50mm) and 2m roadside or boundary barriers for individual PPFs. These mitigation options are not exhaustive. In the future, during detailed design, the BPO mitigation measures will be determined in accordance with the recommended conditions. At that time, any mitigation measure beyond the use of low noise road surface will be investigated to determine the BPO to achieve the noise criteria categories of the PPFs set out in the conditions.

While 2m barriers will be effective for some of the PPFs, others would not receive any benefit from a barrier (either at the road or designation boundary). We have considered barriers where they are effective (i.e. where they achieve a noticeable noise level reduction, or where they achieve a noise level reduction for PPFs from Category C into Category A or B).

The use of EPA7 50mm provides a better outcome than barriers alone, with more PPFs in Category A, but the same number (14) in Category C.

With a combination of EPA7 50mm and 2m barriers, this number can be reduced to 11 PPFs receiving noise levels in Category C, and 135 receiving noise levels in Category A. The use of low noise road surface provides the best mitigation outcome for the wider area. Where barriers may be practicable for existing PPFs, these will be assessed at the time of detailed design to determine if they represent the BPO. At that time, the location and height of any barriers will be determined and a noise mitigation plan prepared in accordance with the conditions.

For any PPFs predicted to receive noise levels in Category C once the future BPO mitigation has been determined, we recommend that building modification is investigated at the implementation of the Project.

Note that some PPFs may not exist anymore at the time of construction of the Project, particularly in FUZ sections.

Table 7-5: Summary of NZS 6806 assessment - NoR 4

Scenario	Number of PPFs		
	NZS 6806 Categories		
	Category A	Category B	Category C
Existing	144	13	4
Do-nothing	125	21	15
Do-minimum	121	17	23
Mitigation Option 1 – 2m barriers	125	22	14
Mitigation Option 2 – EPA7 50mm	130	17	14
Mitigation Option 3 – EPA7 50mm and 2m barriers	135	15	11

7.4.2 Change in noise level

Noise effects can be described based on the change in noise level with and without the Project by comparing the Do-nothing scenario and one of the mitigation scenarios (Mitigation Option 3 – low noise road surface and indicative 2m barriers). These predictions include other local roads as well as SH1 to provide a fuller picture of the predicted noise level changes.

The existing SH1 is a major noise source that will be altered by providing additional lanes. While many of the adjacent PPFs are well shielded by terrain as SH1 is in a cutting for part of the alignment, others are more exposed to traffic noise.

With the road surface and barriers as described in the section above in place, noise levels for the vast majority of PPFs will remain similar or reduce in parts due to the barriers. Only six PPFs are predicted to receive just perceptible increases in noise level.

Figure 7-6 shows the distribution of the noise level changes when comparing the Do-nothing and mitigated scenarios.

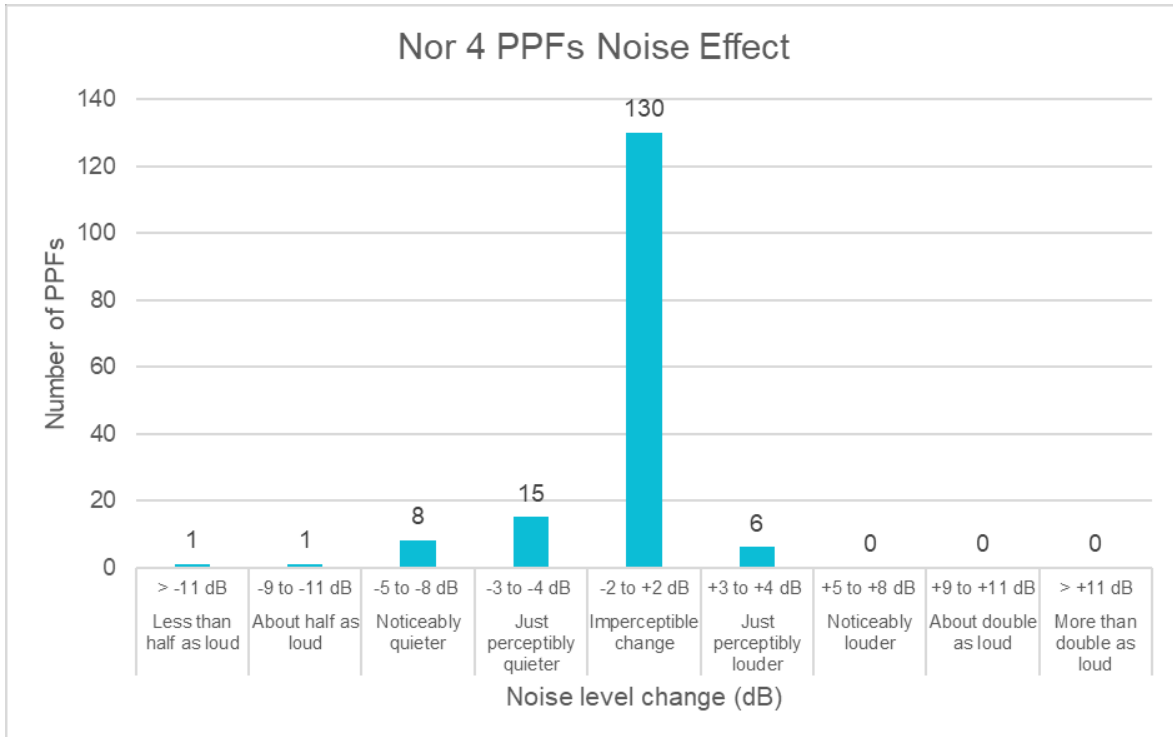


Figure 7-6: Change in noise level – NoR 4

7.4.3 Summary

The proposed SH1 improvements will require mitigation for some PPFs as a number of PPFs currently, and in the future, will receive noise levels in Category B and C. In order to reduce the noise levels at these PPFs, beyond the use of low noise road surface, we have tested several mitigation options including the use of barriers at positions along the road, the designation boundary or, in some places, along the RTC (NoR1) between SH1 and residential areas. The BPO mitigation in addition to the use of low noise road surface will be determined at the time of detailed design, to achieve, at a minimum, the noise criteria categories set out in the conditions.

With mitigation in place, noise levels are predicted to be lower overall than without the Project, with more PPFs receiving noise levels in Category A. Similarly, noise levels are predicted to remain generally similar to, or lower than, those if the Project does not go ahead. Overall, the implementation of NoR4 will provide an improvement for the PPFs in the vicinity.

The active mode transport that is part of NoR4 does not generate noticeable noise levels, especially adjacent to SH1, and has not been included in the assessment in accordance with NZS 6806.

7.5 NoR5 New SH1 Crossing at Dairy Stream

The proposed NoR 5 supports a new crossing at Huruuru (Dairy Stream), with AT being the requiring authority. NoR 5 will overlap with NoR 4 and NoR 13 over some of its length. Design features for this NoR are summarised in Section 2.

7.5.1 NZS6806

Although this NoR supports the construction of a new section of road, the predicted AADT of this road is below 2000 in the Do Minimum scenario. NZS 6806 states that the Standard does not apply to new and altered roads predicted to carry less than 2000 AADT at the design year, therefore this NoR has not been assessed further under the Standard. In addition, the new crossing is in close proximity to SH1, a major road that controls the noise environment. This means that this road would be assessed as an “altered road”, for which it would not meet the trigger levels of effect (refer Section 7.5.2 below).

7.5.2 Change in noise level

Traffic noise from NoR 5 will be dominated by noise from the surrounding road network, in particular from SH1. This is due to the low traffic volumes predicted to use the bridge, compared to the very high traffic volumes predicted along SH1 and surrounding roads.

PPFs within 200m of NoR 5 are already affected by traffic noise from SH1. Changes in traffic noise at these PPFs are covered off in this report in the assessment section for NoR 4.

7.5.3 Summary

The new SH1 crossing at Dairy Stream for NoR 5 does not require assessment under NZS 6806 because traffic volumes using the crossing are predicted to be below 2000 AADT.

Noise levels at PPFs within 200m of this NoR are predicted to be dominated by the surrounding road network, in particular from SH1. Therefore, traffic noise from the SH1 crossing is not predicted to change the noise environment of the surrounding area.

7.6 NoR 6 New Connection between Milldale and Grand Drive

The proposed NoR 6 supports a new connection between Milldale and Grand Drive, with AT being the requiring authority. NoR 6 will overlap with NoR 10 at the intersection of Wainui Road. Design features for this NoR are summarised in Section 2.

7.6.1 NZS6806

NoR 6 has been assessed against the Altered road criteria (refer Section 3.1.2). As discussed, the assessment in accordance with NZS 6806 is undertaken based only on the Project roads, excluding local roads in the area.

A total of 12 PPFs have been assessed. The entirety of NoR 6 falls within the existing rural area (as defined by Stats NZ), meaning that PPFs within 200m of the road edges of the proposed new alignment were assessed. We note that at the time of writing of this report, there is a new development of houses at Ara Hills, however this development is greater than 200m away from the extents of NoR 6.

In effect, this means that the only PPFs assessed are those near the section of NoR 6 comprising alterations to the existing Upper Ōrewa Road, meaning that no PPFs have been assessed against the New roads criteria.

Currently, almost all PPFs receive noise levels within Category A. This is due to low traffic flows along Upper Ōrewa Road.

The traffic volume in the Do-nothing scenario is proposed to increase significantly, resulting in an average 6 decibel noise level increase for most PPFs, and therefore resulting in noise levels in less stringent noise criteria categories.

With the construction of the Project, and considering only Project roads without surrounding roads, all PPFs fall within Category A due to implementation of a low-noise road surface (asphaltic concrete) even though there is a predicted increase in traffic volumes along Upper Ōrewa Road. This means that the road does not meet the definition of an Altered Road under NZS 6806. Therefore, the Standard does not apply, and mitigation options do not need to be considered under the Standard.

Note that some PPFs may not exist anymore at the time of construction of the Project, particularly as this project is largely bordered by FUZ.

A summary of the results of the noise predictions is presented in Table 7-6.

Table 7-6: Summary of NZS 6806 assessment – NoR 6

Scenario	Number of PPFs		
	NZS 6806 Categories		
	Category A	Category B	Category C
Existing	11	1	0
Do-nothing	9	1	2
Do-minimum	12	0	0

7.6.2 Change in noise level

Noise effects can be described based on the change in noise level with and without the Project by comparing the Do-nothing and the Do Minimum scenarios.

The North Projects overall will enable higher traffic flows compared to the Do-Nothing scenario along Upper Ōrewa Road, however noise increases are limited due to implementation of a low-noise road surface (asphaltic concrete).

Noise levels for most PPFs will remain similar or reduce. Only two PPFs are predicted to receive noticeably louder increases in noise level. The increases are due to the increased traffic flows along Upper Ōrewa Road.

Figure 7-7 shows the distribution of the noise level changes when comparing the Do-nothing and Do Minimum scenarios.

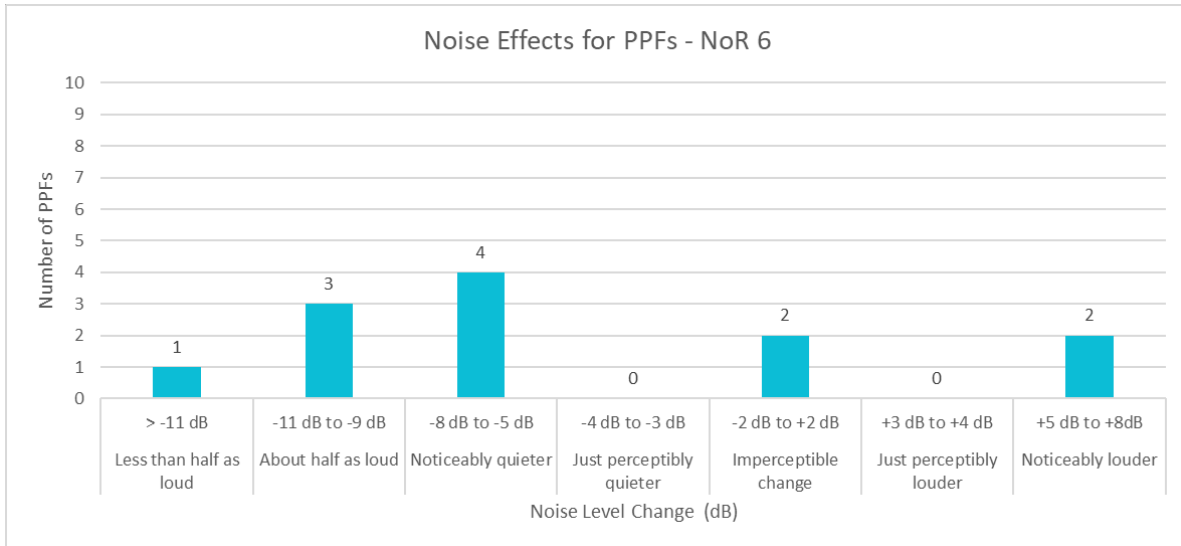


Figure 7-7 Change in noise level - NoR 6

7.6.3 Summary

PPFs near NoR 6 have been assessed against the Altered roads criteria under NZS 6806. All PPFs are predicted to receive noise levels in Category A in the Do Minimum scenario.

With other roads in the vicinity (including other NoRs of the North Projects) noise levels are predicted to remain similar or reduce at most PPFs, with noticeable noise level increases at only two 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 of operation.

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.

7.7 NoR 7 Upgrade to Pine Valley Road

The proposed NoR 7 supports upgrades to Pine Valley Road, with AT being the requiring authority. Design features for this NoR are summarised in Section 2.

7.7.1 NZS6806

NoR 7 has been assessed against the Altered road criteria (refer Section 3.1.2). As discussed, the assessment in accordance with NZS 6806 is undertaken based only on the Project roads, excluding local roads in the area.

A total of 17 PPFs have been assessed. The entirety of NoR 7 falls within the existing rural area (as defined by Stats NZ), meaning that PPFs within 200m of the road edges of the proposed new alignment were assessed.

Currently, all PPFs receive noise levels within Category A. This is due to low traffic flows along Pine Valley Road.

The traffic volume in the Do-nothing scenario is proposed to increase, resulting in an average 4 decibel noise level increase for most PPFs. One PPF will move to Category B and one PPF will move to Category C in the Do-Nothing scenario .

With the construction of the Project, and considering only Project roads without surrounding roads, all PPFs fall within Category A due to implementation of a low-noise road surface (asphaltic concrete), lowering of the speed limit along Pine Valley Road, and a slight reduction in traffic flows. This means that the road does not meet the definition of an Altered Road under NZS 6806. Therefore, the Standard does not apply, and mitigation options do not need to be considered under the Standard.

Note that some PPFs may not exist anymore at the time of construction of the Project, particularly considering the area is zoned FUZ.

A summary of the results of the noise predictions is presented in Table 7-7.

Table 7-7: Summary of NZS 6806 assessment – NoR 7

Scenario	Number of PPFs		
	NZS 6806 Categories		
	Category A	Category B	Category C
Existing	17	0	0
Do-nothing	15	1	1
Do-minimum	17	0	0

7.7.2 Change in noise level

Noise effects can be described based on the change in noise level with and without the Project by comparing the Do-nothing and the Do Minimum scenarios.

The North Projects overall will enable lower traffic flows compared to the Do-Nothing scenario along Pine Valley Road. Further noise reductions are brought about by lowering of the speed limit along Pine Valley Road and implementation of a low-noise road surface (asphaltic concrete).

Noise levels for all PPFs will remain similar or reduce.

Figure 7-8 shows the distribution of the noise level changes when comparing the Do-nothing and Do Minimum scenarios.

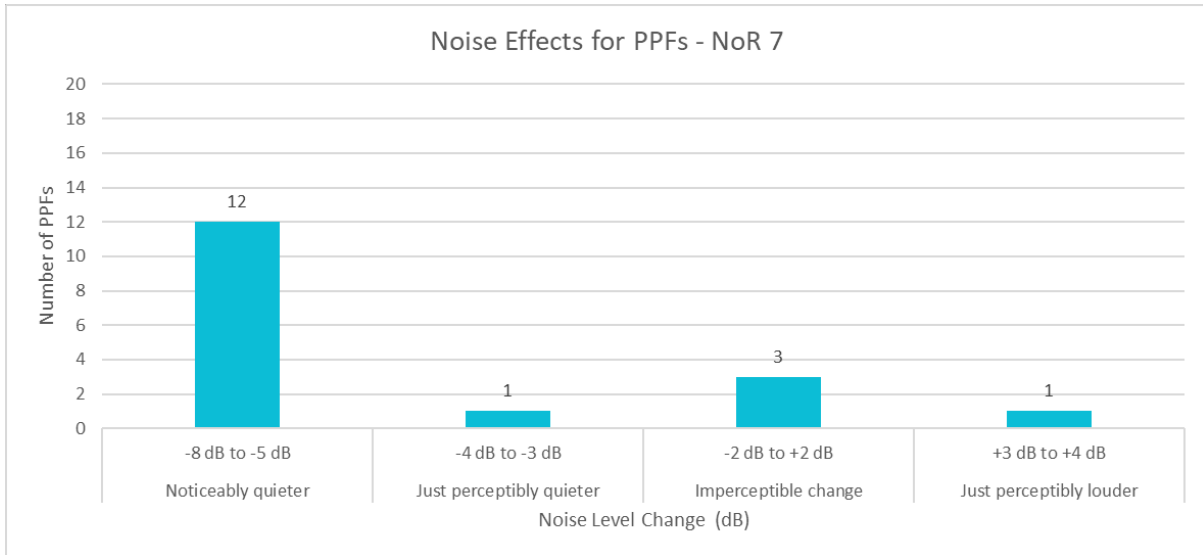


Figure 7-8 Change in noise level - NoR 7

7.7.3 Summary

PPFs near NoR 7 have been assessed against the Altered roads criteria under NZS 6806. All PPFs are predicted to receive noise levels in Category A in the Do Minimum scenario.

With other roads in the vicinity (including other NoRs of the North Projects) noise levels are predicted to remain similar or reduce at all PPFs.

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.

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

The proposed NoR 8 supports upgrades to Dairy Flat Highway between Silverdale and Dairy Flat, with AT being the requiring authority. NoR 8 will overlap with NoR 1, NoR 4, NoR 9, NoR 11 and NoR 12 over some of its length. Design features for this NoR are summarised in Section 2.

7.8.1 NZS6806

NoR 8 has been assessed against the Altered road criteria (refer Section 3.1.2). As discussed, the assessment in accordance with NZS 6806 is undertaken based only on the Project roads, excluding local roads in the area.

A total of 154 PPFs have been assessed. The entirety of NoR 8 falls within the existing rural area (as defined by Stats NZ), meaning that PPFs within 200m of the road edges of the proposed new alignment were assessed.

Currently, the vast majority of PPFs receive noise levels within Category A, with 7 PPFs receiving noise levels within Category B and one PPF receiving noise levels within Category C.

The traffic volume in the Do-nothing scenario is proposed to increase significantly, resulting in an average 3 decibel noise level increase for most PPFs, and therefore resulting in noise levels in less stringent noise criteria categories.

With the construction of the Project, and considering only Project roads without surrounding roads, all PPFs fall within Category A due to implementation of a low-noise road surface (asphaltic concrete) and redistributed road traffic throughout the surrounding proposed network. This means that the road does not meet the definition of an Altered Road under NZS 6806. Therefore, the Standard does not apply, and mitigation options do not need to be considered under the Standard.

Note that some PPFs may not exist anymore at the time of construction of the Project, particularly those in FUZ areas which makes up the majority of the alignment.

A summary of the results of the noise predictions is presented in Table 7-8.

Table 7-8: Summary of NZS 6806 assessment – NoR 8

Scenario	Number of PPFs		
	NZS 6806 Categories		
	Category A	Category B	Category C
Existing	146	7	1
Do-nothing	108	28	18
Do-minimum	154	0	0

7.8.2 Change in noise level

Noise effects can be described based on the change in noise level with and without the Project by comparing the Do-nothing and the Do Minimum scenarios.

The North Projects overall will enable lower traffic flows compared to the Do-Nothing scenario along Dairy Flat Highway. Further noise reductions are brought about by lowering of the speed limit along Dairy Flat Highway and implementation of a low-noise road surface (asphaltic concrete).

Noise levels for all PPFs will remain similar or reduce.

Figure 7-9 shows the distribution of the noise level changes when comparing the Do-nothing and Do Minimum scenarios.

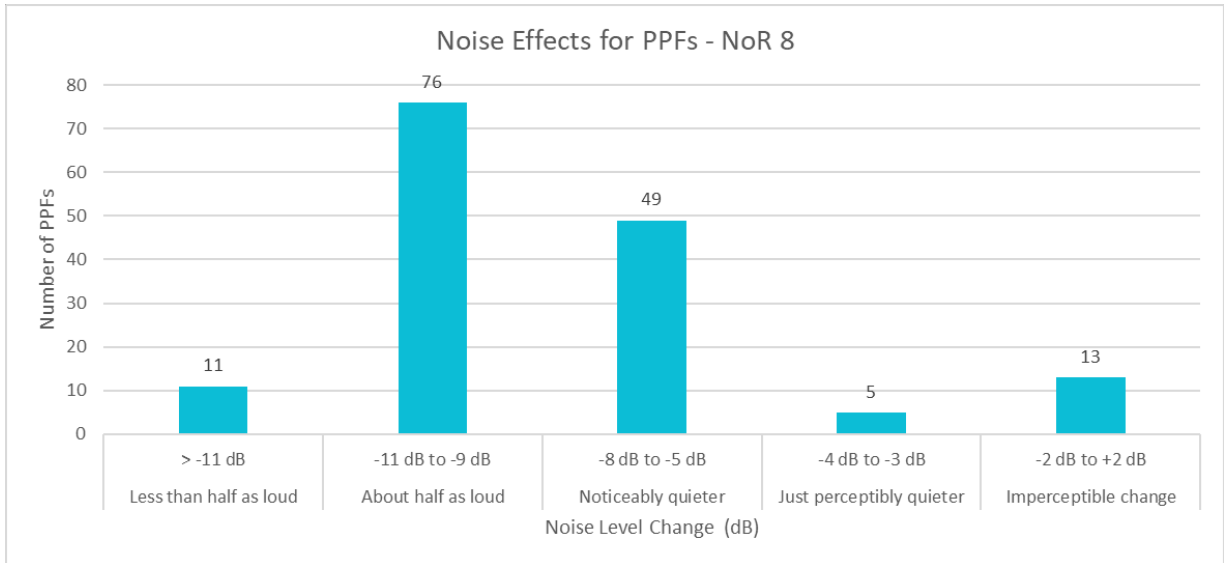


Figure 7-9 Change in noise level - NoR 8

7.8.3 Summary

PPFs near NoR 8 have been assessed against the Altered roads criteria under NZS 6806. All PPFs are predicted to receive noise levels in Category A in the Do Minimum scenario.

With other roads in the vicinity (including other NoRs of the North Projects) noise levels are predicted to remain similar or reduce at all PPFs.

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.

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

The proposed NoR 9 supports upgrades to Dairy Flat Highway between Dairy Flat and Albany, with AT being the requiring authority. NoR 9 will overlap with NoR 8 over some of its length. Design features for this NoR are summarised in Section 2.

7.9.1 NZS6806

NoR 9 has been assessed against the Altered road criteria (refer Section 3.1.2). As discussed, the assessment in accordance with NZS 6806 is undertaken based only on the Project roads, excluding local roads in the area.

A total of 90 PPFs have been assessed. The entirety of NoR 9 falls within the existing rural area (as defined by Stats NZ), meaning that PPFs within 200m of the road edges of the proposed new alignment were assessed.

Currently, all PPFs receive noise levels within Category A. The traffic volume in the Do-nothing scenario is proposed to increase significantly along Dairy Flat Road and some surrounding roads,

resulting in an average 4 decibel noise level increase for most PPFs, and therefore resulting in noise levels in less stringent noise criteria categories.

With the construction of the Project, and considering only Project roads without surrounding roads, all PPFs fall within Category A due to implementation of a low-noise road surface (asphaltic concrete) and redistributed road traffic throughout the surrounding proposed network. This means that the road does not meet the definition of an Altered Road under NZS 6806. Therefore, the Standard does not apply, and mitigation options do not need to be considered under the Standard.

Note that some PPFs may not exist anymore at the time of construction of the Project.

A summary of the results of the noise predictions is presented in Table 7-9.

Table 7-9: Summary of NZS 6806 assessment – NoR 9

Scenario	Number of PPFs NZS 6806 Categories		
	Category A	Category B	Category C
Existing	89	1	0
Do-nothing	73	13	4
Do-minimum	90	0	0

7.9.2 Change in noise level

Noise effects can be described based on the change in noise level with and without the Project by comparing the Do-nothing and the Do Minimum scenarios.

The North Projects overall will enable lower traffic flows compared to the Do-Nothing scenario along Dairy Flat Highway. Further noise reductions are brought about by lowering of the speed limit along Dairy Flat Highway and implementation of a low-noise road surface (asphaltic concrete).

Noise levels for all PPFs will remain similar or reduce at all PPFs.

Figure 7-10 shows the distribution of the noise level changes when comparing the Do-nothing and Do Minimum scenarios.

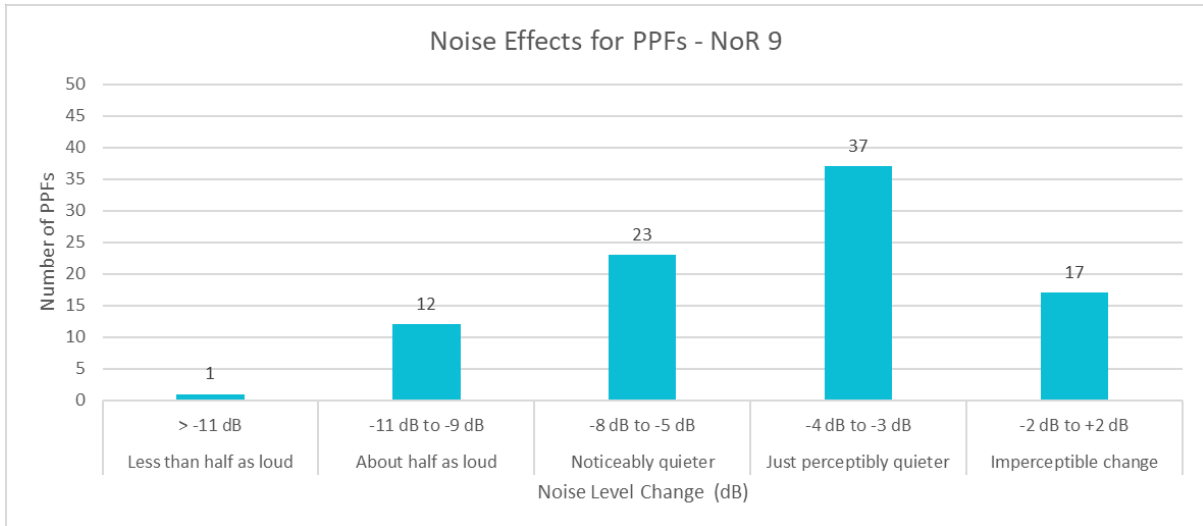


Figure 7-10 Change in noise level - NoR 9

7.9.3 Summary

PPFs near NoR 9 have been assessed against the Altered roads criteria under NZS 6806. All PPFs are predicted to receive noise levels in Category A in the Do Minimum scenario.

With other roads in the vicinity (including other NoRs of the North Projects) noise levels are predicted to remain similar or reduce at the vast majority of PPFs.

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

7.10 NoR 10 Upgrade to Wainui Road

The proposed NoR 10 supports upgrades to Wainui Road, with AT being the requiring authority. NoR 10 will overlap with NoR 6 at the intersection of Upper Orewa Road. Design features for this NoR are summarised in Section 2.

7.10.1 NZS6806

NoR 10 has been assessed against the Altered road criteria (refer Section 3.1.2). As discussed, the assessment in accordance with NZS 6806 is undertaken based only on the Project roads, excluding local roads in the area.

A total of 21 PPFs have been assessed. The majority of NoR 10 falls within the existing rural area (as defined by Stats NZ), meaning that PPFs within 200m of the road edges of the proposed new alignment were assessed. A small section of Wainui Road runs parallel to SH1, where the urban/rural boundary lies; there are some PPFs within 180m of this section along Millwater Parkway, however because they fall within the urban area, they do not fall within the 100m assessment area that is assessable under NZS 6806 and do not require further assessment.

Currently, almost all PPFs receive noise levels within Category A. This is due to low traffic flows along Wainui Road.

The traffic volumes in the Do-nothing scenario are proposed to increase significantly, resulting in an average 5 decibel noise level increase for most PPFs, and therefore resulting in noise levels in less stringent noise criteria categories.

With the construction of the Project, and considering only Project roads without surrounding roads, all PPFs fall within Category A due to implementation of a low-noise road surface (asphaltic concrete). This means that the road does not meet the definition of an Altered Road under NZS 6806. Therefore, the Standard does not apply, and mitigation options do not need to be considered under the Standard.

Note that some PPFs may not exist anymore at the time of construction of the Project, particularly considering the FUZ zoning along most of the length of this corridor.

A summary of the results of the noise predictions is presented in Table 7-10.

Table 7-10: Summary of NZS 6806 assessment – NoR 10

Scenario	Number of PPFs		
	NZS 6806 Categories		
	Category A	Category B	Category C
Existing	19	2	0
Do-nothing	16	1	4
Do-minimum	21	0	0

7.10.2 Change in noise level

Noise effects can be described based on the change in noise level with and without the Project by comparing the Do-nothing and the Do Minimum scenarios.

The North Projects overall will enable lower traffic flows compared to the Do-Nothing scenario along Wainui Road. Further noise reductions are brought about by lowering of the speed limit along Wainui Road and implementation of a low-noise road surface (asphaltic concrete).

Noise levels for all PPFs will remain similar or reduce at almost all PPFs.

Figure 7-11 shows the distribution of the noise level changes when comparing the Do-nothing and Do Minimum scenarios.

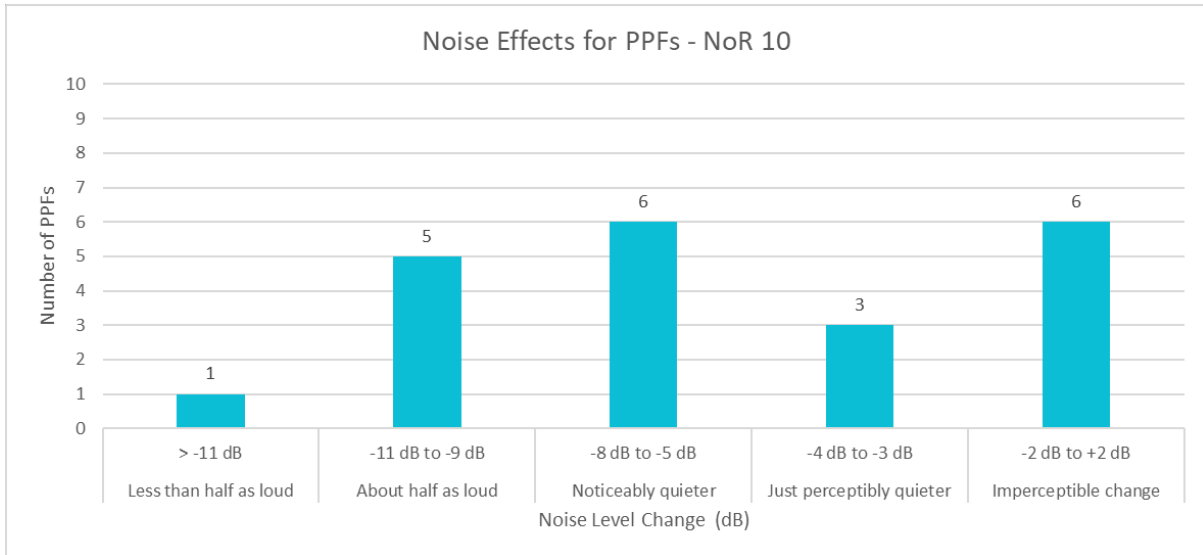


Figure 7-11 Change in noise level - NoR 10

7.10.3 Summary

PPFs near NoR 10 have been assessed against the Altered roads criteria under NZS 6806. All PPFs are predicted to receive noise levels in Category A in the Do Minimum scenario.

With other roads in the vicinity (including other NoRs of the North Projects) noise levels are predicted to remain similar or reduce at all PPFs.

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.

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

The proposed NoR 11 supports a proposed connection between Dairy Flat Highway and Wilks Road, with AT being the requiring authority. NoR 11 will overlap with NoR 1, NoR 4 and NoR 8 over some of its length. Design features for this NoR are summarised in Section 2.

7.11.1 NZS6806

The entirety of NoR 11 falls within the rural area (as defined by Stats NZ), meaning that PPFs within 200m of the road edges of the proposed new alignment were assessed.

NoR 11 traverses both greenfield and brownfield areas. Where NoR 11 is within 200m of existing roads, PPFs have been assessed against the Altered road criteria (refer Section 3.1.2). For parts of the alignment greater than 200m from existing roads, the PPFs have been assessed against the New road criteria. Figure 7-1 shows the PPFs assessed against the Altered (blue) and New (yellow) roads criteria within the assessment area for NoR 11 shown in red.



Figure 7-12: NoR11 showing PPFs assessed against New (yellow) and Altered (blue) road criteria

There are a total of 35 PPFs, of which 5 have been assessed against the New road criteria and 30 against the Altered road criteria

7.11.1.1 Altered Road

PPFs within 200m of existing roads have been assessed against the Altered roads criteria (refer Section 3.1.2). As discussed, the assessment in accordance with NZS 6806 is undertaken based only on the Project roads, excluding local roads in the area.

Currently, most PPFs receive noise levels within Category A. This is due to low traffic flows in the surrounding road network.

The traffic volume in the Do-nothing scenario is proposed to increase significantly, resulting in an average 5 decibel noise level increase for most PPFs.

With the construction of the Project, and considering only Project roads without surrounding roads, almost all PPFs fall within Category A. This is due to a number of factors including redistribution of traffic through the surrounding road network, reduction of speed limits around surrounding roads, and implementation of low-noise road surfaces (asphaltic concrete).

There are two PPFs (10 and 12 Kahikatea Flat Road) predicted to remain in Category B between the Do Nothing and Do Minimum scenarios, however the predicted noise level at each of these PPFs is the same between the two scenarios. Because the noise level did not increase by 3 dB or greater at these PPFs between the Do Nothing and Do Minimum scenarios, the road does not meet the definition of an Altered Road under NZS 6806. Therefore, the Standard does not apply, and mitigation options do not need to be considered under the Standard.

Note that some PPFs may not exist anymore at the time of construction of the Project, particularly considering the area is zoned FUZ and proposed as future industrial.

A summary of the results of the noise predictions is presented in Table 7-11.

Table 7-11: Summary of NZS 6806 assessment – NoR 11, Altered Roads

Scenario	Number of PPFs		
	NZS 6806 Categories		
	Category A	Category B	Category C
Existing	27	3	0
Do-nothing	18	8	4
Do-minimum	28	2	0

7.11.1.2 New Road

Where NoR 11 diverges from existing roads and traverses green field areas, the New road criteria have been used to assess noise levels. Here, the existing (from existing local roads) and Do-minimum scenarios (NoR 11 roads only) are compared.

Currently, all PPFs receive noise in Category A, with noise levels ranging from 45 to 50 dB $L_{Aeq(24h)}$.

In the Do Minimum scenario, noise levels are predicted to increase at most PPFs compared to the Existing scenario, however all PPFs are predicted to remain in Category A.

No mitigation for the New roads section of NoR 11 is required.

A summary of the results of the noise predictions is presented in Table 7-12.

Table 7-12: Summary of NZS 6806 assessment – NoR 11, New Roads

Scenario	Number of PPFs		
	NZS 6806 Categories		
	Category A	Category B	Category C
Existing	5	0	0
Do-minimum	5	0	0

7.11.2 Change in noise level

Noise effects can be described based on the change in noise level with and without the Project by comparing the Do-nothing and the Do Minimum scenarios.

The North Projects overall will enable lower traffic flows compared to the Do-Nothing scenario along surrounding existing roads such as Wilks Road, Dairy Flat Highway and Postman Road. Further noise reductions are brought about by lowering of the speed limit along surrounding roads and implementation of a low-noise road surface (asphaltic concrete).

Noise level increases are predicted at four of the New Roads PPFs. This is due to the introduction of a new noise source in the area (the new road). Noise levels for all PPFs will remain similar or reduce at all other PPFs.

Figure 7-13 and Figure 7-14 show the distribution of the noise level changes when comparing the Do-nothing and Do Minimum scenarios.

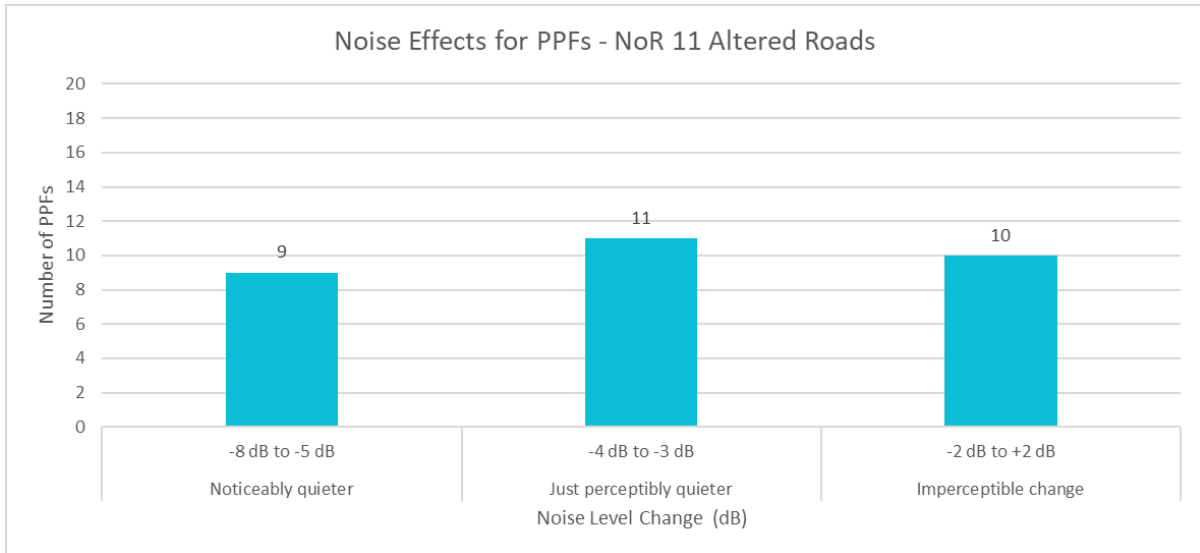


Figure 7-13 Change in noise level – NoR 11 Altered roads

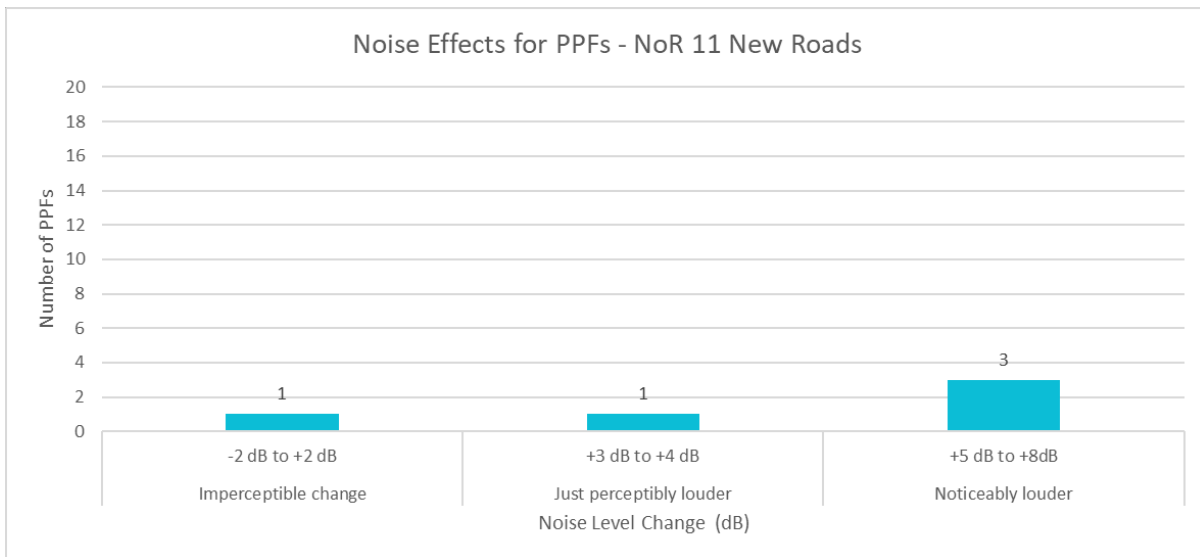


Figure 7-14 Change in noise level - NoR 11 New roads

7.11.3 Summary

PPFs near NoR 11 have been assessed against the New and Altered roads criteria under NZS 6806. The altered roads section does not meet the definition of an Altered Road under NZS 6806, therefore mitigation does not need to be considered further under the Standard. All PPFs in the New section of road meet the Category A noise criterion, therefore mitigation does not need to be considered further for the New road section under the standard.

With other roads in the vicinity (including other NoRs of the North Projects) noise levels are predicted to remain similar or reduce at almost all PPFs.

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

7.12 NoR 12 Upgrade and Extension to Bawden Road

The proposed NoR 12 supports upgrades and a proposed extension for Bawden Road, with AT being the requiring authority. NoR 12 will overlap with NoR 1, NoR 4, and NoR 8 over some of its length. Design features for this NoR are summarised in Section 2.

7.12.1 NZS6806

NoR 12 has been assessed against the Altered road criteria (refer Section 3.1.2). As discussed, the assessment in accordance with NZS 6806 is undertaken based only on the Project roads, excluding local roads in the area. There are some sections of NoR 12 that will traverse greenfield areas, however all PPFs under assessment are within 200m of existing roads, therefore no PPFs require assessment under the New roads criteria.

A total of 55 PPFs have been assessed. All of NoR 12 falls within the existing rural area (as defined by Stats NZ), meaning that PPFs within 200m of the road edges of the proposed new alignment were assessed.

Currently, all PPFs receive noise levels within Category A. This is due to low traffic flows along Bawden Road and the surrounding roads.

The traffic volumes in the Do-nothing scenario are proposed to increase significantly, resulting in an average 10 decibel noise level increase for most PPFs, and therefore resulting in noise levels in less stringent noise criteria categories.

With the construction of the Project, and considering only Project roads without surrounding roads, all PPFs fall within Category A due to implementation of a low-noise road surface (asphaltic concrete). This means that the road does not meet the definition of an Altered Road under NZS 6806. Therefore, the Standard does not apply, and mitigation options do not need to be considered under the Standard.

Note that some PPFs may not exist anymore at the time of construction of the Project.

A summary of the results of the noise predictions is presented in Table 7-13.

Table 7-13: Summary of NZS 6806 assessment – NoR 12

Scenario	Number of PPFs		
	NZS 6806 Categories		
	Category A	Category B	Category C
Existing	55	0	0
Do-nothing	47	7	1
Do-minimum	55	0	0

7.12.2 Change in noise level

Noise effects can be described based on the change in noise level with and without the Project by comparing the Do-nothing and the Do Minimum scenarios.

The North Projects overall will enable noise reductions through lowering of the speed limit along Bawden Road and implementation of a low-noise road surface (asphaltic concrete).

Noise levels for all PPFs will remain similar or reduce at all PPFs.

Figure 7-15 shows the distribution of the noise level changes when comparing the Do-nothing and Do Minimum scenarios.

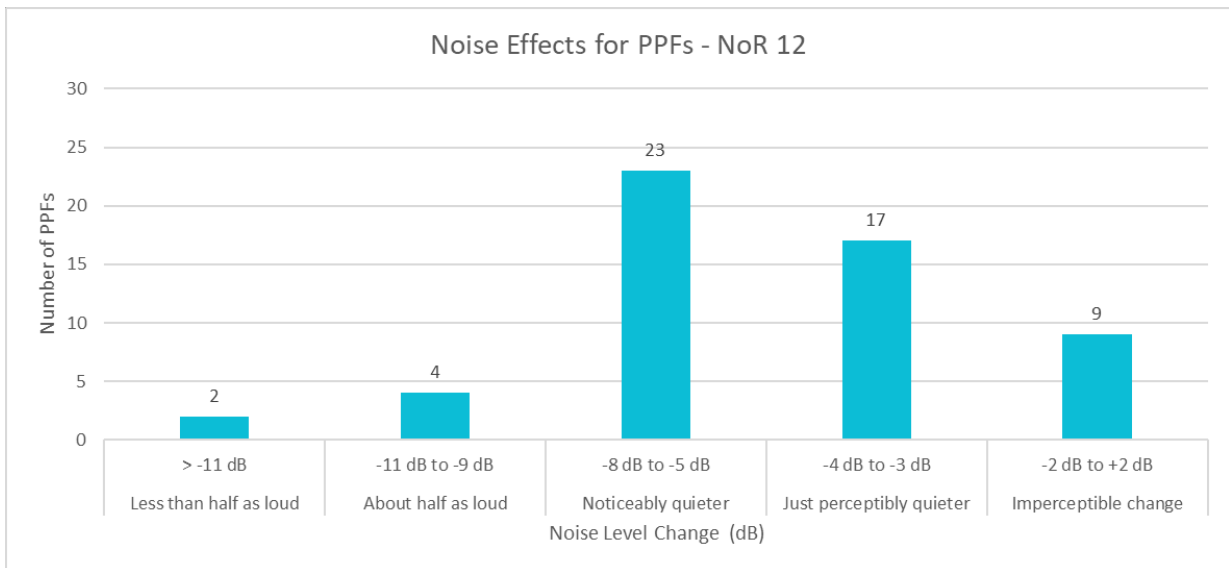


Figure 7-15 Change in noise level - NoR 12

7.12.3 Summary

PPFs near NoR 12 have been assessed against the Altered roads criteria under NZS 6806. All PPFs are predicted to receive noise levels in Category A in the Do Minimum scenario.

With other roads in the vicinity (including other NoRs of the North Projects) noise levels are predicted to remain similar or reduce at all PPFs.

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.

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

The proposed NoR 13 supports upgrades to East Coast Road between Silverdale and Ō Mahurangi Penlink (Redvale) Interchange with AT being the requiring authority. NoR 13 will overlap with NoR 4 and NoR 5 over some of its length. Design features for this NoR are summarised in Section 2.

7.13.1 NZS6806

NoR 13 has been assessed against the Altered road criteria (refer Section 3.1.2). As discussed, the assessment in accordance with NZS 6806 is undertaken based only on the Project roads, excluding local roads in the area.

A total of 132 PPFs have been assessed. The majority of NoR 13 falls within the rural area (as defined by Stats NZ), meaning that PPFs within 200m of the road edges of the proposed new alignment were assessed. The northern section of East Coast Road falls within the urban area. South of Auckland Memorial Park and south of 91 Small Road, the land changes to rural. Figure 7-16 shows the urban and rural areas, along with the assessment area used.

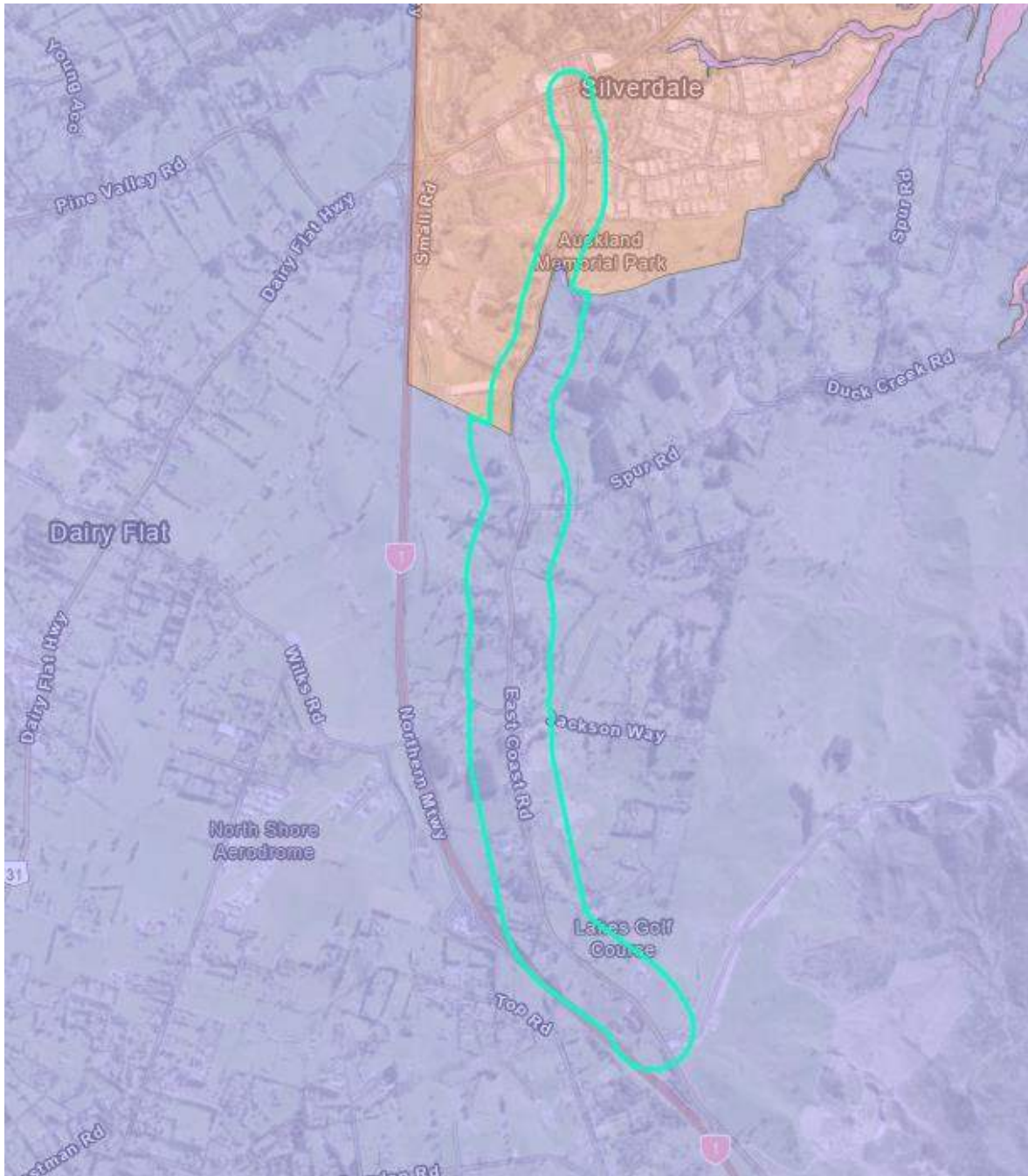


Figure 7-16 Urban and rural areas for NoR 13 assessment (orange - urban, purple - rural)

Currently, the majority of PPFs receive noise levels within Category A, with 20 PPFs receiving noise levels within Category B and 13 PPFs receiving noise levels within Category C. The traffic volume in the Do-nothing scenario is proposed to increase significantly along East Coast Road and some surrounding roads, resulting in an average 3 decibel noise level increase for most PPFs, and therefore resulting in noise levels in less stringent noise criteria categories at more PPFs.

With the construction of the Project, and considering only Project roads without surrounding roads, almost all PPFs fall within Category A due to implementation of a low-noise road surface (asphaltic concrete), speed limit reductions, and redistributed road traffic throughout the surrounding proposed network. 13 PPFs are predicted to remain in Category B. Because the noise level did not increase by 3 dB or greater at these PPFs between the Do Nothing and Do Minimum scenarios, the road does not

meet the definition of an Altered Road under NZS 6806. Therefore, the Standard does not apply, and mitigation options do not need to be considered under the Standard.

Note that some PPFs may not exist anymore at the time of construction of the Project, particularly along FUZ sections.

A summary of the results of the noise predictions is presented in Table 7-14.

Table 7-14: Summary of NZS 6806 assessment – NoR 13

Scenario	Number of PPFs		
	NZS 6806 Categories		
	Category A	Category B	Category C
Existing	99	20	13
Do-nothing	82	17	33
Do-minimum	119	13	0

7.13.2 Change in noise level

Noise effects can be described based on the change in noise level with and without the Project by comparing the Do-nothing and the Do Minimum scenarios.

The North Projects overall will enable lower traffic flows compared to the Do-Nothing scenario along East Coast Road. Further noise reductions are brought about by lowering of the speed limit along East Coast Road and implementation of a low-noise road surface (asphaltic concrete).

Noise levels for all PPFs will remain similar or reduce at almost all PPFs. Figure 7-17 shows the distribution of the noise level changes when comparing the Do-nothing and Do Minimum scenarios.

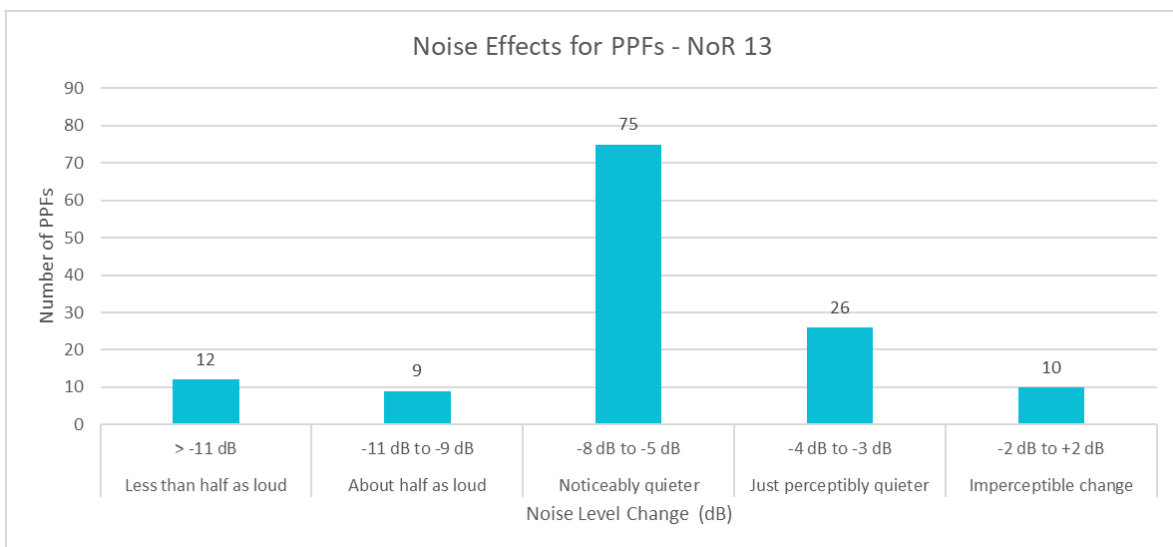


Figure 7-17 Change in noise level - NoR 13

7.13.3 Summary

PPFs near NoR 13 have been assessed against the Altered roads criteria under NZS 6806. The Project does not meet the definition of an Altered Road under NZS 6806; therefore mitigation does not need to be considered further under the Standard.

With other roads in the vicinity (including other NoRs of the North Projects) noise levels are predicted to remain similar or reduce at the vast majority of PPFs.

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.

7.14 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects – Summary for all NoRs

Of all NoRs assessed within the North Projects, only NoR 4 (SH1 Improvements) requires some mitigation in addition to the use of low noise road surface. For this NoR, the BPO mitigation option will be determined at the time of detailed design with focus on the small number of PPFs that would receive noise levels in Categories B or C.

All other NoRs cause either insufficient effects to require mitigation beyond the use of low noise road surface, or all PPFs receive noise levels within Category A.

8 Conclusion

We have assessed operational traffic noise for all NoRs within the North Projects. There are 13 NoRs: 10 roading projects involving new or altered roads (NoRs 4 to 13), one rapid transit corridor (assumed to facilitate electric buses) (NoR 1) and two stations (NoRs 2 and 3).

NoR 5 causes insignificant noise effects and have not been assessed further as they do not fall under the trigger levels of NZS 6806.

NoRs 2 and 3 (the stations) have been assessed against the underlying AUP:OP zone limits. The main noise source from stations is the PA system (and potentially other mechanical equipment), which can be designed to comply with the relevant limits, as well as the park and ride and kiss and ride facilities as relevant. People noise is not controlled by the AUP, cannot be controlled by the road controlling authority and has not been included in the assessment. Existing sensitive receivers are at a significant distance or well shielded for both stations, and we predict ready compliance including at night-time. Future intensification is proposed around the New Pine Valley East Station (NoR 3) and we have assessed noise levels at potential new dwellings also. Compliance is predicted in all instances.

The road traffic noise of NoRs 4 and 6 to 13 has been assessed against NZS 6806 and in relation to the change in noise level. None of the NoRs apart from NoR 4 require noise mitigation as all PPFs are predicted to receive noise levels in Category A. NoR 4 requires some mitigation beyond the use of low noise road surface. The BPO mitigation will be determined at the time of detailed design and may include barriers. While some noise level reduction can be achieved, and the vast majority of PPFs are predicted to receive noise levels in Category A, a small number would still receive noise levels within Category C (unchanged from a scenario if the Project is not implemented). These PPFs should be assessed for building modification mitigation at the time of construction if they still exist.

The rapid transit corridor in NoR 1 is assumed to be operate electric buses. We have assessed the noise against NZS 6806, with all PPFs predicted to receive noise levels in Category A.

Road traffic vibration is not normally an issue, particularly for newly constructed and well-maintained roads. Therefore, we have not further assessed it here.

Overall, the implementation of the suite of NoRs assessed in this report is predicted to result in a reduction in noise level across the majority of PPFs. While some PPFs are predicted to receive noise level increases (particularly in the vicinity of NoR 4), overall, with mitigation in place, noise levels at the vast majority of PPFs will be lower with the North Projects implemented than would have been the case without.

1 Appendix A: Noise survey

MP1 146 Pine Valley Road, Dairy Flat

Logger Measurements



Date: Tuesday, 2 May 2023
 File name:

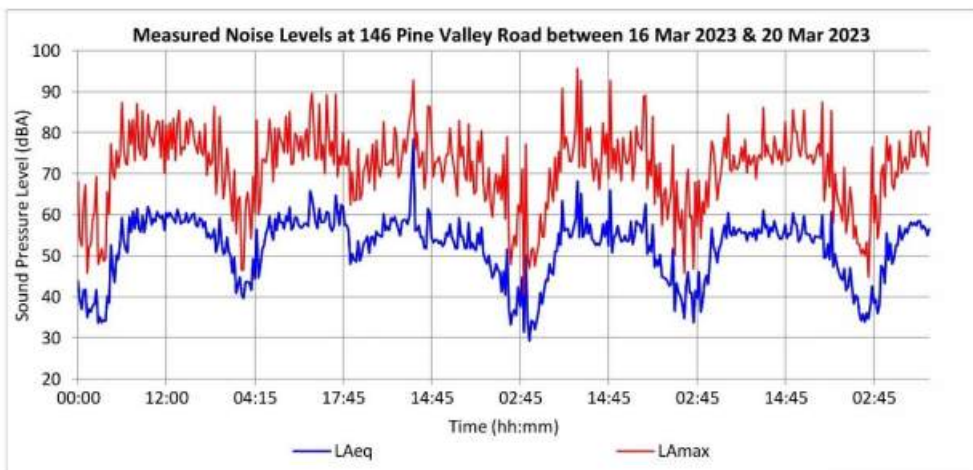
Job number: 20220733
 Job name: SGA North Strategic
 Initials: OL
 Measurement Dates: Thursday, 16 March 2023 to Monday, 20 March 2023
 Weather during Measurement: Rain happened for sometime during the measurement, affected data have been removed from the data set before the analysis
 Notes: L10 values have been logarithmically averaged

OVERVIEW SUMMARY SHEET

Noise Level, dB		L _{Aeq}	L _{A10}	L _{A90}	L _{Amax}
Day (0700-1800)	Lowest	39	38	31	47
	Average	59	62	46	75
	Highest	78	82	58	96
Evening (1800-2200)	Lowest	47	50	40	58
	Average	57	59	46	75
	Highest	66	70	54	90
Night (2200-0700)	Lowest	29	31	24	41
	Average	53	54	38	66
	Highest	65	65	55	89



L_{Aeq} 24-hr 58 dB



MP2 40 Top Road, Dairy Flat



Logger Measurements

Date: Tuesday, 2 May 2023
 File name:

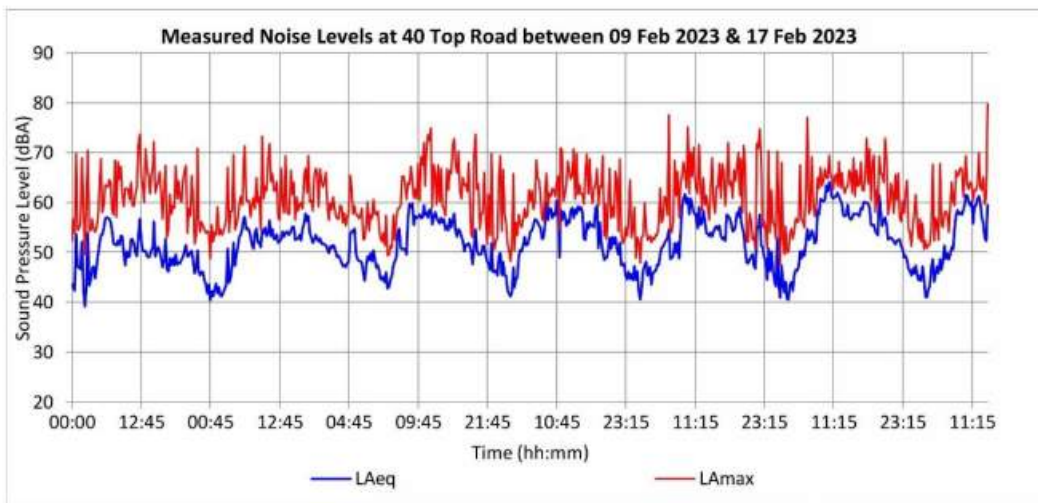
Job number: 20220733
 Job name: SGA North Strategic
 Initials: OL
 Measurement Dates: Thursday, 09 February 2023 to Friday, 17 February 2023
 Weather during Measurement: Rain and heavy wind happened for few days, affected data have been removed from the data set before the analysis
 Notes: L10 values have been logarithmically averaged

OVERVIEW SUMMARY SHEET

Noise Level, dB		L _{Aeq}	L _{A10}	L _{A90}	L _{Amax}
Day (0700-1800)	Lowest	46	48	42	53
	Average	55	57	51	63
	Highest	62	64	60	75
Evening (1800-2200)	Lowest	47	48	41	51
	Average	52	54	48	61
	Highest	59	65	58	74
Night (2200-0700)	Lowest	40	42	28	48
	Average	50	51	43	57
	Highest	58	58	55	78



L_{Aeq 24-hr} 53 dB



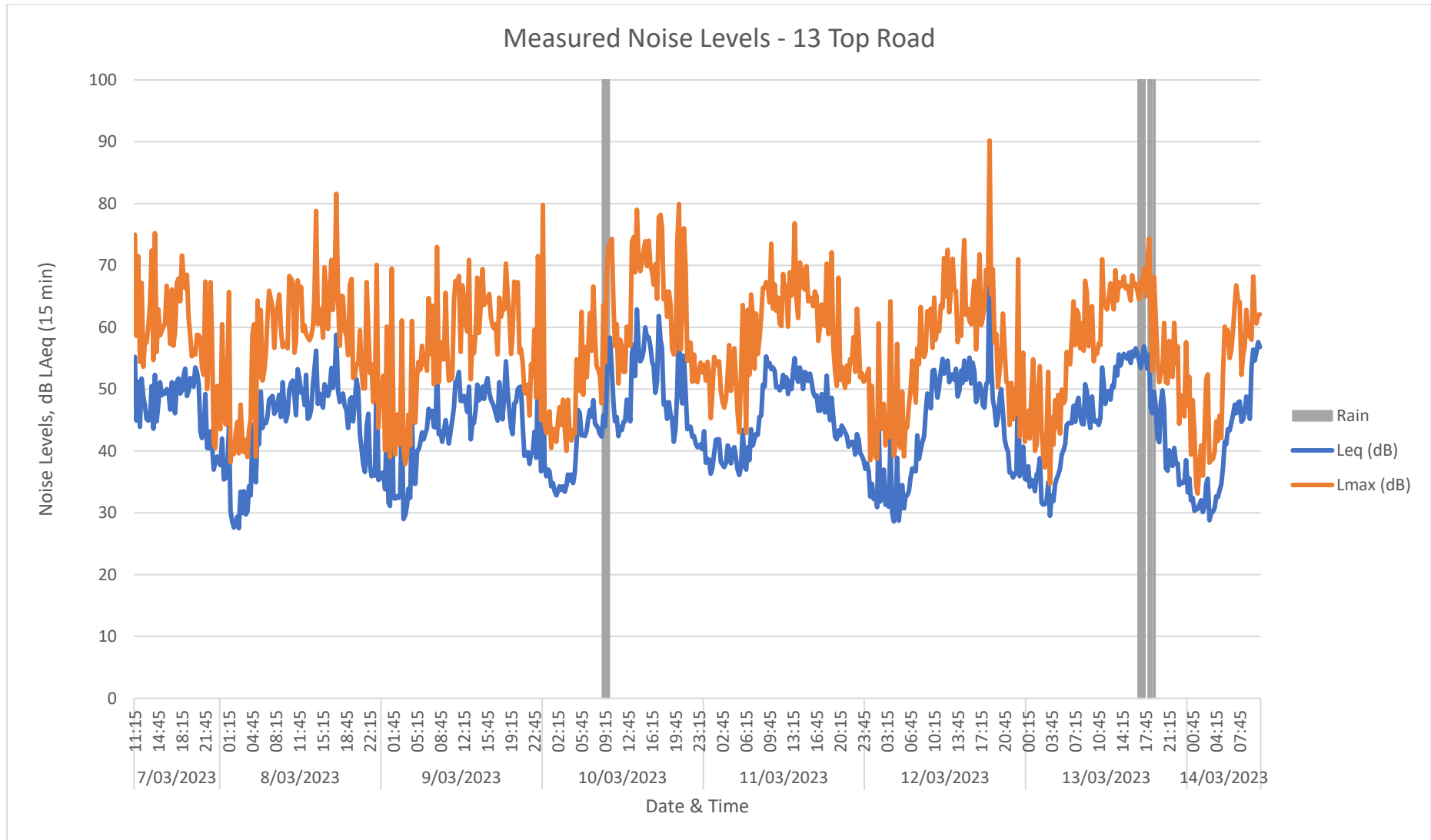
MP3 13 Top Road



NOISE MONITORING FORM	
Summary	
Project name	SGA
Project number	60558831
Date / time	07/03/23 10:30am
Engineer(s)	Niels Arnesen & Dhulkifl Ahmed
Address	13 Top Road
Location (NZTM2000)	1749590 X 5940332 Y
Equipment	
Manufacturer	01dB
Type	Cube
Serial number	10707
Date of last calibration	08/08/22
Calibration drift pre/post	
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	Bawden Rd, chicken coop ~20m away, planes/helicopters flying over from North Shore Airport, cicadas, driveway ~20m from logger.
Any special audible characteristics (tonality, impulsivity etc.) and comment on k_2 adjustment	No
Meteorological Conditions	
Wind speed and direction at microphone	2.1 m/s
Wind speed and direction at dominant source(s)	2.1 m/s
Precipitation	0 mm
Fog	N/A
Temperature	21.9 °c
Humidity	65 %
Percentage cloud cover	
Site Conditions	
Microphone height	1.5m
Distance to dominant noise source(s)	55m (Bawden Road)
Height of noise source(s)	Ground level
Distance from any reflective surfaces	8m from façade
Intervening topography	Small hill between logger and Bawden Road
Hard, mixed or soft ground	Soft
Barriers between source(s) and microphone	None
General comments and sketches	

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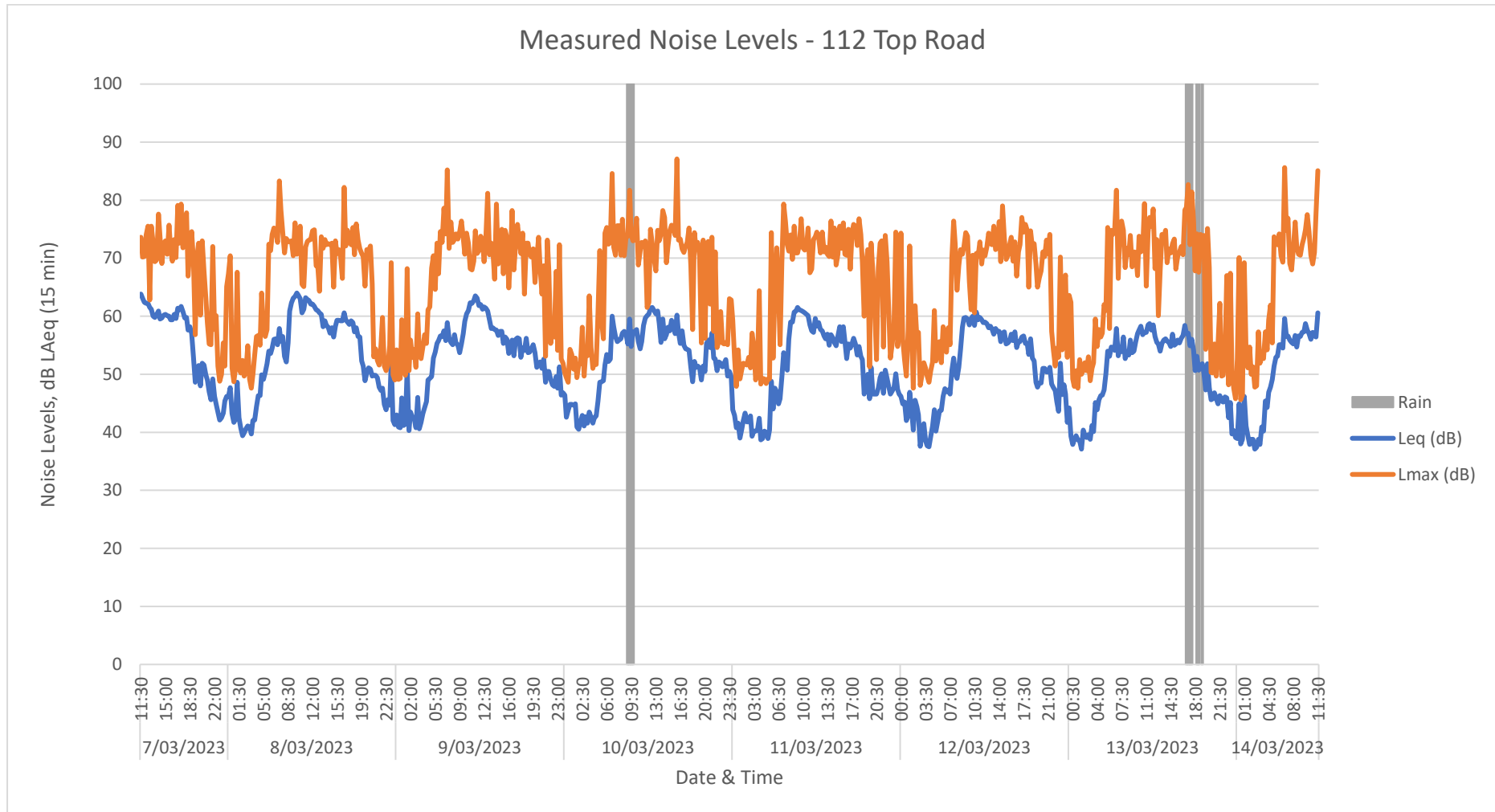
MP4 112 Top Road



NOISE MONITORING FORM	
Summary	
Project name	SGA
Project number	60558831
Date / time	07/03/23 11:30am
Engineer(s)	Niels Arnesen & Dhulkifl Ahmed
Address	112 Top Road
Location (NZTM2000)	1749175 X 5941160 Y
Equipment	
Manufacturer	Rion
Type	NL-52
Serial number	00898331
Date of last calibration	26/11/21
Calibration drift pre/post	
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	SH1, logger by property driveway, cicadas, foliage noise, planes flying over from North Shore Airport. Lots of construction materials were located at the property but no works were noted to be occurring
Any special audible characteristics (tonality, impulsivity etc.) and comment on k_2 adjustment	No
Meteorological Conditions	
Wind speed and direction at microphone	1.8 m/s
Wind speed and direction at dominant source(s)	1.8 m/s
Precipitation	0 mm
Fog	N/A
Temperature	23.2 °c
Humidity	56 %
Percentage cloud cover	30 %
Site Conditions	
Microphone height	1.5m
Distance to dominant noise source(s)	8m (Top Road), 175m (SH1)
Height of noise source(s)	Ground level
Distance from any reflective surfaces	18m from façade
Intervening topography	N/A
Hard, mixed or soft ground	Soft
Barriers between source(s) and microphone	House is between microphone at SH1
General comments and sketches	

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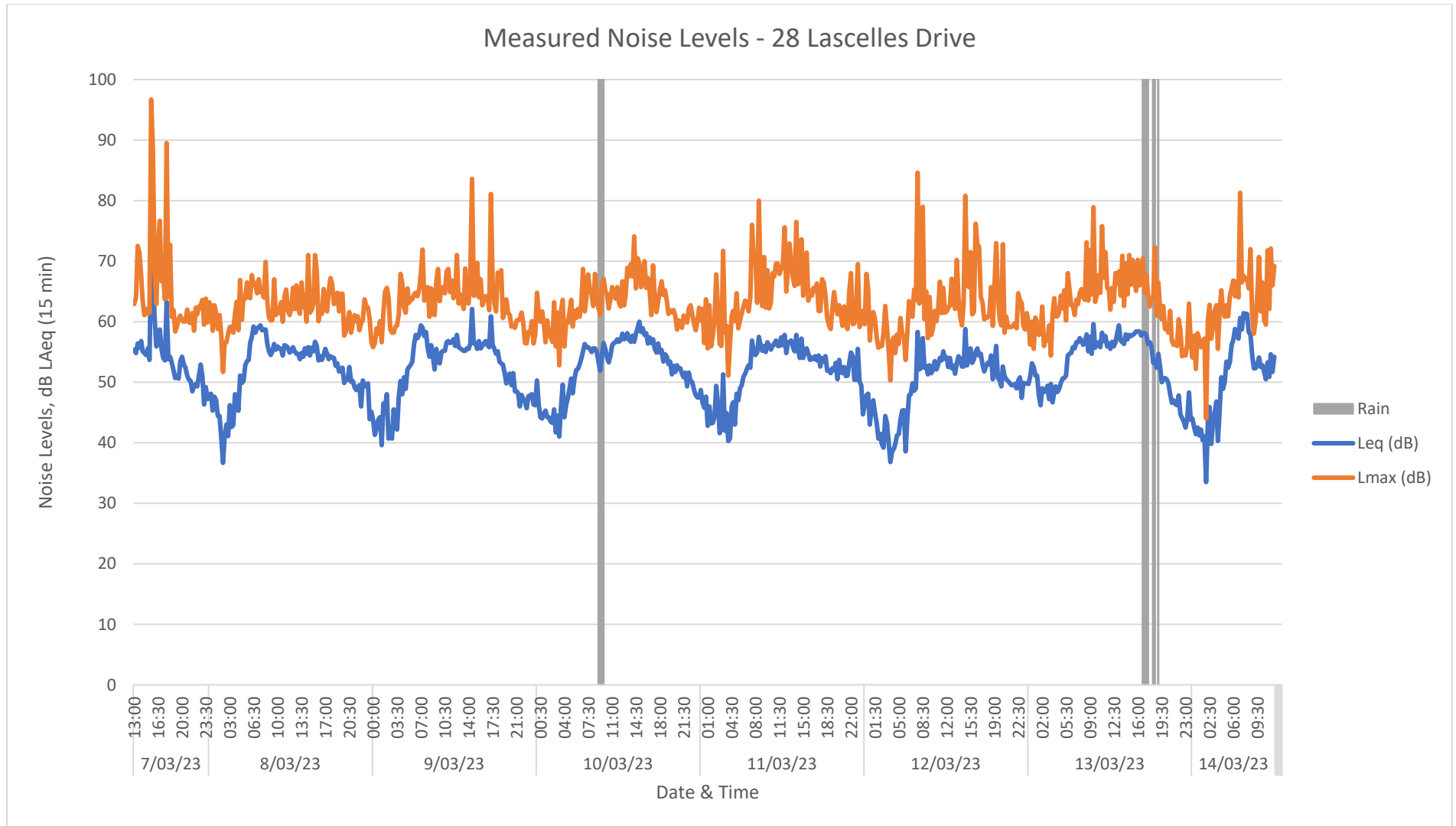
MP5 28 Lascelles Drive



NOISE MONITORING FORM	
Summary	
Project name	SGA
Project number	60558831
Date / time	07/03/23 12:40pm
Engineer(s)	Niels Arnesen & Dhulkifl Ahmed
Address	28 Lascelles Drive
Location (NZTM2000)	1749590 X 5940332 Y
Equipment	
Manufacturer	01dB
Type	Cube
Serial number	10836
Date of last calibration	11/08/21
Calibration drift pre/post	
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	Dairy Flat Highway, cow paddock with 2 cows next to logger, planes flying over from North Shore Airport, circular saw heard from 38 Lascelles Drive. Residents had a dog but it was indoors.
Any special audible characteristics (tonality, impulsivity etc.) and comment on k_2 adjustment	No
Meteorological Conditions	
Wind speed and direction at microphone	2.4 m/s
Wind speed and direction at dominant source(s)	2.4 m/s
Precipitation	0 mm
Fog	N/A
Temperature	23 °c
Humidity	56 %
Percentage cloud cover	30 %
Site Conditions	
Microphone height	1.5m
Distance to dominant noise source(s)	180m (Dairy Flat Hwy)
Height of noise source(s)	Ground level
Distance from any reflective surfaces	10m from façade
Intervening topography	N/A
Hard, mixed or soft ground	Soft
Barriers between source(s) and microphone	None between Dairy Flat Hwy, Lascelles Dr
General comments and sketches	

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2 Appendix B: Predicted Project noise levels for all PPFs

2.1 NoR 1

PPFs assessed against the New Road criteria

PPF Address NoR 1	Existing scenario	Do-minimum scenario
	dB L _{Aeq} (24h)	dB L _{Aeq} (24h)
66 Bawden Road	41.2	41.5
72 Bawden Road	40.4	40.2
72 Bawden Road	41.5	44
74 Bawden Road	44.6	43.8
77 Bawden Road	42.2	40.8
83 Bawden Road	45.9	43.5
99 Bawden Road	55	44.3
120 Bawden Road	41.9	43.2
124 Bawden Road	41.5	47.9
126 Bawden Road	41.6	40.4
136 Bawden Road	41.6	38.3
140 Bawden Road	41.6	40.7
174 Bawden Road	43	39.4
178 Bawden Road	43	34.6
396 Bawden Road	45	45.2
404 Bawden Road	43.8	36.5
408 Bawden Road	44.2	41.2
410 Bawden Road	54	44.6
421 Bawden Road	58.8	41.3
422 Bawden Road	54.2	44.2
224E Bawden Road	44.8	34.8
926 Dairy Flat Highway	38.8	35.9
928 Dairy Flat Highway	37.1	33.6
1248 Dairy Flat Highway	39.3	35.6
1252 Dairy Flat Highway	40.1	41.8

PPF Address NoR 1	Existing scenario	Do-minimum scenario
	dB L _{Aeq} (24h)	dB L _{Aeq} (24h)
1320 Dairy Flat Highway	42.1	50.9
1549 Dairy Flat Highway	51.2	45
1550 Dairy Flat Highway	57.6	44.4
1564 Dairy Flat Highway	56	41.5
1583 Dairy Flat Highway	46.1	45.6
1587 Dairy Flat Highway	45.2	44.2
1599 Dairy Flat Highway	46.1	53
1603 Dairy Flat Highway	43.6	46.8
1609 Dairy Flat Highway	46.3	41.7
1270A Dairy Flat Highway	40.3	44.6
1579A Dairy Flat Highway	48.7	42.2
33 Dairy Stream Road	43.9	44.5
47 Dairy Stream Road	41.7	41.3
52 Dairy Stream Road	43.1	41.6
16 Follies Way	38.6	44.5
143 Goodland Drive	41	47
146 Goodland Drive	41.6	47.2
9 Grace Hill Drive	40.8	39.3
42 Grace Hill Drive	39.4	36.1
62 Grace Hill Drive	38.5	35
93 Grace Hill Drive	42.5	33.6
45 Kingscliff Rise	37.5	33.2
50 Kingscliff Rise	38.4	37.7
4 Lascelles Drive	52	37.2
11 Lascelles Drive	50.9	37
17 Lascelles Drive	48.7	42.2
27 Lascelles Drive	45.2	36.8
43 Lascelles Drive	44.4	37.4
43 Lascelles Drive	44.2	37
65 Lascelles Drive	44.1	35.9
89 Lascelles Drive	43.5	41.3

PPF Address NoR 1	Existing scenario	Do-minimum scenario
	dB L _{Aeq} (24h)	dB L _{Aeq} (24h)
10 Old Pine Valley Road	54.8	43.9
37 Old Pine Valley Road	43	40.8
90 Old Pine Valley Road	46.6	46.3
165 Pine Valley Road	43.3	40.9
165 Pine Valley Road	43.6	43.8
175 Pine Valley Road	42.5	38.8
189 Pine Valley Road	42.4	38.1
207 Pine Valley Road	43.1	40.8
227 Pine Valley Road	42.8	38.8
227 Pine Valley Road	42.8	38.7
66 Postman Road	38.8	38.4
77 Postman Road	39.3	35.4
81 Postman Road	41.6	40.2
87 Postman Road	40.2	44.5
99 Postman Road	52.4	38.4
131 Postman Road	43.2	38.5
143 Postman Road	41.3	43.3
147 Postman Road	41.6	43.3
149 Postman Road	40.7	46.7
177 Postman Road	41.3	41.6
207 Postman Road	43	40.4
295 Postman Road	44.6	43.3
313 Postman Road	44.8	43.9
315 Postman Road	44.8	37.8
327 Postman Road	45.7	42.3
349 Postman Road	48	35
349 Postman Road	47.8	35.3
143A Postman Road	40.2	45.7
29 Wilks Road	57	43.2
29 Wilks Road	60.2	46.3
30 Wilks Road	59.2	40.4

PPF Address NoR 1	Existing scenario	Do-minimum scenario
	dB L _{Aeq(24h)}	dB L _{Aeq(24h)}
58 Wilks Road	51.8	42.6
82 Wilks Road	49	41.4
90 Wilks Road	48.6	43.5
44A Wilks Road	45.2	44.1
9A Wilks Road	52.5	45.7
4 Wilson Road	52.9	47.5
7 Wilson Road	60.4	45.6
40 Wilson Road	51	40.3
41 Wilson Road	58.2	43.8

PPFs assessed against the Altered Road criteria

PPF Address NoR 1	Existing scenario	Do-nothing scenario	Do-minimum scenario
	dB L _{Aeq(24h)}	dB L _{Aeq(24h)}	dB L _{Aeq(24h)}
71 Ahutoetoe Road	58.1	60.9	30
73 Ahutoetoe Road	58	60.8	32.4
75 Ahutoetoe Road	57.9	60.7	36.6
77 Ahutoetoe Road	57.8	60.6	38.9
79 Ahutoetoe Road	58.2	61	40.5
81 Ahutoetoe Road	57.7	60.5	40.2
83 Ahutoetoe Road	57.1	59.9	39.5
85 Ahutoetoe Road	53.1	55.9	35.7
87 Ahutoetoe Road	56.6	59.4	39
89 Ahutoetoe Road	56.6	59.4	37.7
91 Ahutoetoe Road	52.3	55.1	34.7
92 Ahutoetoe Road	51.5	54.3	33.6
93 Ahutoetoe Road	55.6	58.4	37.8
94 Ahutoetoe Road	52.2	55	33.9
95 Ahutoetoe Road	52	54.7	35.8
96 Ahutoetoe Road	53	55.8	34
100 Ahutoetoe Road	56.5	59.2	35.8

PPF Address NoR 1	Existing scenario dB L _{Aeq(24h)}	Do-nothing scenario dB L _{Aeq(24h)}	Do-minimum scenario dB L _{Aeq(24h)}
102 Ahutoetoe Road	56.5	59.3	36.5
106 Ahutoetoe Road	52.1	54.9	41.1
108 Ahutoetoe Road	49.8	52.6	41.4
91A Ahutoetoe Road	51.1	53.9	35.2
92A Ahutoetoe Road	51.7	54.4	33.2
5 Ash Avenue	49.3	52.7	43.4
1 Carthey Road	54.4	57.2	33.4
24 Cherry Hill	49.8	53.5	40.4
28 Dahlia Drive	50.4	54.4	40.5
29 Dahlia Drive	51.3	55.2	41.4
34 Dahlia Drive	50.9	54.2	40.3
35 Dahlia Drive	53.7	57.3	41
1172 East Coast Road	61.6	64.2	44.8
1226 East Coast Road	56.2	58.8	41.6
1262 East Coast Road	64.7	67.3	46.6
1370 East Coast Road	57.2	59.8	38
1373 East Coast Road	59.9	62.6	39.8
1384 East Coast Road	62.3	64.9	40.3
1384 East Coast Road	63.8	66.5	41.7
1401 East Coast Road	61.1	63.7	40.3
1413 East Coast Road	60.4	63	37.4
1425 East Coast Road	58.8	61.4	38.8
1451 East Coast Road	60.6	63.2	39.5
1471 East Coast Road	64	66.7	42.9
1513 East Coast Road	64.1	66.7	43.1
38 Elm Haven	52.3	55.6	39.1
39 Elm Haven	53.7	57.4	40.9
43 Elm Haven	52.4	55.5	40.3
44 Elm Haven	55	58.4	41.9
48 Fuschia Lane	54.5	57.4	40.8
49 Fuschia Lane	56	59.1	43.5
53 Fuschia Lane	54	56.7	41.9

PPF Address NoR 1	Existing scenario dB L _{Aeq(24h)}	Do-nothing scenario dB L _{Aeq(24h)}	Do-minimum scenario dB L _{Aeq(24h)}
54 Fuschia Lane	54.2	57.1	42.8
55 Fuschia Lane	56.2	59.1	42.8
57 Gardenia Grove	52.8	55.5	39.3
59 Gardenia Grove	53.7	56.7	41.2
60 Gardenia Grove	54.6	57.6	42.7
61 Gardenia Grove	56.4	59.1	41.4
11 Haigh Access Road	59.2	61.8	38.2
11 Haigh Access Road	56.7	59.3	37.1
63 Hibiscus Crescent	54.7	57.2	36.9
64 Hibiscus Crescent	57.1	59.7	39
65 Hibiscus Crescent	56.5	59.1	38.7
66 Hibiscus Crescent	56.5	58.9	37.1
67 Hibiscus Crescent	55.5	58.1	38
68 Hibiscus Crescent	56	58.6	37.3
69 Hibiscus Crescent	55.3	58	37
81 Iris Watch	48.9	52.5	42
81 Iris Watch	49.5	53.4	42.9
1 John Fair Drive	56.9	59.7	38.4
5 Kewa Road	66.2	68.9	48.7
9 Kewa Road	63.1	65.7	46
15 Kewa Road	65.3	68	48.9
21 Kewa Road	65	67.7	48.6
21 Kewa Road	64.8	67.4	48.3
25 Kewa Road	70.7	73.4	55.5
29 Kewa Road	64	66.6	47.6
31 Kewa Road	65.1	67.8	49.3
33 Kewa Road	66.1	68.8	50.4
35 Kewa Road	67.7	70.4	52.4
37 Kewa Road	67.4	70.1	52.3
39 Kewa Road	67.4	70.1	52.9
42 Kewa Road	57.4	60.1	40.3
44 Kewa Road	54.6	57.2	37.3

PPF Address NoR 1	Existing scenario dB L _{Aeq(24h)}	Do-nothing scenario dB L _{Aeq(24h)}	Do-minimum scenario dB L _{Aeq(24h)}
45 Kewa Road	49	51.7	33.8
46 Kewa Road	53	55.7	35.7
47 Kewa Road	47.9	50.8	33.9
49 Kewa Road	47.4	50.4	35.9
61 Kewa Road	39.2	43	44.6
120 Kewa Road	40.7	44.5	47.5
122 Kewa Road	43	46.8	49.4
124 Kewa Road	42.7	46.4	49.4
126 Kewa Road	41.2	45	47.5
128 Kewa Road	39.7	43.6	44.9
162 Lonely Track Road	61.7	64.3	45.2
190 Lonely Track Road	55.3	58	42.8
196 Lonely Track Road	58.2	60.8	41.4
190D Lonely Track Road	62.1	64.8	44.5
1 Paikea Street	56	58.6	40.1
2 Paikea Street	51.6	54.3	35.2
3 Paikea Street	67.8	70.5	54
4 Paikea Street	49.5	52.3	36.6
5 Paikea Street	67.5	70.3	53.9
6 Paikea Street	48.5	51.4	35.2
7 Paikea Street	66.7	69.6	53.4
8 Paikea Street	47.9	51	38.6
9 Paikea Street	66.6	69.5	53.7
10 Paikea Street	46.8	50.6	40.1
11 Paikea Street	65.3	68.4	52.9
12 Paikea Street	45	49.1	41.1
13 Paikea Street	63.9	67.1	51.9
14 Paikea Street	42.5	46	40.5
15 Paikea Street	63.9	67.2	52.2
16 Paikea Street	40.7	44.6	40.7
17 Paikea Street	62.7	66.1	51.7
19 Paikea Street	58.8	62.7	49.5

PPF Address NoR 1	Existing scenario dB L _{Aeq(24h)}	Do-nothing scenario dB L _{Aeq(24h)}	Do-minimum scenario dB L _{Aeq(24h)}
21 Paikea Street	53.1	57.3	46.9
23 Paikea Street	50.3	54.4	46.3
25 Paikea Street	43.7	48.4	43.8
27 Paikea Street	44	47.8	46.5
29 Paikea Street	37.2	41.3	41.9
37 Pampas Drive	54.8	57.5	32
38 Pampas Drive	57.8	60.6	29.9
61A Rautahi Terrace	57.2	59.9	38.6
23 Redvale Rise	58.8	61.4	43.2
27 Redvale Rise	59.1	61.7	42.3
1 Siren Street	54.2	57	34.3
3 Snowden Road	53.3	56.1	33
8 Wright Road	58.9	61.5	42.1
8 Wright Road	56.6	59.3	39.5
39 Wright Road	69.5	72.1	51.6
46 Wright Road	57.6	60.2	40.1
46 Wright Road	53.5	56.2	36.3
46 Wright Road	55.9	58.5	38.4
51 Wright Road	62.2	64.8	44.2
51 Wright Road	60	62.7	42.1
75 Wright Road	61.9	64.6	44.1
71A Wright Road	63.9	66.6	46.5

2.2 NoR 4

	Existing scenario	Do-nothing scenario	Do-minimum scenario	Mitigation Option 3: EPA7 + barriers
PPF Address NoR 4	dB L _{Aeq} (24h)	dB L _{Aeq} (24h)	dB L _{Aeq} (24h)	dB L _{Aeq} (24h)
10 Aeropark Drive	55.3	58.9	58.9	57.4
12 Aeropark Drive	56.9	60.2	60.8	59.3
14 Aeropark Drive	56.8	59.9	61.1	59.5
16 Aeropark Drive	58	60.8	62.9	61.3
22 Aeropark Drive	57.2	59.9	61.6	60
2 Aileron Rise	59.5	65.9	61.9	60.6
4 Aileron Rise	55.6	59.1	59.3	57.8
5 Aileron Rise	55	58.5	58.4	56.9
8 Aileron Rise	54.1	58.4	57.4	55.9
9 Aileron Rise	54.9	57.9	58.9	57.3
421 Bawden Road	58.8	61.5	62.7	61.2
23 Cherry Hill	46.1	50.4	51.5	50.4
24 Cherry Hill	49.8	53.5	54.6	53.5
28 Dahlia Drive	50.4	54.4	55.7	54.6
29 Dahlia Drive	51.3	55.2	56.6	55.6
32 Dahlia Drive	48.6	51.9	53.2	52.1
33 Dahlia Drive	49.7	53.2	54.6	53.6
34 Dahlia Drive	50.9	54.2	55.5	54.5
35 Dahlia Drive	53.7	57.3	58.7	57.6
1732 Dairy Flat Highway	56.4	59.2	59	57.4
1170 East Coast Road	60.1	62.7	65.5	63.4
1172 East Coast Road	61.6	64.2	67.8	65.1
1180 East Coast Road	56.5	59.1	64.4	61.7
1226 East Coast Road	56.2	58.8	66.3	62.5
1242 East Coast Road	61.4	64.1	66.7	64.8
1250 East Coast Road	60.1	62.7	64.8	63
1258 East Coast Road	60.5	63.1	65.8	64.1
1262 East Coast Road	64.7	67.3	70.3	68.7
1370 East Coast Road	57.2	59.8	61.7	60.2
1373 East Coast Road	59.9	62.6	63.4	62

	Existing scenario	Do-nothing scenario	Do-minimum scenario	Mitigation Option 3: EPA7 + barriers
PPF Address NoR 4	dB L _{Aeq(24h)}	dB L _{Aeq(24h)}	dB L _{Aeq(24h)}	dB L _{Aeq(24h)}
1384 East Coast Road	62.3	64.9	64.1	62.6
1384 East Coast Road	63.8	66.5	66	64.5
1401 East Coast Road	61.1	63.7	63.6	62.1
1413 East Coast Road	60.4	63	61.8	60.3
1425 East Coast Road	58.8	61.4	63	61.5
1451 East Coast Road	60.6	63.2	63.9	62.3
1469 East Coast Road	61.6	64.2	65.3	63.3
1471 East Coast Road	64	66.7	67.3	64.7
1473 East Coast Road	60.4	63	64.1	62
1513 East Coast Road	64.1	66.7	67.7	64.9
1726 East Coast Road	62.3	65	65.4	63.8
1726 East Coast Road	61.2	64.1	63	61.4
1726 East Coast Road	60.3	63.1	61.5	59.7
1746 East Coast Road	60.8	63.4	64	62.4
1778 East Coast Road	60.4	63.1	64.2	62.6
1870 East Coast Road	57.6	60.9	61.2	59.6
1871 East Coast Road	54.4	59.1	55.5	54
1872 East Coast Road	57.6	62	61.5	59.7
1910 East Coast Road	59	65	57.7	56.2
1780A East Coast Road	61.7	64.3	65.5	63.9
36 Elm Haven	51.3	54.4	55.7	54.6
37 Elm Haven	50.9	53.8	55.4	54.4
38 Elm Haven	52.3	55.6	57.1	56.1
39 Elm Haven	53.7	57.4	59.1	58
40 Elm Haven	51	54.1	55.4	54.4
41 Elm Haven	50.4	53.2	54.6	53.6
43 Elm Haven	52.4	55.5	57.4	56.4
44 Elm Haven	55	58.4	60.9	59.9
46 Fuschia Lane	53.3	56.1	57.6	56.5
47 Fuschia Lane	52.1	54.9	56.6	55.5
48 Fuschia Lane	54.5	57.4	59.8	58.8

	Existing scenario	Do-nothing scenario	Do-minimum scenario	Mitigation Option 3: EPA7 + barriers
PPF Address NoR 4	dB L _{Aeq(24h)}	dB L _{Aeq(24h)}	dB L _{Aeq(24h)}	dB L _{Aeq(24h)}
49 Fuschia Lane	56	59.1	62.7	61.7
50 Fuschia Lane	52	54.7	56.4	55.4
51 Fuschia Lane	52.6	55.3	56.8	55.9
52 Fuschia Lane	52.8	55.5	57.1	56.1
53 Fuschia Lane	54	56.7	59.3	58.2
54 Fuschia Lane	54.2	57.1	60.2	59.2
55 Fuschia Lane	56.2	59.1	62	61
56 Gardenia Grove	53.9	56.6	57.8	56.7
57 Gardenia Grove	52.8	55.5	57	56.2
59 Gardenia Grove	53.7	56.7	59.5	58.3
60 Gardenia Grove	54.6	57.6	60.4	59.4
61 Gardenia Grove	56.4	59.1	60.8	59.7
11 Haigh Access Road	59.2	61.8	61.9	60.4
11 Haigh Access Road	56.7	59.3	60.4	58.9
20 Haigh Access Road	58.5	61.1	61.5	60
23 Haigh Access Road	60.3	62.9	63.9	62.3
62 Hibiscus Crescent	55.6	58.2	59.4	58.3
63 Hibiscus Crescent	54.7	57.2	58.5	57.3
64 Hibiscus Crescent	57.1	59.7	61	59.8
65 Hibiscus Crescent	56.5	59.1	59.5	58.5
66 Hibiscus Crescent	56.5	58.9	59.2	58
67 Hibiscus Crescent	55.5	58.1	59.4	58.2
68 Hibiscus Crescent	56	58.6	59.7	58.5
69 Hibiscus Crescent	55.3	58	58.5	57.3
70 Hibiscus Crescent	56.4	59	59	57.9
71 Hibiscus Crescent	55.9	58.6	57.9	56.7
8 Jackson Way	61.1	65.2	57.3	55.9
30 Jackson Way	54	59.6	51.9	50.4
5 Kewa Road	66.2	68.9	69.7	67.9
9 Kewa Road	63.1	65.7	67	64.1
15 Kewa Road	65.3	68	68.9	65.4

	Existing scenario	Do-nothing scenario	Do-minimum scenario	Mitigation Option 3: EPA7 + barriers
PPF Address NoR 4	dB L _{Aeq(24h)}	dB L _{Aeq(24h)}	dB L _{Aeq(24h)}	dB L _{Aeq(24h)}
21 Kewa Road	65	67.7	69	66.4
21 Kewa Road	64.8	67.4	68.6	65.8
25 Kewa Road	70.7	73.4	73.5	70.2
29 Kewa Road	64	66.6	67.2	63.3
31 Kewa Road	65.1	67.8	68.2	63.6
33 Kewa Road	66.1	68.8	69.4	65.2
35 Kewa Road	67.7	70.4	71.4	68.4
37 Kewa Road	67.4	70.1	71.1	68
39 Kewa Road	67.4	70.1	71.2	68
42 Kewa Road	57.4	60.1	61.7	59.5
162 Lonely Track Road	61.7	64.3	67.7	66.2
190 Lonely Track Road	55.3	58	57.2	55.7
196 Lonely Track Road	58.2	60.8	62	60.6
190D Lonely Track Road	62.1	64.8	65.8	64.3
1 Paikea Street	56	58.6	59.9	57.2
2 Paikea Street	51.6	54.3	55.2	53.6
3 Paikea Street	67.8	70.5	71.7	69
4 Paikea Street	49.5	52.3	53.6	52
5 Paikea Street	67.5	70.3	71.5	69.3
6 Paikea Street	48.5	51.4	52.8	51.3
7 Paikea Street	66.7	69.6	70.9	68.3
8 Paikea Street	47.9	51	52	50.5
9 Paikea Street	66.6	69.5	70.8	67.9
11 Paikea Street	65.3	68.4	69.8	66.5
13 Paikea Street	63.9	67.1	68.5	64.6
15 Paikea Street	63.9	67.2	68.5	65
17 Paikea Street	62.7	66.1	67.5	64
19 Paikea Street	58.8	62.7	64.2	60.4
21 Paikea Street	53.1	57.3	58.4	55.3
23 Paikea Street	50.3	54.4	55.4	52.7
25 Paikea Street	43.7	48.4	49.4	47.7

	Existing scenario	Do-nothing scenario	Do-minimum scenario	Mitigation Option 3: EPA7 + barriers
PPF Address NoR 4	dB L _{Aeq(24h)}	dB L _{Aeq(24h)}	dB L _{Aeq(24h)}	dB L _{Aeq(24h)}
23 Redvale Rise	58.8	61.4	62.5	61
27 Redvale Rise	59.1	61.7	63	61.5
11 Stubbs Place	60.4	62.9	60.3	59
1 Throttle Close	56.7	59.8	60.4	58.9
2 Throttle Close	57.1	60.2	60.5	59
6 Throttle Close	57.9	61	61.7	60.2
10 Throttle Close	55	57.8	58.9	57.4
13 Throttle Close	55.8	58.8	59.8	58.2
14 Throttle Close	54.7	57.5	58.8	57.2
34 Top Road	56.5	59.6	59.3	57.5
40 Top Road	57.8	60.7	60.9	58.9
46 Top Road	60.8	63.6	64	62.3
48 Top Road	59.4	62.2	62.9	60.9
60 Top Road	58.2	61	61.5	59.7
64 Top Road	60	62.7	63.5	61.8
64 Top Road	61.4	64.1	65.1	63.4
65 Top Road	58.6	61.3	61.8	60.2
75 Top Road	58.5	61.2	62.4	60.6
95 Top Road	57	59.7	61	59.3
106 Top Road	64.5	67.2	69	67.5
109 Top Road	57.6	60.3	62	60.2
109 Top Road	56.4	59.2	61.2	59.5
112 Top Road	58.2	60.9	62.6	61
174 Wilks Road	53.9	57.1	56.8	55.2
235 Wilks Road	61.1	66.4	63.2	61.7
243 Wilks Road	63	72.6	60.2	58.7
251 Wilks Road	58.9	67	60.1	58.5
7 Wilson Road	60.4	63.1	64.5	63
29 Wilks Road	57	59.7	60.1	58.6
29 Wilks Road	60.2	62.8	63.7	62.3
8 Wright Road	58.9	61.5	62.8	61.3

	Existing scenario	Do-nothing scenario	Do-minimum scenario	Mitigation Option 3: EPA7 + barriers
PPF Address NoR 4	dB L _{Aeq(24h)}	dB L _{Aeq(24h)}	dB L _{Aeq(24h)}	dB L _{Aeq(24h)}
8 Wright Road	56.6	59.3	60.7	59.2
46 Wright Road	57.6	60.2	61.5	60
46 Wright Road	53.5	56.2	57.4	55.9
46 Wright Road	55.9	58.5	59.7	58.2
51 Wright Road	62.2	64.8	66	64.5
51 Wright Road	60	62.7	63.7	62.2
71A Wright Road	63.9	66.6	66.3	64.8

2.3 NoR 6

PPF Address NoR 6	Existing scenario dB L _{Aeq(24h)}	Do-nothing scenario dB L _{Aeq(24h)}	Do-minimum scenario dB L _{Aeq(24h)}
85 Upper Orewa Road	53	57	59
406 Wainui Road	59	65	57
411 Wainui Road	64	69	56
11 Russell Road	45	51	52
90 Upper Orewa Road	54	56	51
24 Upper Orewa Road	49	56	50
29 Upper Orewa Road	49	56	50
100 Upper Orewa Road	43	44	48
392 Wainui Road	51	57	48
411 Wainui Road	54	60	47
379 Wainui Road	66	72	46
427 Wainui Road	52	58	39

2.4 NoR 7

PPF Address NoR 7	Existing, dB LAeq(24hr)	Do Nothing, dB LAeq(24hr)	Do Minimum, LAeq(24hr)
10 Old Pine Valley Road	63	67	58
195 Pine Valley Road	59	63	56
223 Pine Valley Road	58	61	53
212 Pine Valley Road	56	61	53
21 Young Access	56	59	52

211 Pine Valley Road	56	60	52
165 Pine Valley Road	56	60	51
1 Old Pine Valley Road	51	57	51
210 Pine Valley Road	54	58	51
146 Pine Valley Road	54	58	50
231 Pine Valley Road	56	57	50
37 Old Pine Valley Road	50	56	50
175 Pine Valley Road	54	58	50
189 Pine Valley Road	53	57	50
19 Young Access	54	68	50
36 Old Pine Valley Road	50	55	48
180 Pine Valley Road	53	56	48

2.5 NoR 8

Address	Existing, dB LAeq(24hr)	Do Nothing, dB LAeq(24hr)	Do Minimum, LAeq(24hr)
1686 Dairy Flat Highway	64	69	62
1680 Dairy Flat Highway	66	71	62
1321 Dairy Flat Highway	68	72	61
1349 Dairy Flat Highway	66	70	61
1338 Dairy Flat Highway	62	67	61
1008 Dairy Flat Highway	64	69	60
12 Durey Road	61	65	60
1564A Dairy Flat Highway	65	70	60
1570 Dairy Flat Highway	65	70	60
1258 Dairy Flat Highway	64	69	60
1306 Dairy Flat Highway	63	68	59
1284 Dairy Flat Highway	63	67	59
1286 Dairy Flat Highway	64	68	59
2 Horseshoe Bush Road	65	69	59
1285 Dairy Flat Highway	63	68	59
957 Dairy Flat Highway	62	71	59
1731 Dairy Flat Highway	62	66	59
1424 Dairy Flat Highway	65	69	59
1361 Dairy Flat Highway	63	67	59
1452 Dairy Flat Highway	65	69	58
41 Durey Road	62	67	58
1315 Dairy Flat Highway	62	66	58
1182 Dairy Flat Highway	62	67	58
11 Durey Road	58	62	57
1700 Dairy Flat Highway	61	66	57
825 Dairy Flat Highway	63	67	57
1355 Dairy Flat Highway	62	66	57
1584 Dairy Flat Highway	62	67	57
5 Postman Road	60	65	57
4 Lascelles Drive	61	65	57
25 Lynwood Grove	61	68	57
1 Richards Road	60	64	57
1636 Dairy Flat Highway	61	66	56
1596 Dairy Flat Highway	61	66	56

1646 Dairy Flat Highway	60	65	56
17 Lower Jeffs Road	58	63	56
1550 Dairy Flat Highway	61	66	56
859 Dairy Flat Highway	60	65	56
1215 Dairy Flat Highway	60	64	56
16 Durey Road	57	61	56
1016 Dairy Flat Highway	59	64	55
18 Wilks Road West	54	62	55
1005A Dairy Flat Highway	57	63	55
956 Dairy Flat Highway	58	67	55
15 Wilks Road	59	63	55
1615 Dairy Flat Highway	60	65	55
12 Postman Road	58	64	55
1153 Dairy Flat Highway	57	62	55
1564 Dairy Flat Highway	60	65	55
1006 Dairy Flat Highway	59	66	54
1250 Dairy Flat Highway	58	62	54
18 Langford Place	59	63	54
27 Green Road	59	61	54
22 Langford Place	58	62	54
18 Green Road	62	64	54
20 Jeffs Road	57	62	54
883 Dairy Flat Highway	56	63	54
792 Dairy Flat Highway	52	55	54
1617 Dairy Flat Highway	58	63	54
9 Lower Jeffs Road	56	61	54
6 Lynwood Grove	55	61	54
6 Kennedy Road	56	66	53
7 Lower Jeffs Road	55	60	53
851 Dairy Flat Highway	60	64	53
16 Langford Place	59	63	53
55 Kennedy Road	56	63	53
1327 Dairy Flat Highway	57	62	53
2 Lynwood Grove	56	64	53
1412 Dairy Flat Highway	57	61	53
22 Lynwood Grove	52	59	53
1579A Dairy Flat Highway	57	62	53
31 Green Road	55	60	53
1602A Dairy Flat Highway	57	62	52
1660 Dairy Flat Highway	56	61	52
16 Lynwood Grove	52	59	52
38 Jeffs Road	55	60	52
26 Langford Place	56	60	52
20 Langford Place	56	60	52
987 Dairy Flat Highway	56	64	52
1349A Dairy Flat Highway	56	61	52
6 Langford Place	58	62	52
823 Dairy Flat Highway	56	60	52
1236 Dairy Flat Highway	57	61	52
1623 Dairy Flat Highway	56	61	51
19 Richards Road	55	60	51
21 Postman Road	53	59	51

28 Lynwood Grove	53	60	51
785 Dairy Flat Highway	59	61	51
1005 Dairy Flat Highway	55	61	51
841 Dairy Flat Highway	56	61	51
32 Jeffs Road	53	58	51
26 Lynwood Grove	51	59	50
1602 Dairy Flat Highway	55	60	50
918 Dairy Flat Highway	53	61	50
1414 Dairy Flat Highway	55	59	50
1270B Dairy Flat Highway	53	58	50
807 Dairy Flat Highway	54	58	50
14 Blackbridge Road	53	58	50
18 Kennedy Road	54	68	50
22 Postman Road	52	60	50
15 Lower Jeffs Road	51	56	50
851B Dairy Flat Highway	55	60	50
1491 Dairy Flat Highway	56	60	50
1326 Dairy Flat Highway	53	58	50
30 Wilks Road	59	65	50
11 Lascelles Drive	56	60	49
1687 Dairy Flat Highway	55	59	49
1509 Dairy Flat Highway	54	59	49
10 Lascelles Drive	56	59	49
1248 Dairy Flat Highway	54	58	49
1487 Dairy Flat Highway	56	60	49
1667 Dairy Flat Highway	54	59	49
17 Kahikatea Flat Road	53	57	49
19 Kennedy Road	52	68	49
958 Dairy Flat Highway	51	62	49
11 Jeffs Road	52	57	49
28 Blackbridge Road	51	57	49
1198A Dairy Flat Highway	53	57	49
10 Bawden Road	56	66	49
34 Lascelles Drive	55	59	49
1448 Dairy Flat Highway	56	60	49
989 Dairy Flat Highway	52	61	49
785 Dairy Flat Highway	53	56	49
24 Goodland Drive	54	64	48
8 Kennedy Road	52	60	48
934 Dairy Flat Highway	51	60	48
37 Whiteways Drive	49	57	48
1416 Dairy Flat Highway	53	57	48
1256 Dairy Flat Highway	53	57	48
28 Lascelles Drive	55	58	48
20 Kennedy Road	51	60	48
1428 Dairy Flat Highway	53	57	48
1455 Dairy Flat Highway	56	60	48
32 Langford Place	51	55	48
9 Goodland Drive	54	61	48
31 Wilks Road West	52	58	47
25 Postman Road	51	60	47
19 Langford Place	51	56	47

1014 Dairy Flat Highway	52	63	47
36 Blackbridge Road	51	57	47
9 Langford Place	52	58	47
24 Lynwood Grove	48	55	47
29 Langford Place	49	53	46
1198C Dairy Flat Highway	50	55	46
38 Wilks Road West	51	58	46
30 Wilks Road West	50	56	45
1440 Dairy Flat Highway	60	64	44
783 Dairy Flat Highway	57	59	44
1444 Dairy Flat Highway	52	56	44
26 Postman Road	47	58	43
12 Kahikatea Flat Road	61	65	42
1432 Dairy Flat Highway	51	55	42
10 Kahikatea Flat Road	61	65	39
16 Kahikatea Flat Road	58	61	38

2.6 NoR 9

Address	Existing, dB LAeq(24hr)	Do Nothing, dB LAeq(24hr)	Do Minimum, LAeq(24hr)
624 Dairy Flat Highway	62	67	64
623 Dairy Flat Highway	61	66	64
473 Dairy Flat Highway	64	67	64
2 Potter Road	60	69	63
452 Dairy Flat Highway	66	68	63
615 Dairy Flat Highway	61	66	63
341 Dairy Flat Highway	64	67	62
614 Dairy Flat Highway	60	65	62
449 Dairy Flat Highway	62	65	61
2 Foley Quarry Road	61	65	61
430 Dairy Flat Highway	61	64	60
508 Dairy Flat Highway	61	63	60
349 Dairy Flat Highway	63	65	60
664 Dairy Flat Highway	59	64	60
652 Dairy Flat Highway	59	63	60
328 Dairy Flat Highway	62	64	59
501 Dairy Flat Highway	59	62	58
2A Foley Quarry Road	57	60	58
540 Dairy Flat Highway	58	61	58
1 Potter Road	56	62	58
461 Dairy Flat Highway	59	62	58
1 Hobson Road	60	62	58
2 Stevensons Crescent	60	63	57
792 Dairy Flat Highway	51	58	57
459 Dairy Flat Highway	58	62	57
668 Dairy Flat Highway	58	63	57
448 Dairy Flat Highway	58	61	56
345 Dairy Flat Highway	59	62	56
347 Dairy Flat Highway	60	63	56

Address	Existing, dB LAeq(24hr)	Do Nothing, dB LAeq(24hr)	Do Minimum, LAeq(24hr)
310 Dairy Flat Highway	58	61	56
641 Dairy Flat Highway	56	60	55
316 Dairy Flat Highway	57	60	55
4 Foley Quarry Road	56	59	55
11 Hobson Road	57	59	54
785 Dairy Flat Highway	59	62	54
530 Dairy Flat Highway	54	57	54
442 Dairy Flat Highway	55	57	54
507 Dairy Flat Highway	54	57	54
10 Potter Road	56	59	54
733 Dairy Flat Highway	60	62	53
12 Agnew Place	58	60	53
23 Agnew Place	57	59	53
12 Coatesville-Riverhead Highway	59	60	52
8 Stevensons Crescent	55	58	52
481 Dairy Flat Highway	51	54	52
528 Dairy Flat Highway	52	55	52
619 Dairy Flat Highway	51	55	52
655 Dairy Flat Highway	51	56	52
6 Agnew Place	59	62	51
406 Dairy Flat Highway	52	54	51
738 Dairy Flat Highway	57	60	51
169 Foley Quarry Road	57	60	51
770 Dairy Flat Highway	57	60	51
4 Agnew Place	61	64	51
783 Dairy Flat Highway	56	60	50
505 Dairy Flat Highway	51	54	50
8 Agnew Place	58	60	50
761A Dairy Flat Highway	57	60	50
2 Agnew Place	64	66	50
471 Dairy Flat Highway	51	54	50
121 Foley Quarry Road	55	58	50
17 Lomas Way	52	54	50
3 Potter Road	49	55	50
3 Foley Quarry Road	51	54	50
748 Dairy Flat Highway	56	59	49
18 Albany Heights Road	56	66	49
16 Hobson Heights Road	53	55	49
18 Hobson Heights Road	52	54	49
33 Foley Quarry Road	50	53	49
19 Lomas Way	52	54	49
10 Hobson Heights Road	52	54	49
26 Coatesville-Riverhead Highway	60	61	48
557 Dairy Flat Highway	54	55	48
21 Agnew Place	51	54	48
38 Lomas Way	51	53	48
508B Dairy Flat Highway	50	53	47
10 Agnew Place	50	52	47
16 Durey Road	55	65	46

Address	Existing, dB LAeq(24hr)	Do Nothing, dB LAeq(24hr)	Do Minimum, LAeq(24hr)
555 Dairy Flat Highway	54	55	45
30 Coatesville-Riverhead Highway	53	54	45
508A Dairy Flat Highway	46	49	45
731 Dairy Flat Highway	51	54	45
785 Dairy Flat Highway	51	58	44
12 Durey Road	59	69	43
623A Dairy Flat Highway	42	48	43
185 Kennedy Road	46	58	41
807 Dairy Flat Highway	50	59	40
41 Durey Road	62	72	40
823 Dairy Flat Highway	50	60	36
11 Durey Road	57	67	35

2.7 NoR 10

Address	Existing, dB LAeq(24hr)	Do Nothing, dB LAeq(24hr)	Do Minimum, LAeq(24hr)
379 Wainui Road	66	72	59
411 Wainui Road	64	69	58
406 Wainui Road	59	65	57
480 Wainui Road	65	70	55
330 Wainui Road	56	60	55
315 Wainui Road	54	59	53
362 Wainui Road	58	64	52
20 Kowhai Road	56	61	52
440 Wainui Road	56	62	51
42 Kowhai Road	53	58	50
411 Wainui Road	54	60	50
37 Kowhai Road	57	61	50
427 Wainui Road	52	58	48
295 Wainui Road	52	55	48
392 Wainui Road	51	57	47
297 Wainui Road	51	54	47
16 Lysnar Road	52	57	46
293A Wainui Road	50	53	45
500 Wainui Road	64	69	44
293B Wainui Road	50	53	44
293 Wainui Road	52	57	42

2.8 NoR 11

2.8.1 Altered Roads

Address	Existing, dB LAeq(24hr)	Do Nothing, dB LAeq(24hr)	Do Minimum, LAeq(24hr)
10 Kahikatea Flat Road	61	65	65
12 Kahikatea Flat Road	61	65	65
1424 Dairy Flat Highway	65	70	63
2 Horseshoe Bush Road	65	70	62
1452 Dairy Flat Highway	65	69	62
1440 Dairy Flat Highway	60	65	61
16 Kahikatea Flat Road	61	64	59
332 Postman Road	55	66	58
343 Postman Road	50	60	58
325 Postman Road	54	65	56
1448 Dairy Flat Highway	56	60	56
326 Postman Road	49	60	55
132 Wilks Road	58	66	55
1455 Dairy Flat Highway	56	61	54
323 Postman Road	52	63	54
1444 Dairy Flat Highway	52	56	54
1432 Dairy Flat Highway	51	55	54
363 Postman Road	52	60	53
322 Postman Road	49	60	52
14 Runway Rise	47	55	52
314 Postman Road	54	65	51
1428 Dairy Flat Highway	53	57	51
1412 Dairy Flat Highway	57	62	49
311 Postman Road	56	68	49
5 Runway Rise	48	54	48
2 Aileron Rise	55	61	48
17 Kahikatea Flat Road	53	57	48
4 Aileron Rise	54	58	47
8 Aileron Rise	53	57	46
174 Wilks Road	59	66	61

2.8.2 New Roads

Address	Existing, dB LAeq(24hr)	Do Minimum, LAeq(24hr)
327 Postman Road	45	52
349 Postman Road	49	57
90 Wilks Road	47	47
65 Lascelles Drive	50	57
57 Lascelles Drive	50	49

2.9 NoR 12

Address	Existing, dB LAeq(24hr)	Do Nothing, dB LAeq(24hr)	Do Minimum, dB LAeq(24hr)
351 Bawden Road	56	64	62
152 Bawden Road	52	66	61
166 Bawden Road	50	64	59
59 Bawden Road	58	66	59
119 Bawden Road	52	66	59
1006 Dairy Flat Highway	59	64	58
135 Bawden Road	49	63	58
74 Bawden Road	57	65	58
63 Bawden Road	55	63	57
357 Bawden Road	56	62	57
218 Bawden Road	48	62	56
215 Bawden Road	46	60	56
335 Bawden Road	54	60	56
2 Bobs Way	46	59	56
120 Bawden Road	51	61	55
99 Bawden Road	57	65	55
165 Bawden Road	44	58	55
143 Bawden Road	46	59	54
38 Bawden Road	58	67	54
77 Bawden Road	53	61	54
190 Bawden Road	43	57	54
226A Bawden Road	44	59	54
366 Bawden Road	56	64	53
142 Bawden Road	45	59	53
83 Bawden Road	51	59	53
126 Bawden Road	47	58	53
250 Bawden Road	43	57	52
136 Bawden Road	45	58	52
264 Bawden Road	41	56	52
6 Bobs Way	50	55	52
170 Bawden Road	43	56	52
153 Bawden Road	42	56	51
359 Bawden Road	56	65	51
276 Bawden Road	41	54	51
25 Oregon Park	43	52	51
3 Bobs Way	41	54	50
8 Dairy Stream Road	49	58	50
320 Bawden Road	48	59	50
4 Bobs Way	47	54	50
36 Bawden Road	51	60	49
1014 Dairy Flat Highway	52	59	49
124 Bawden Road	47	56	49
358 Bawden Road	50	58	49
1008 Dairy Flat Highway	64	69	49
10 Bawden Road	56	64	49
1005A Dairy Flat Highway	57	63	48
292 Bawden Road	39	52	48
1005 Dairy Flat Highway	54	61	48

Address	Existing, dB LAeq(24hr)	Do Nothing, dB LAeq(24hr)	Do Minimum, LAeq(24hr)
252 Bawden Road	37	51	47
304 Bawden Road	39	52	47
46 Top Road	58	61	47
41 Top Road	56	59	46
355 Bawden Road	57	60	46
34 Top Road	57	59	46
987 Dairy Flat Highway	56	63	45

2.10 NoR 13

Address	Existing, dB LAeq(24hr)	Do Nothing, dB LAeq(24hr)	Do Minimum, LAeq(24hr)
1959 East Coast Road	73	76	67
1746 East Coast Road	62	65	67
1 Kea Road	70	72	66
2 Spur Road	67	69	65
1787 East Coast Road	68	71	65
5 Kea Road	68	71	65
7 Kea Road	68	71	65
3 Kea Road	68	70	65
9 Kea Road	68	71	65
1780A East Coast Road	62	64	65
11 Kea Road	68	71	65
13 Kea Road	68	71	65
15 Kea Road	68	71	65
17 Kea Road	68	71	64
19 Kea Road	67	70	64
21 Kea Road	66	70	64
2 Kea Road	67	68	64
23 Kea Road	66	69	64
2127 East Coast Road	69	72	63
16 Spur Road	64	64	63
25 Kea Road	65	68	63
1 Mita Road	65	66	63
1778 East Coast Road	61	64	63
2109 East Coast Road	67	70	62
8 Jackson Way	64	68	62
1837 East Coast Road	68	71	62
1910 East Coast Road	60	65	62
57 Kea Road	66	69	62
1797 East Coast Road	61	64	62
1824 East Coast Road	65	68	61
32 Worsnop Way	59	62	61
2157 East Coast Road	66	69	61
2087 East Coast Road	64	67	61
1791 East Coast Road	65	69	61
1826 East Coast Road	58	61	60
1971 East Coast Road	65	69	60
27 Kea Road	64	67	60
1914 East Coast Road	62	65	59
1921 East Coast Road	62	66	58
1871 East Coast Road	61	64	58

Address	Existing, dB LAeq(24hr)	Do Nothing, dB LAeq(24hr)	Do Minimum, LAeq(24hr)
2083 East Coast Road	62	65	58
2077 East Coast Road	61	64	58
43 Kea Road	66	69	58
11 Spur Road	59	60	58
1832 East Coast Road	62	66	58
2104 East Coast Road	63	66	57
1830 East Coast Road	57	60	57
55 Kea Road	66	69	57
1838 East Coast Road	61	65	57
4 Kea Road	61	62	56
29 Kea Road	64	67	56
1960 East Coast Road	59	63	56
2118 East Coast Road	57	60	56
33 Kea Road	65	69	56
1976 East Coast Road	55	58	55
10 Newman Road	60	63	55
31 Kea Road	65	68	55
6 Kea Road	59	61	55
37 Kea Road	65	68	55
1853 East Coast Road	61	64	54
8 Kea Road	58	59	54
35 Kea Road	65	68	54
1958 East Coast Road	58	61	53
53 Kea Road	64	67	53
39 Kea Road	65	68	53
41 Kea Road	64	67	53
60 Kea Road	57	60	53
3 Mita Road	54	55	53
10 Kea Road	56	57	53
56 Kea Road	58	61	53
14 Kea Road	54	56	52
12 Kea Road	55	57	52
58 Kea Road	57	60	52
52 Kea Road	58	61	52
5 Mita Road	53	55	52
16 Kea Road	53	55	52
43 Mita Road	55	58	52
18 Kea Road	52	54	52
19 Spur Road	54	56	52
54 Kea Road	57	60	52
47 Kea Road	62	65	51
41 Mita Road	54	57	51
45 Mita Road	54	56	51
49 Mita Road	53	55	51
55 Mita Road	51	54	51
2065 East Coast Road	55	59	51
2045 East Coast Road	56	59	51
51 Kea Road	62	65	51
50 Kea Road	55	58	51
49 Kea Road	62	65	51
25 Mita Road	51	53	51
1973 East Coast Road	54	58	51
45 Kea Road	61	64	50
20 Kea Road	51	53	50
47 Mita Road	52	54	50
7 Mita Road	52	53	50

Address	Existing, dB LAeq(24hr)	Do Nothing, dB LAeq(24hr)	Do Minimum, LAeq(24hr)
39 Mita Road	53	56	50
51 Mita Road	52	54	50
2095 East Coast Road	53	56	50
2065A East Coast Road	54	57	50
53 Mita Road	50	53	50
48 Kea Road	53	56	49
9 Mita Road	51	53	49
37 Mita Road	52	54	49
21 Mita Road	50	53	49
26 Kea Road	51	54	49
23 Mita Road	50	53	49
2079 East Coast Road	53	56	49
19 Mita Road	50	52	49
32 Kea Road	53	55	49
34 Kea Road	53	56	49
28 Kea Road	51	54	49
35 Mita Road	52	55	49
17 Mita Road	50	52	49
36 Kea Road	53	56	49
11 Mita Road	50	52	48
44 Kea Road	52	55	48
38 Kea Road	53	56	48
46 Kea Road	52	55	48
27 Mita Road	50	53	48
42 Kea Road	52	55	48
30 Kea Road	52	55	48
33 Mita Road	52	54	48
40 Kea Road	52	55	48
29 Mita Road	51	53	48
31 Mita Road	51	53	48
13 Mita Road	50	52	48
22 Kea Road	50	52	48
15 Mita Road	49	52	48
2095A East Coast Road	50	53	48
24 Kea Road	50	53	48
17 Newman Road	53	56	48

3 Appendix C: Noise level contours



Overview Map



Map Legend

New Road (dB $L_{Aeq(24h)}$)		Contours dB $L_{Aeq(24h)}$
 < 57 Category A	Nor1 RTC Alignments	55
 57 - 64 Category B	Nor4 SH1 Alignments	60
 > 64 Category C	Noise protection wall	65
Altered Road (dB $L_{Aeq(24h)}$)	Nor2 Milldale Station Kiss n Ride	70
 < 64 Category A	Nor2 Milldale Station Station Building	
 64 - 67 Category B	Nor3 Pine Valley Staion Park n Ride	
 > 67 Category C	Nor3 Pine Valley Staion Station Building	

3.1 NoR 1



NOR 1 RTC



Existing



Do-Nothing



Do-Minimum



NOR 1 RTC





NOR 1 RTC





NOR 1 RTC



Existing



Do-Nothing



Do-Minimum



NOR 1 RTC





NOR 1 RTC



Existing



Do-Nothing



Do-Minimum

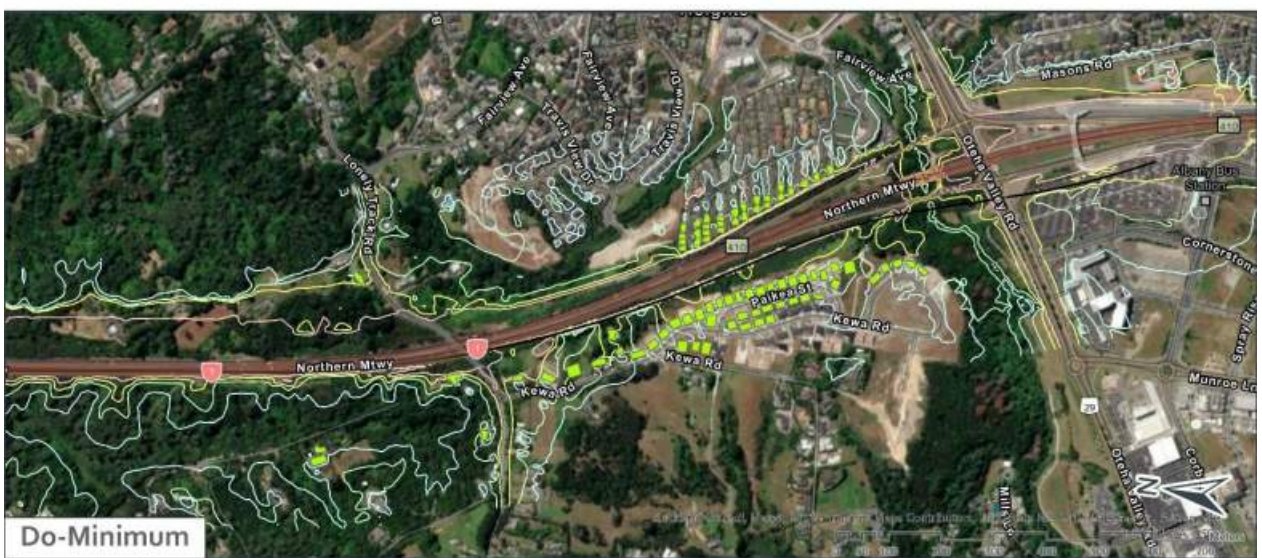


NOR 1 RTC





NOR 1 RTC



3.2 NoR 4



NOR4 SH1





NOR4 SH1





NOR4 SH1





NOR4 SH1





NOR4 SH1

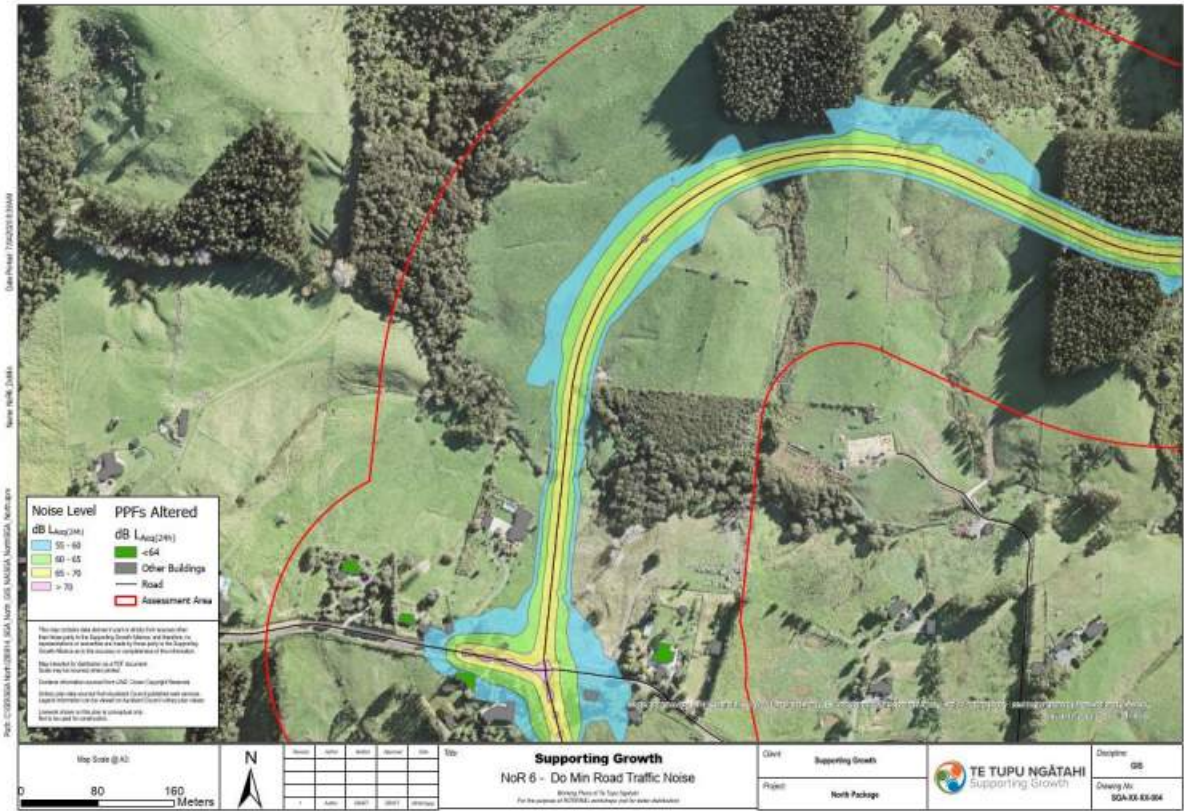
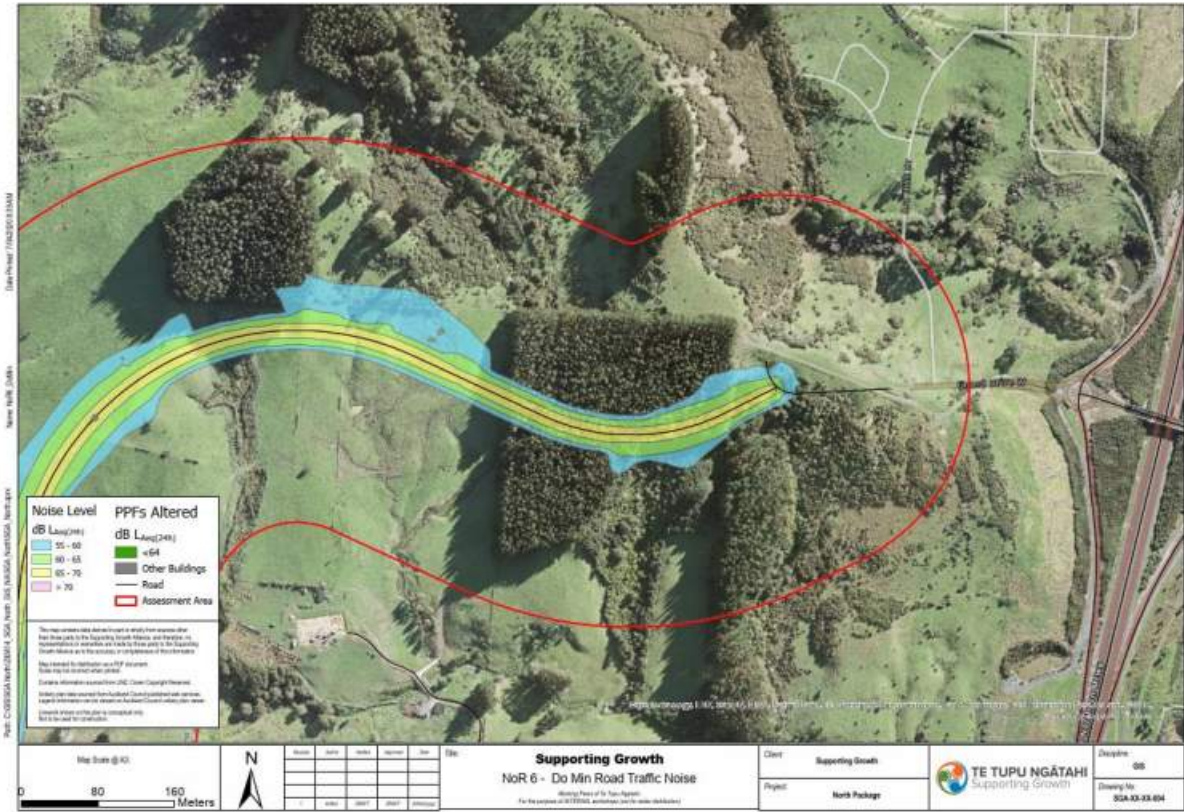


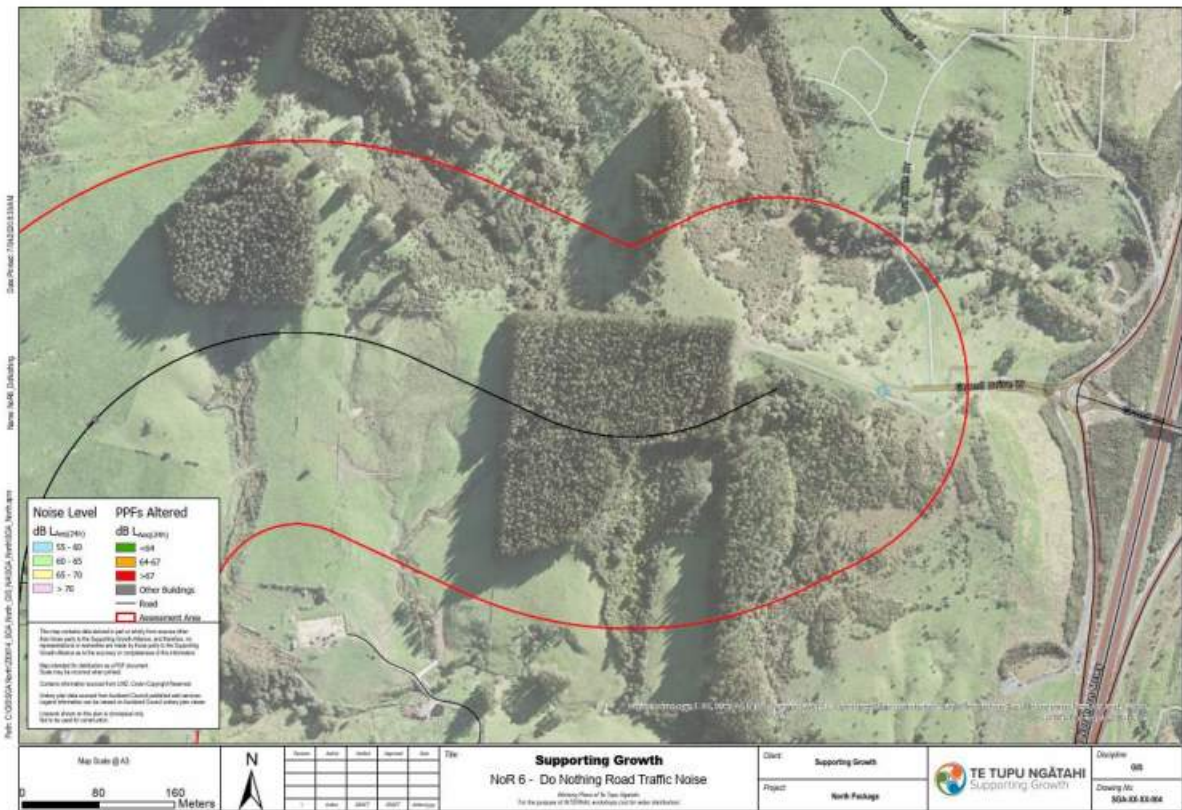
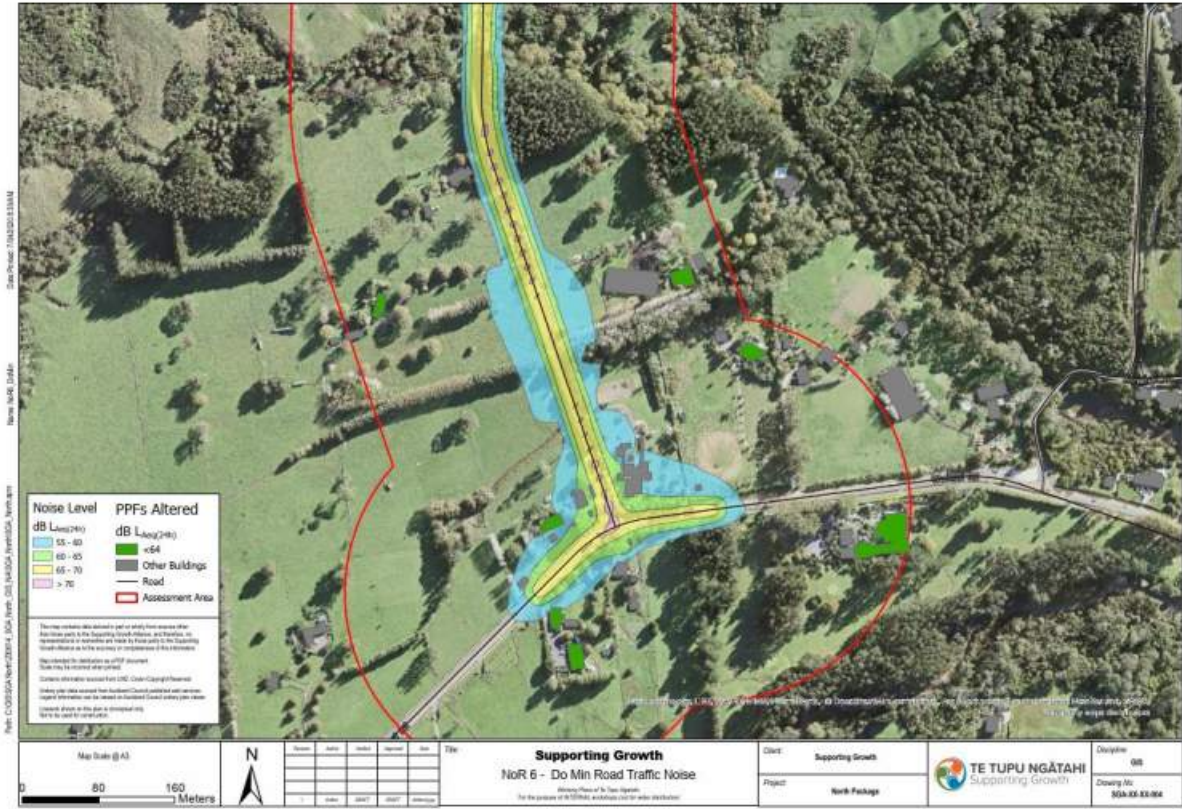


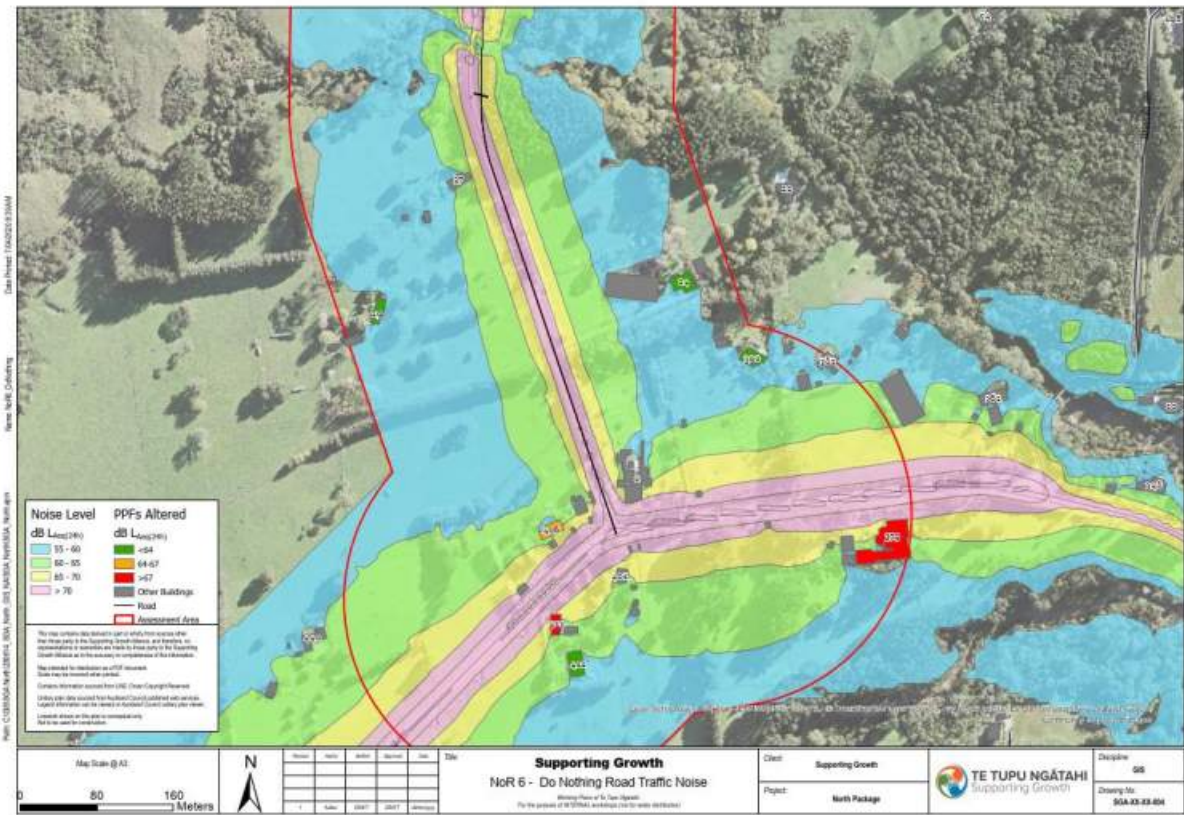
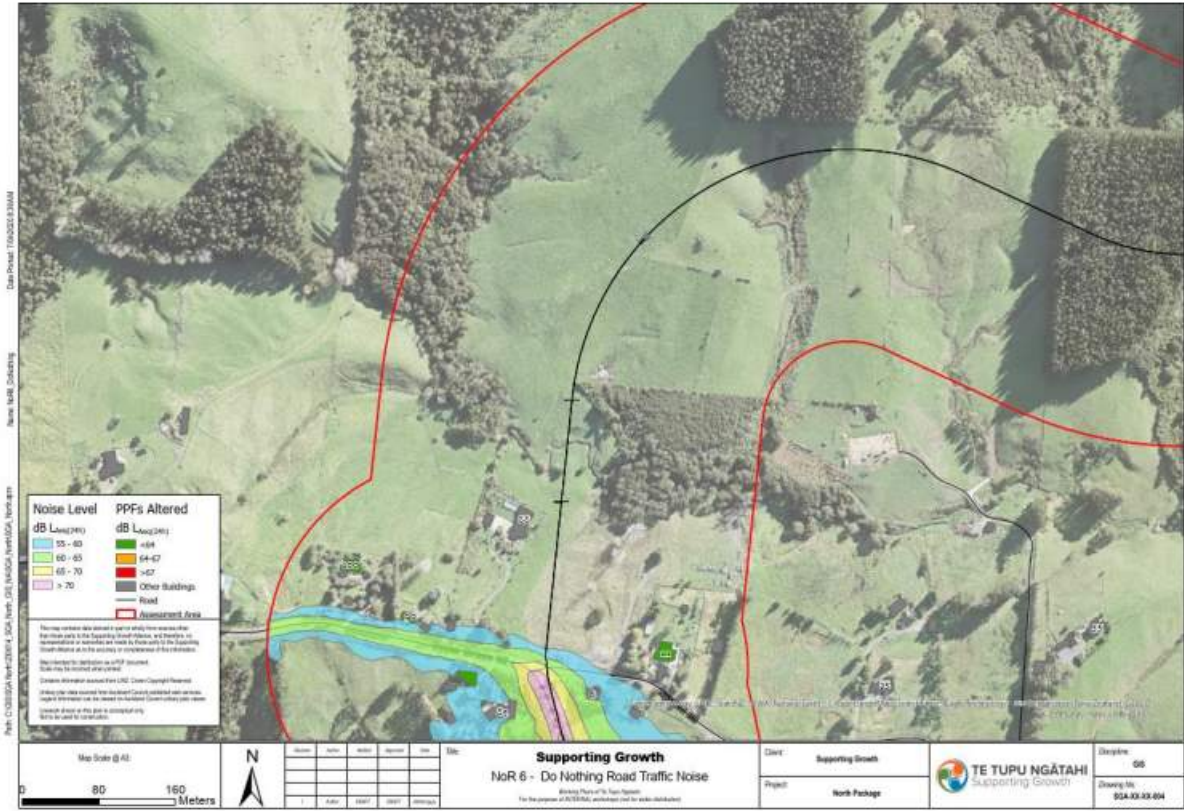
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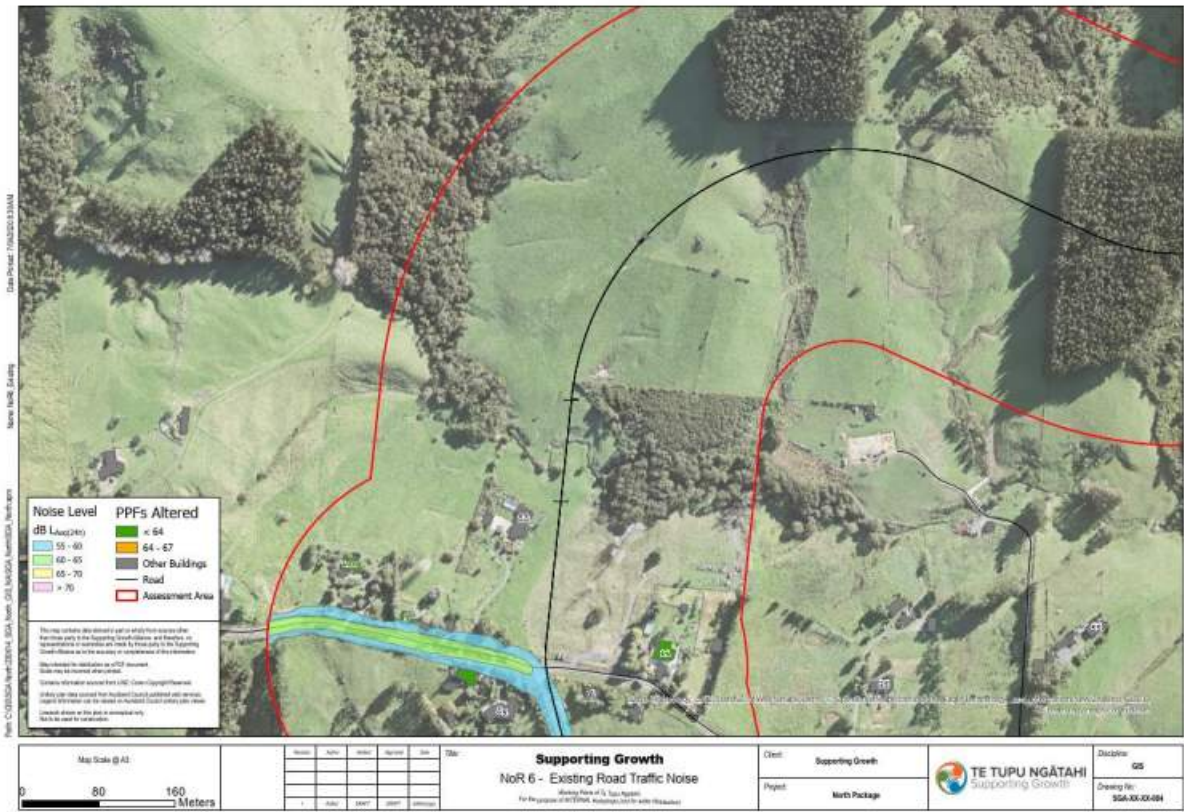
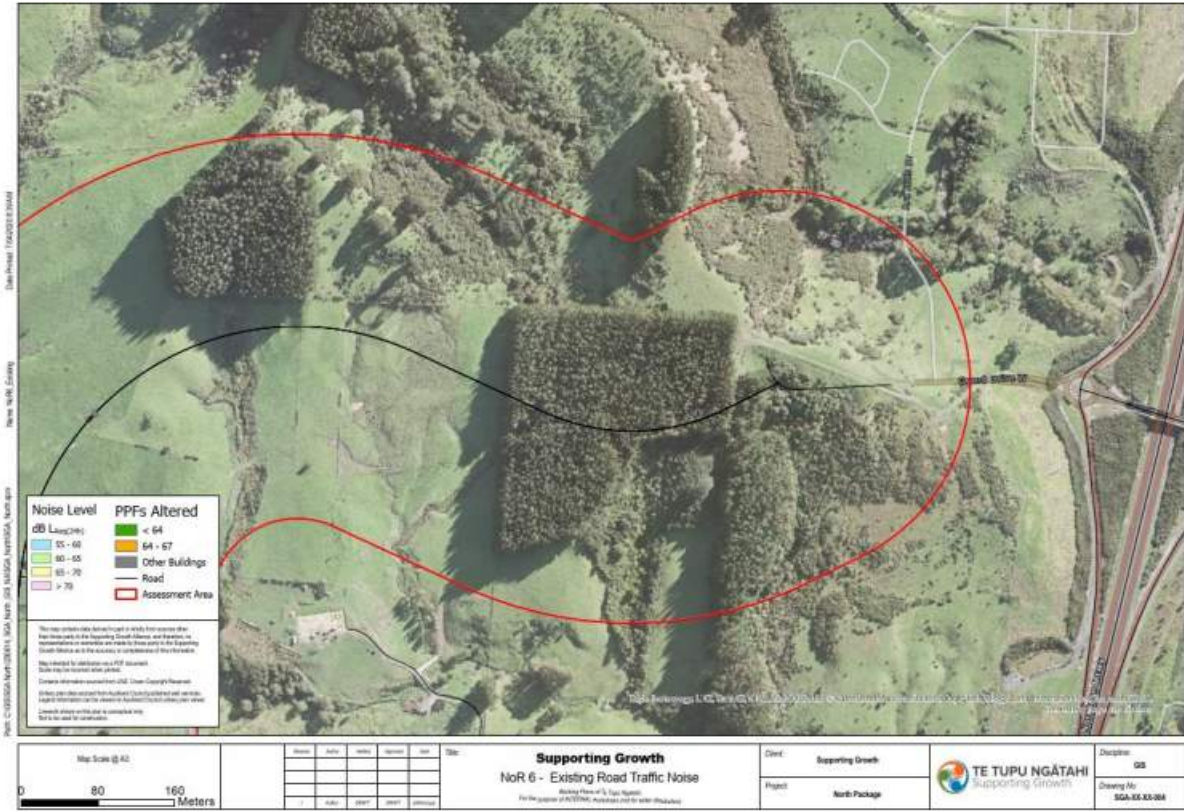


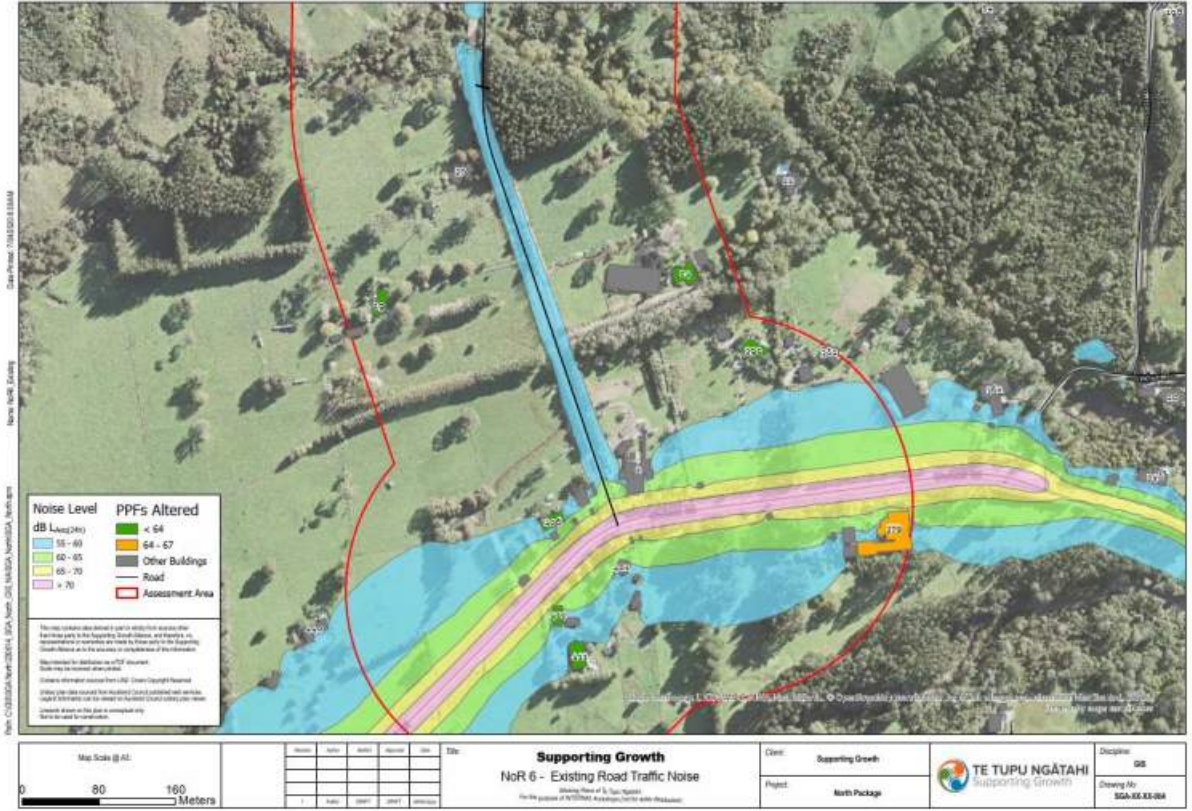
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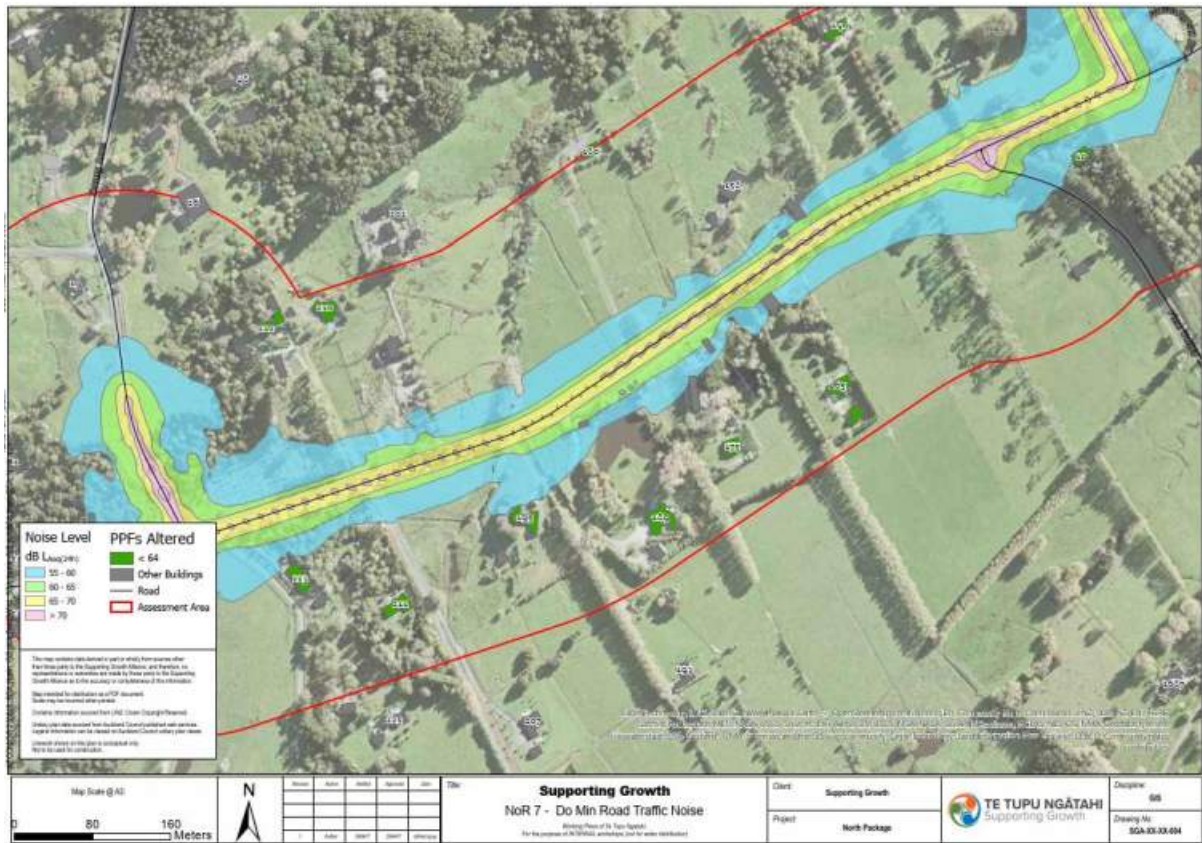
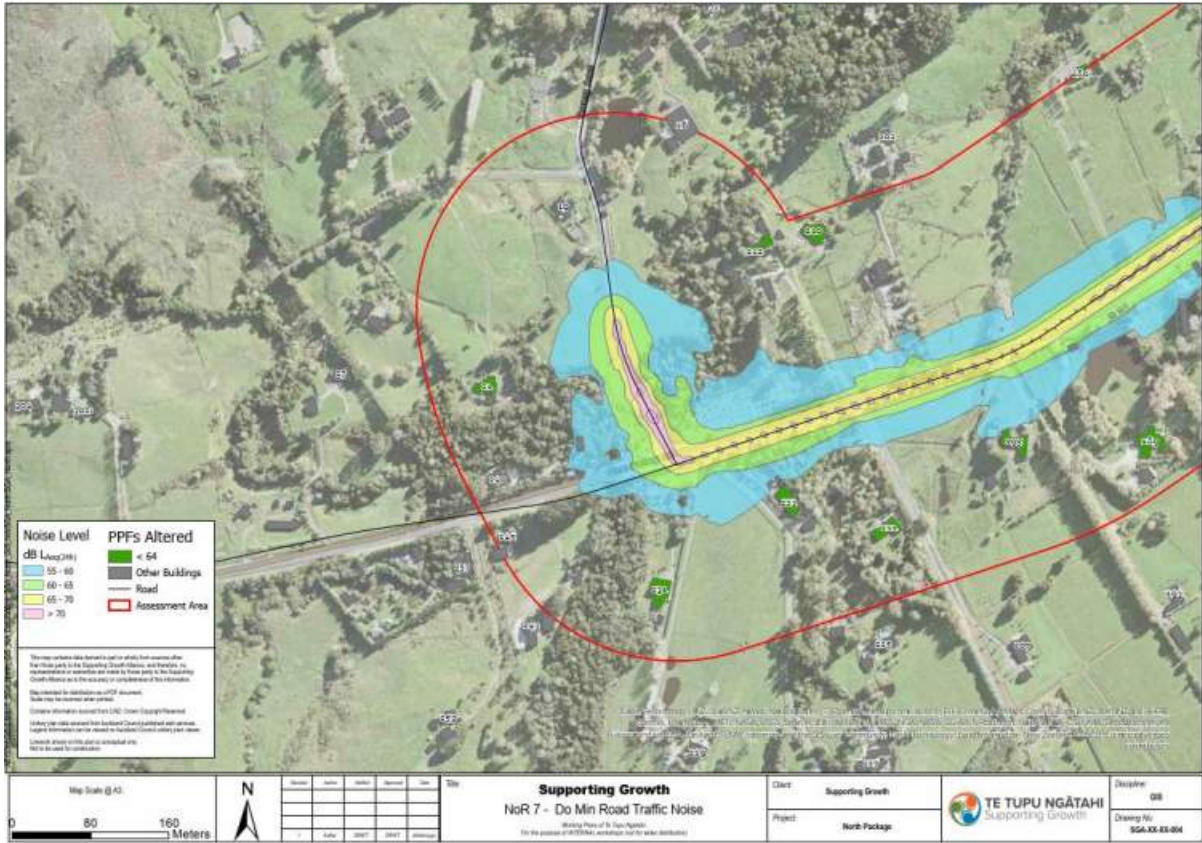


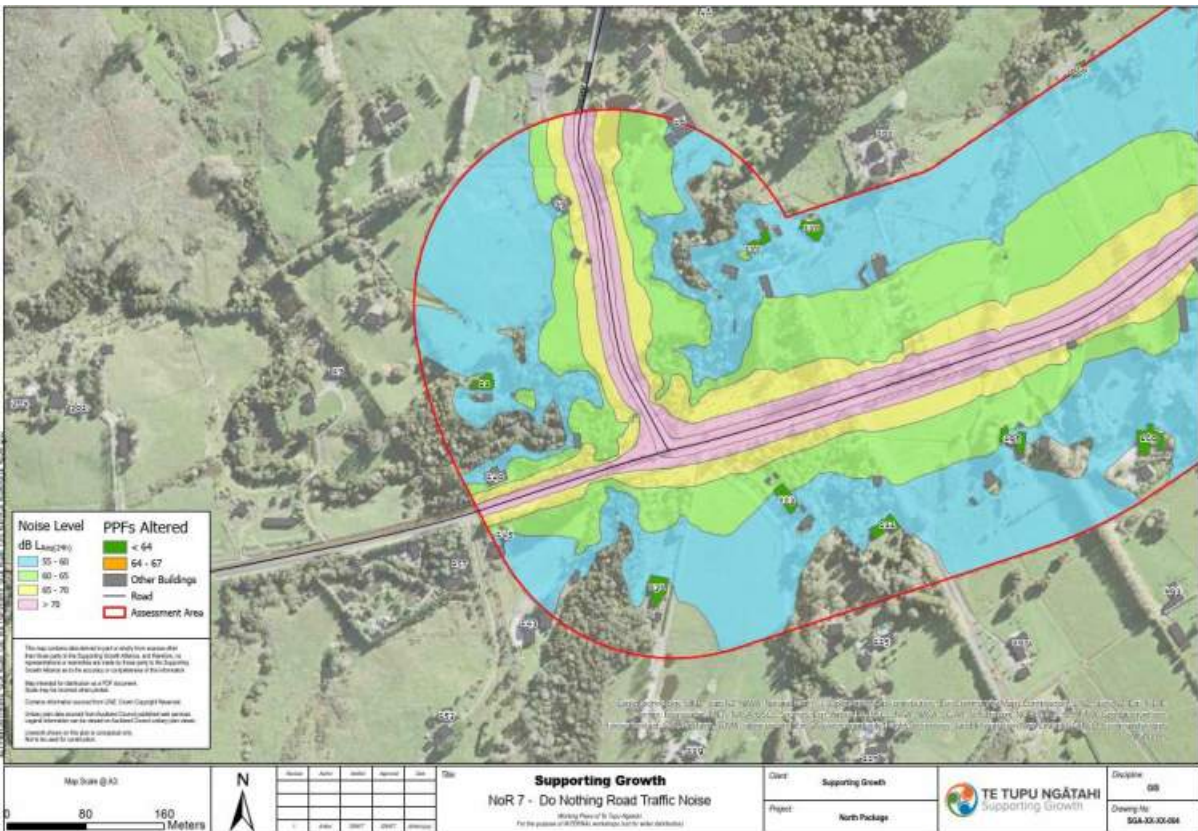
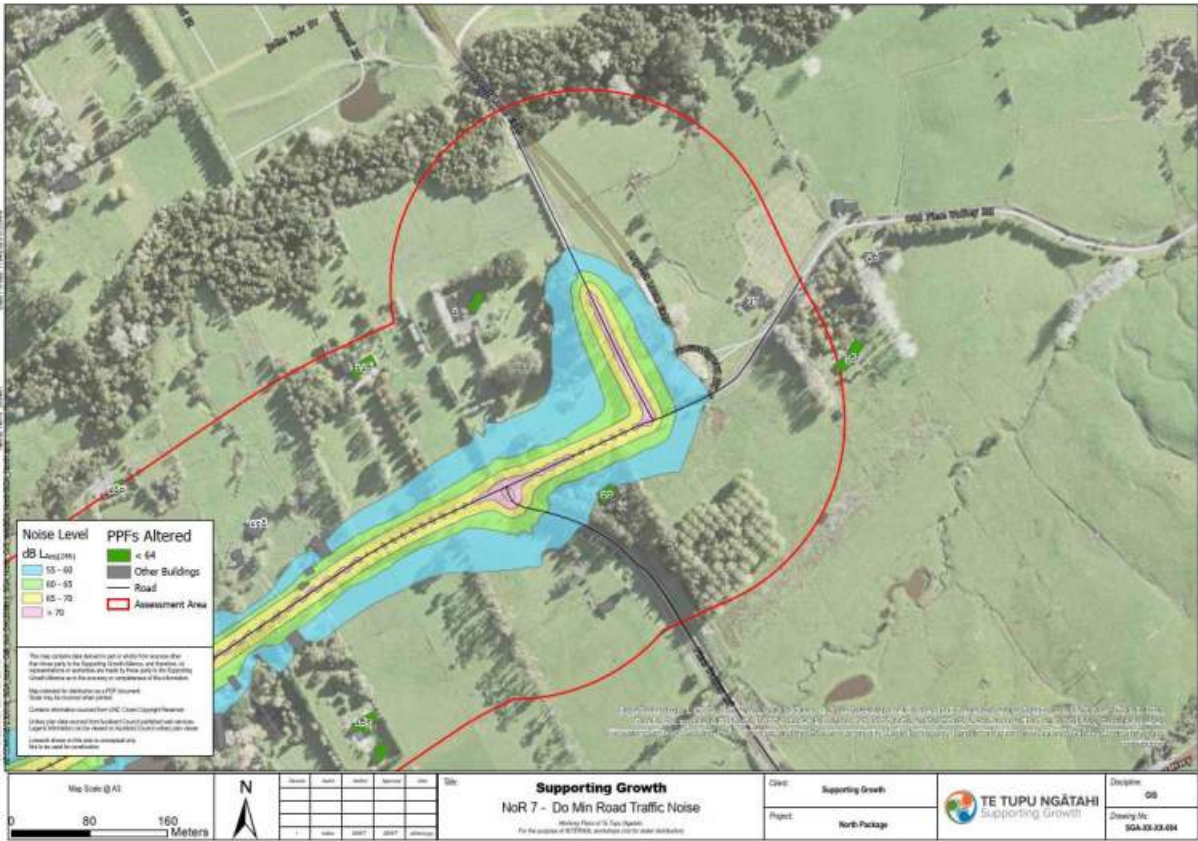


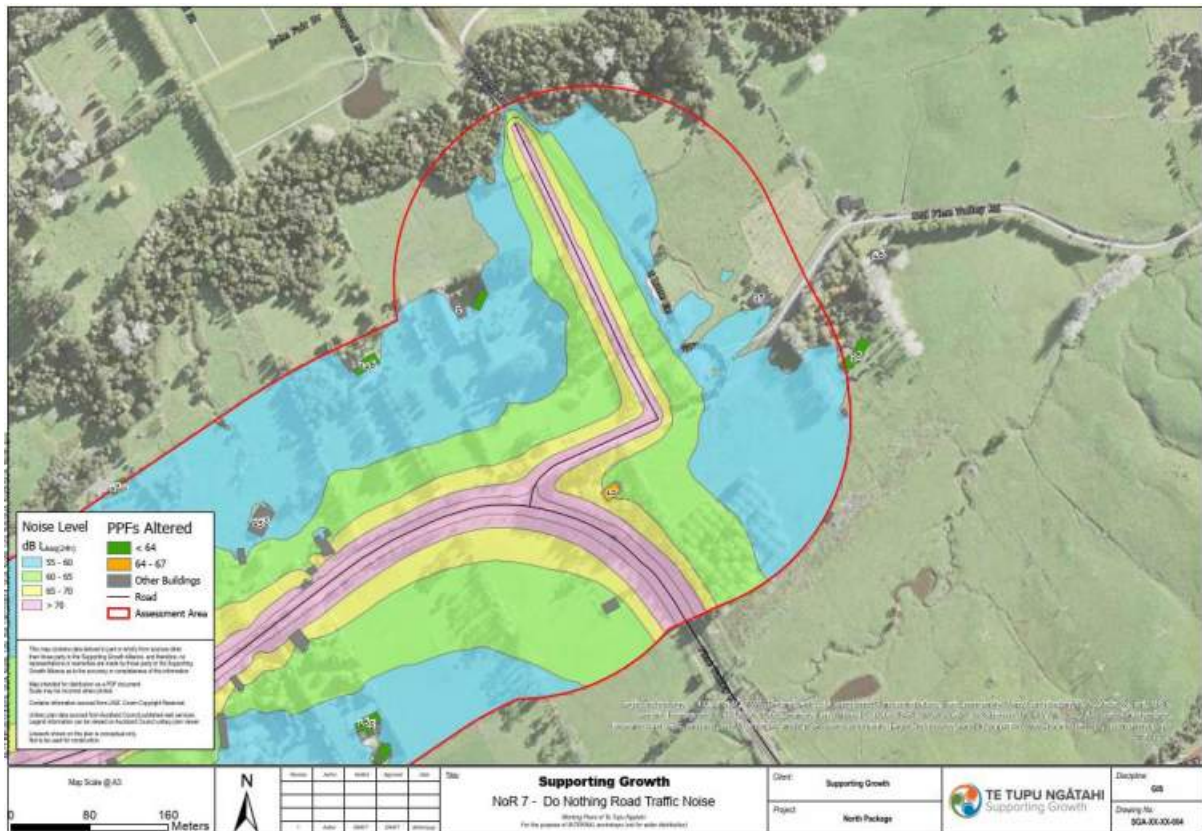
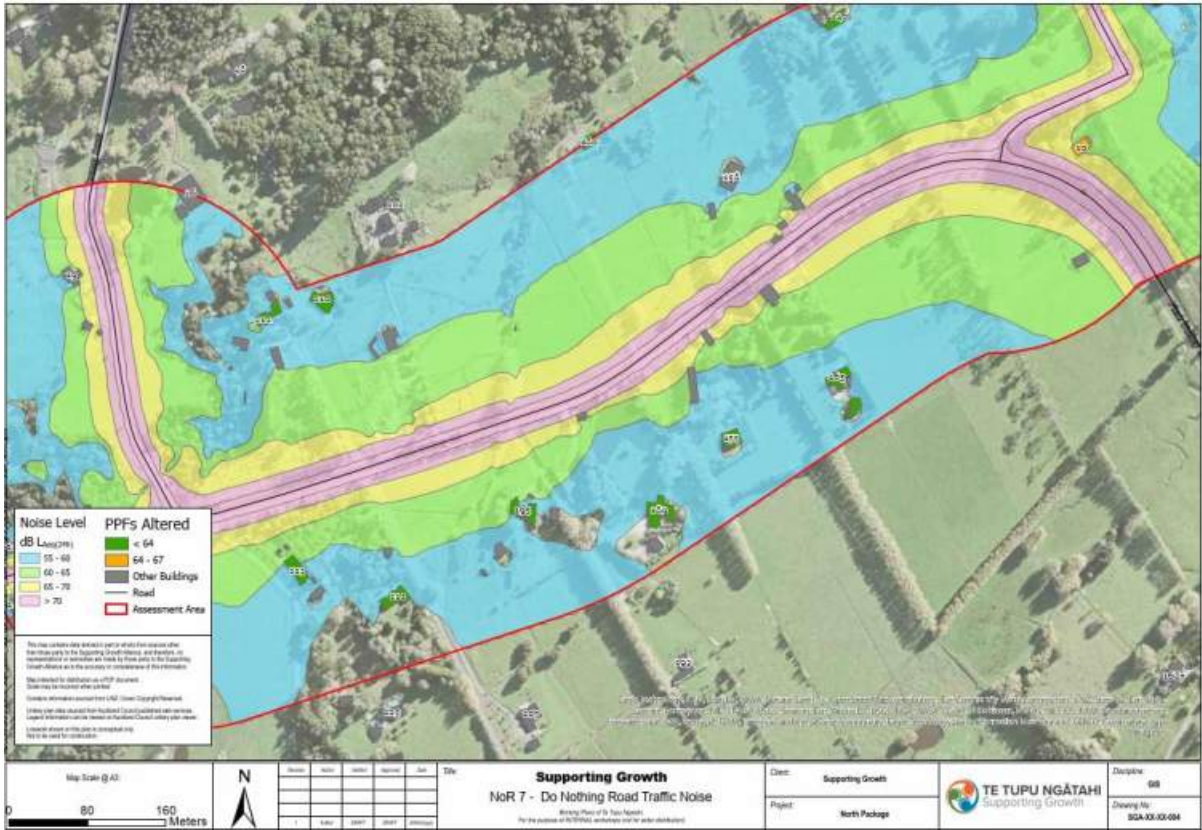


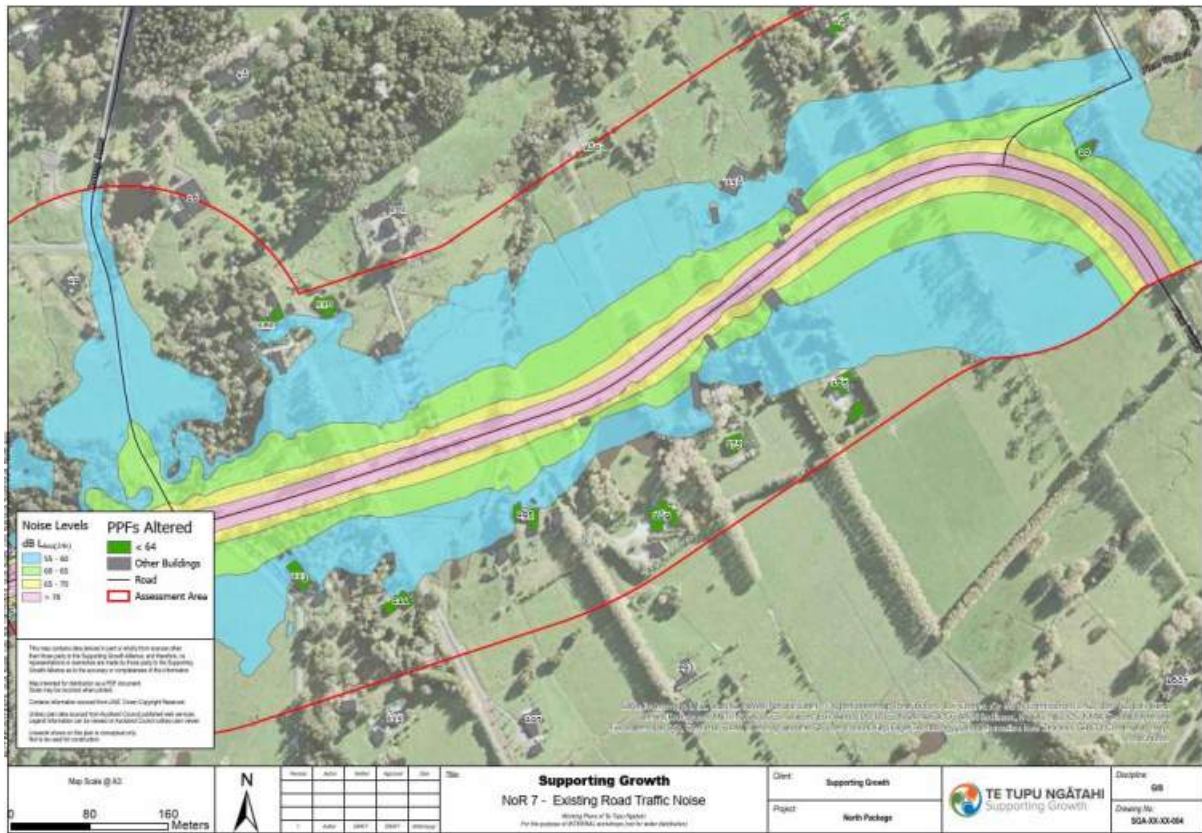
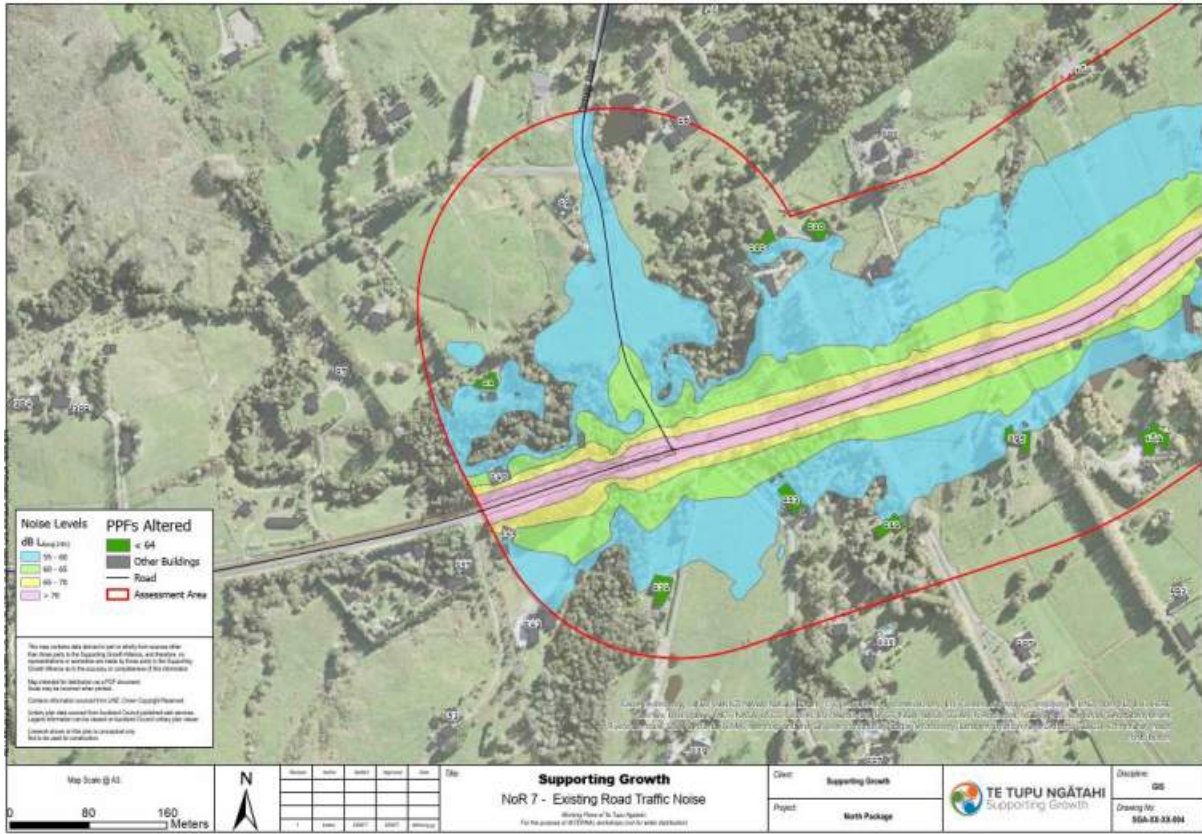


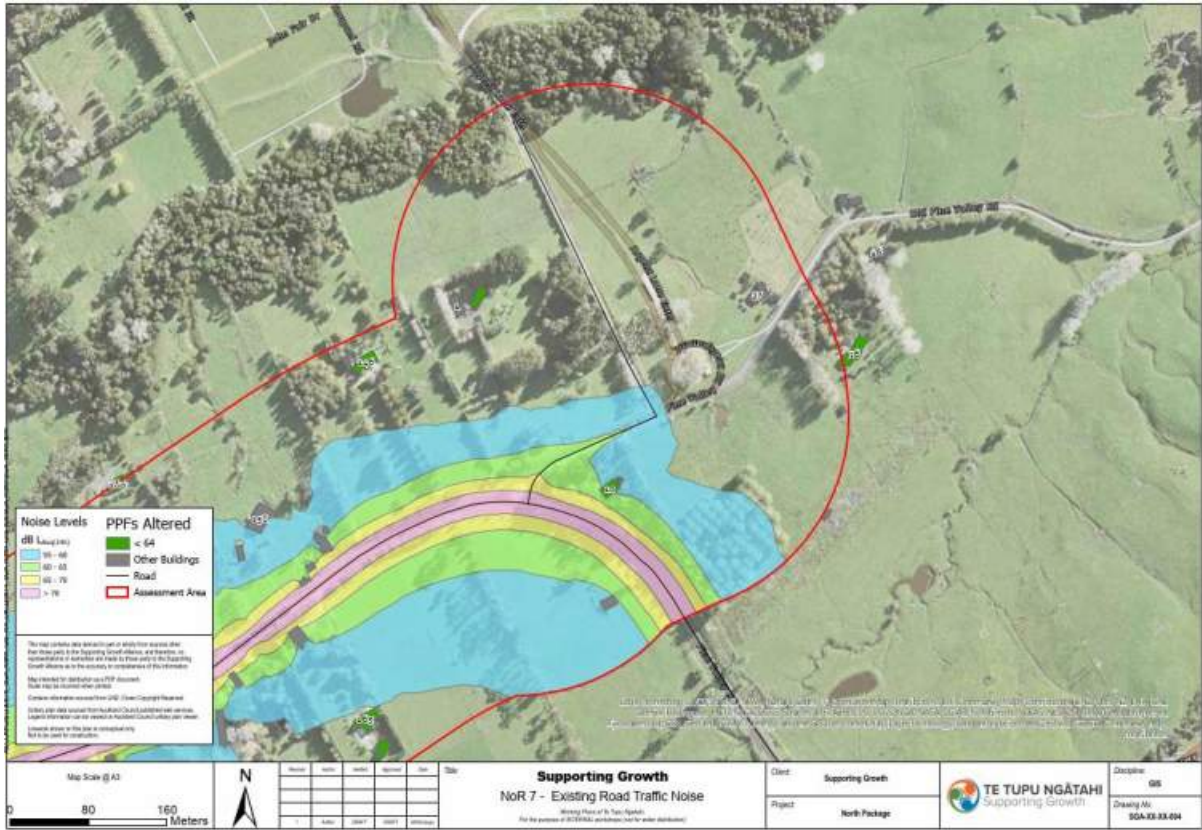
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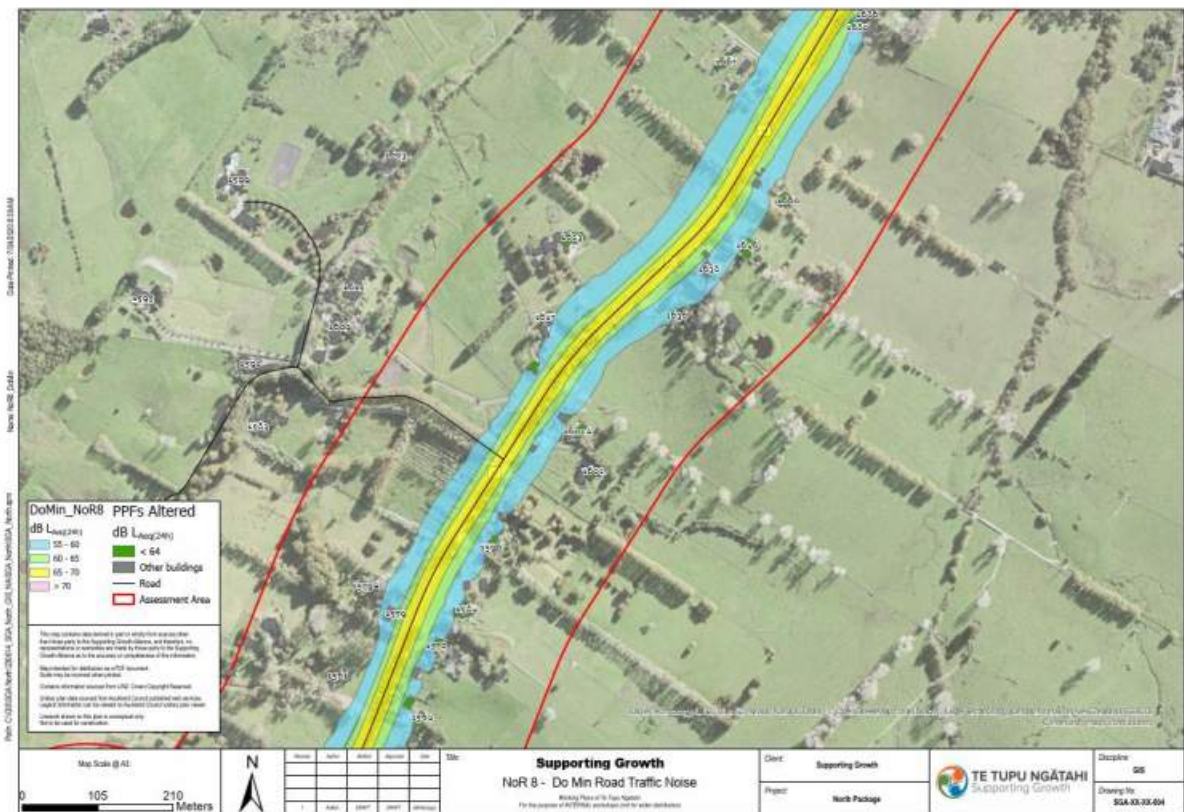
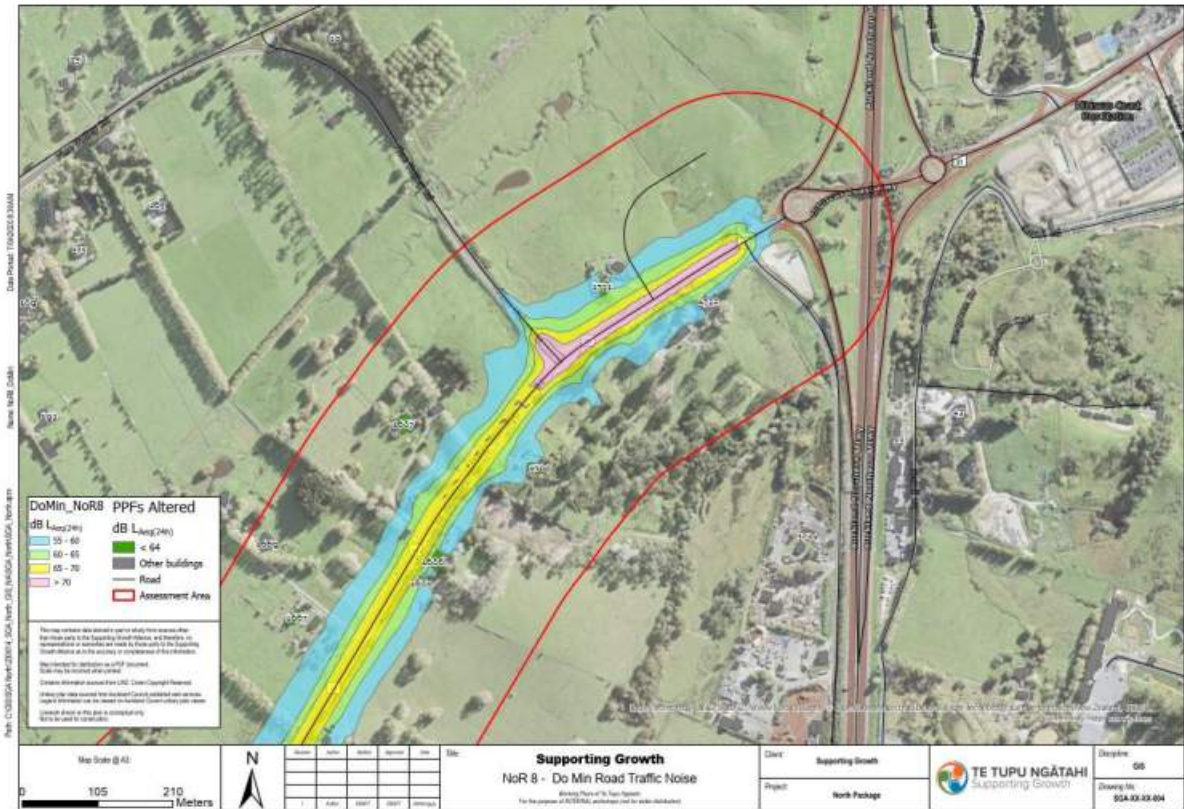


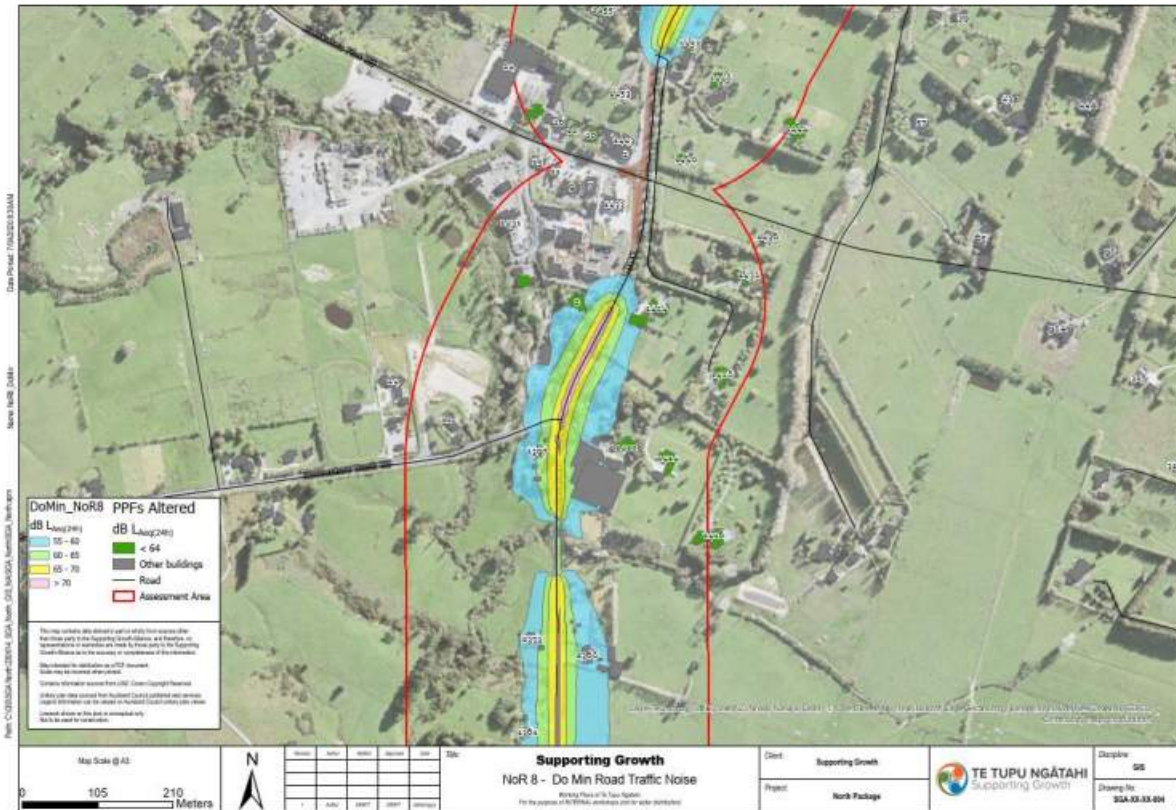
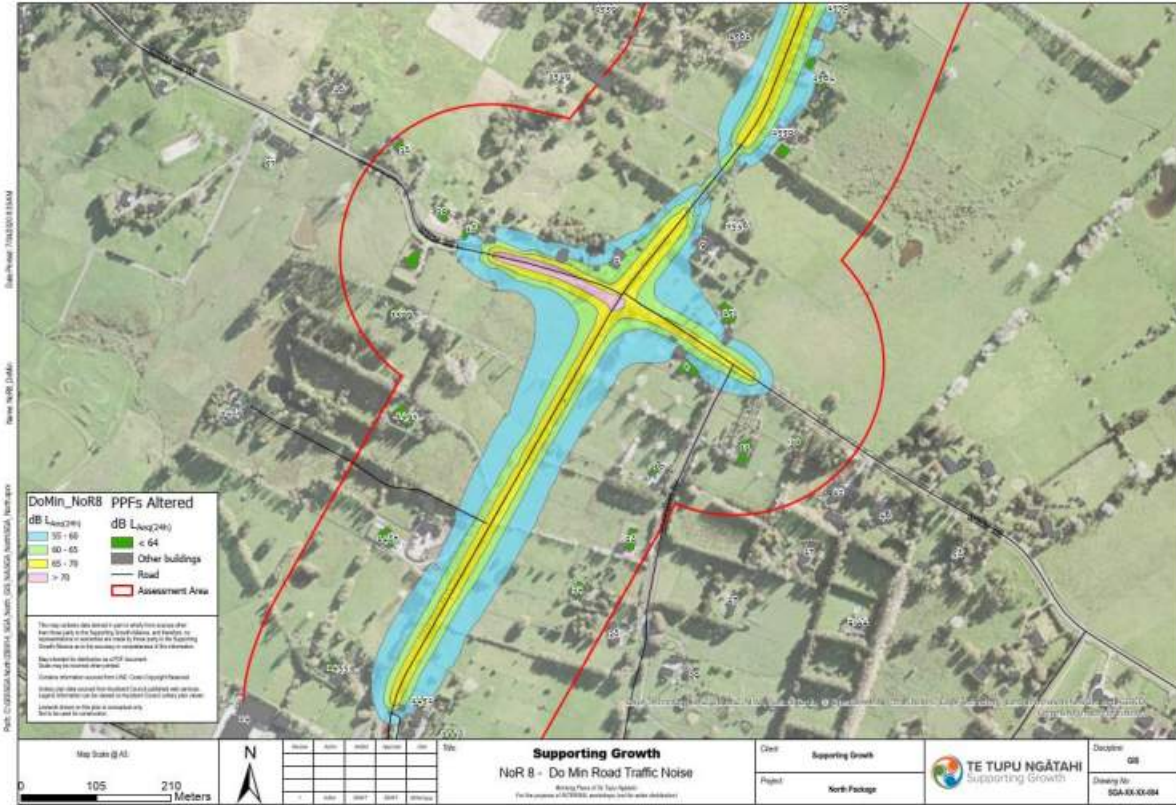


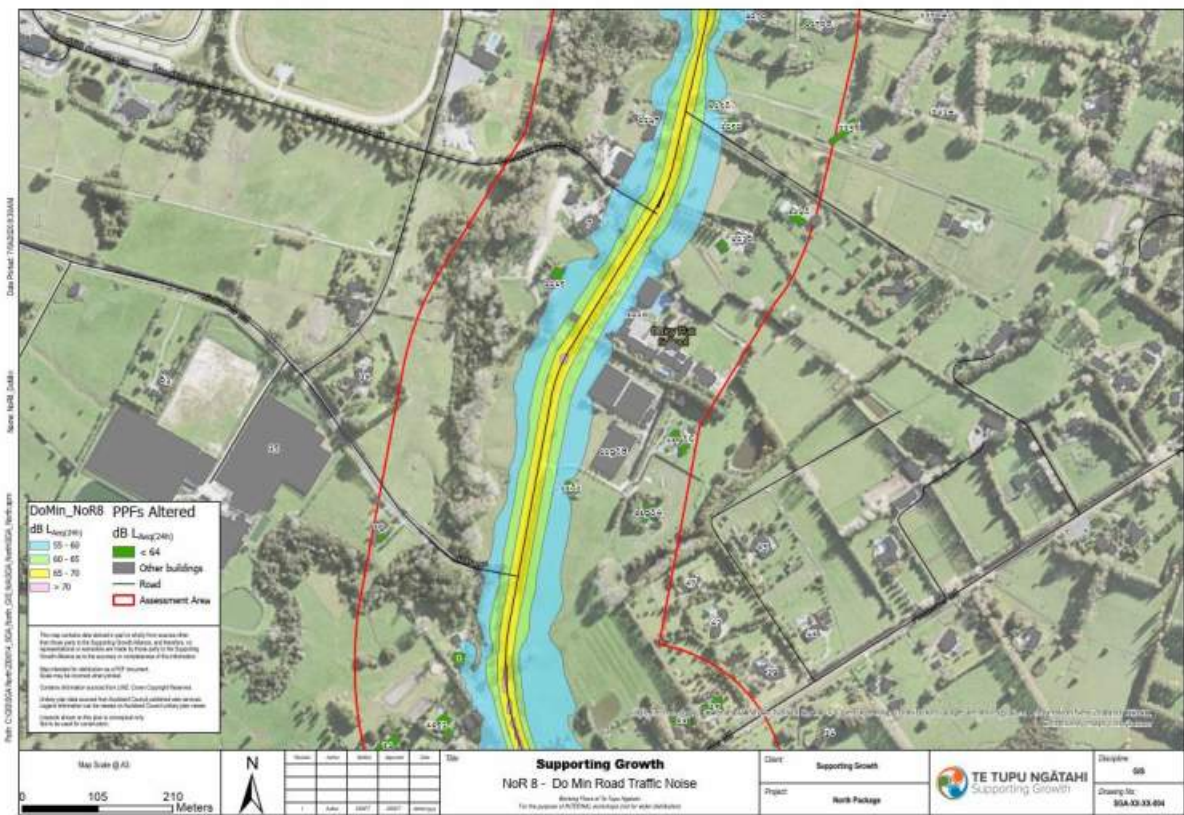
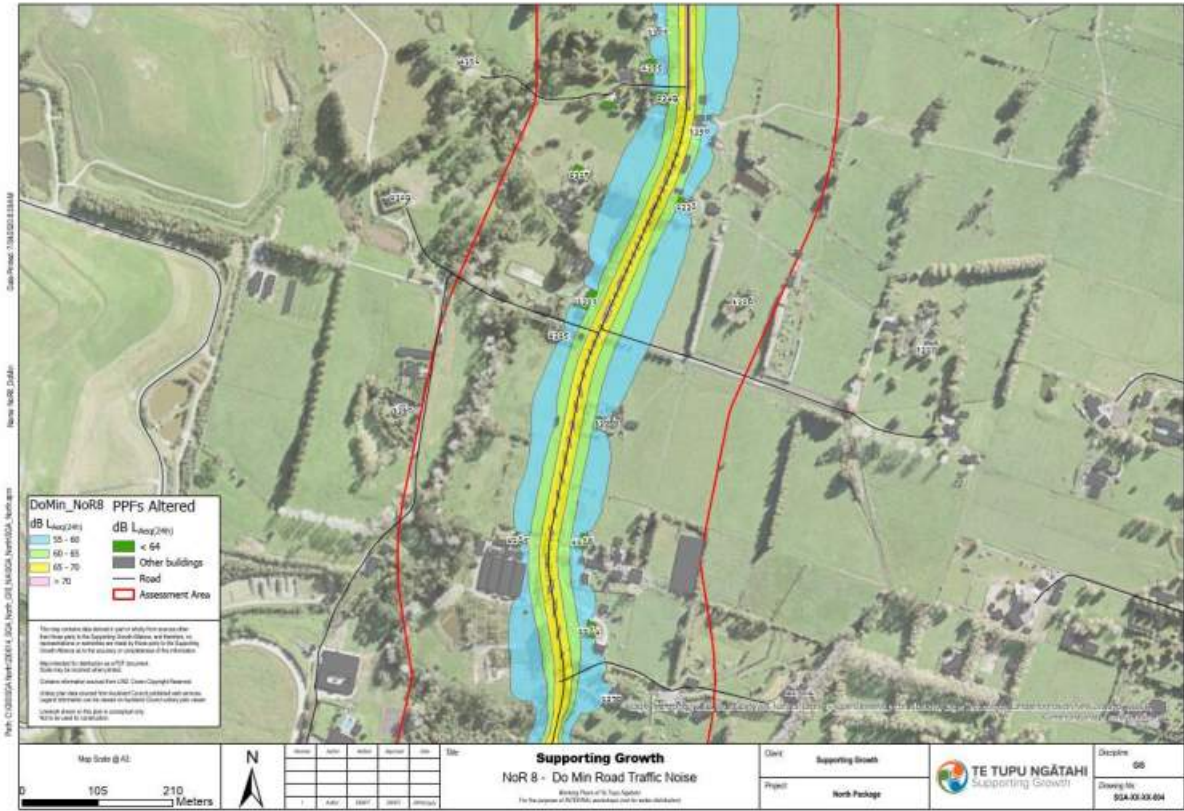


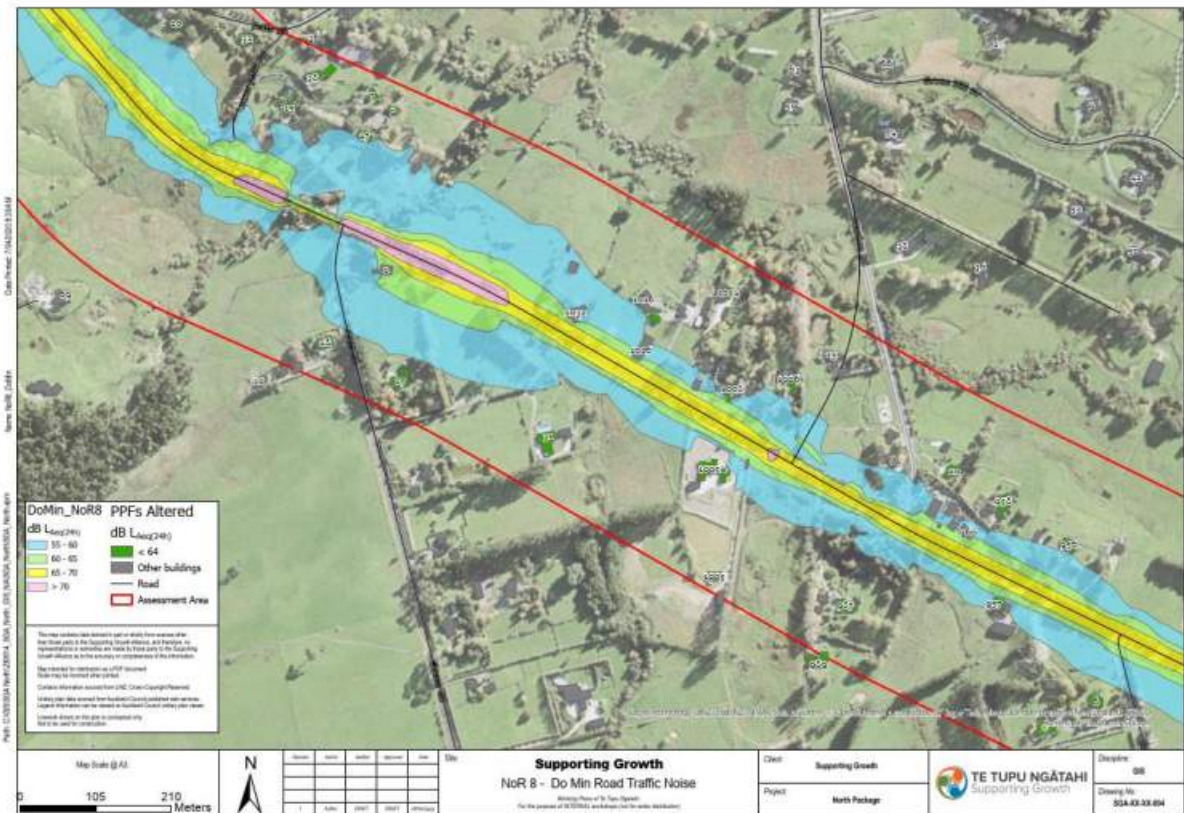
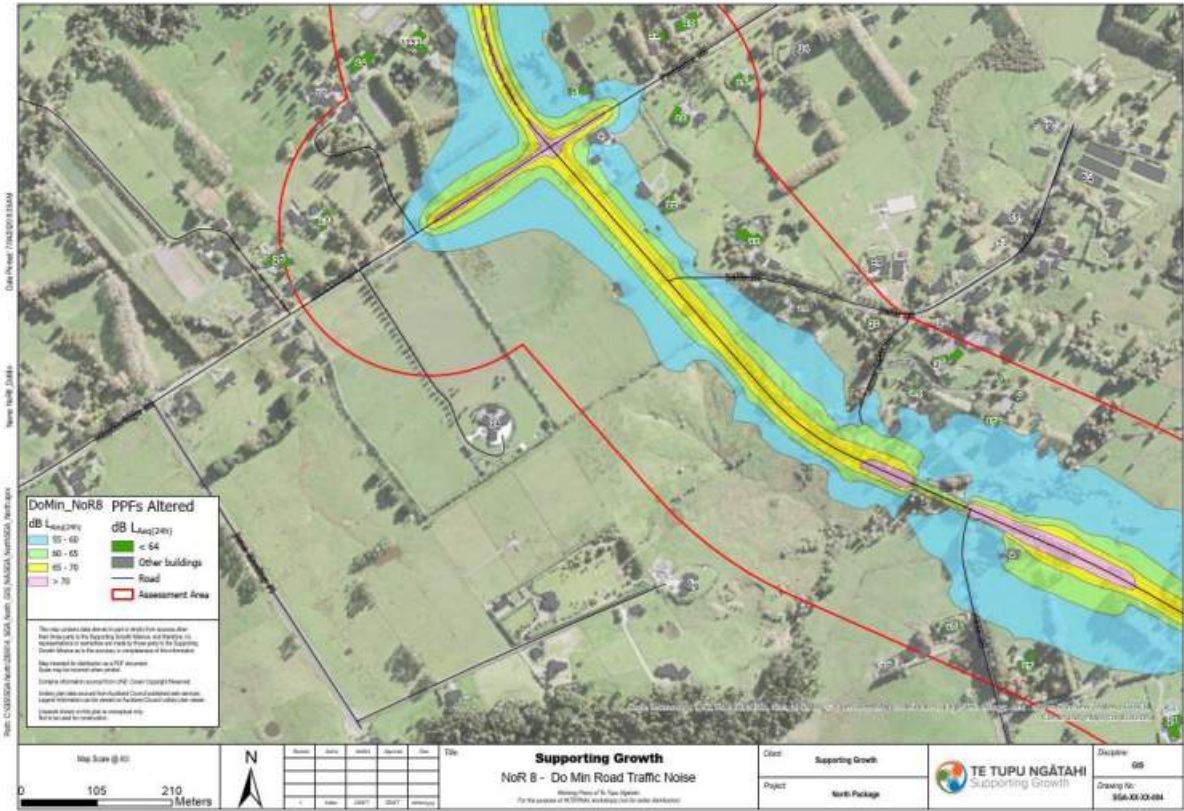


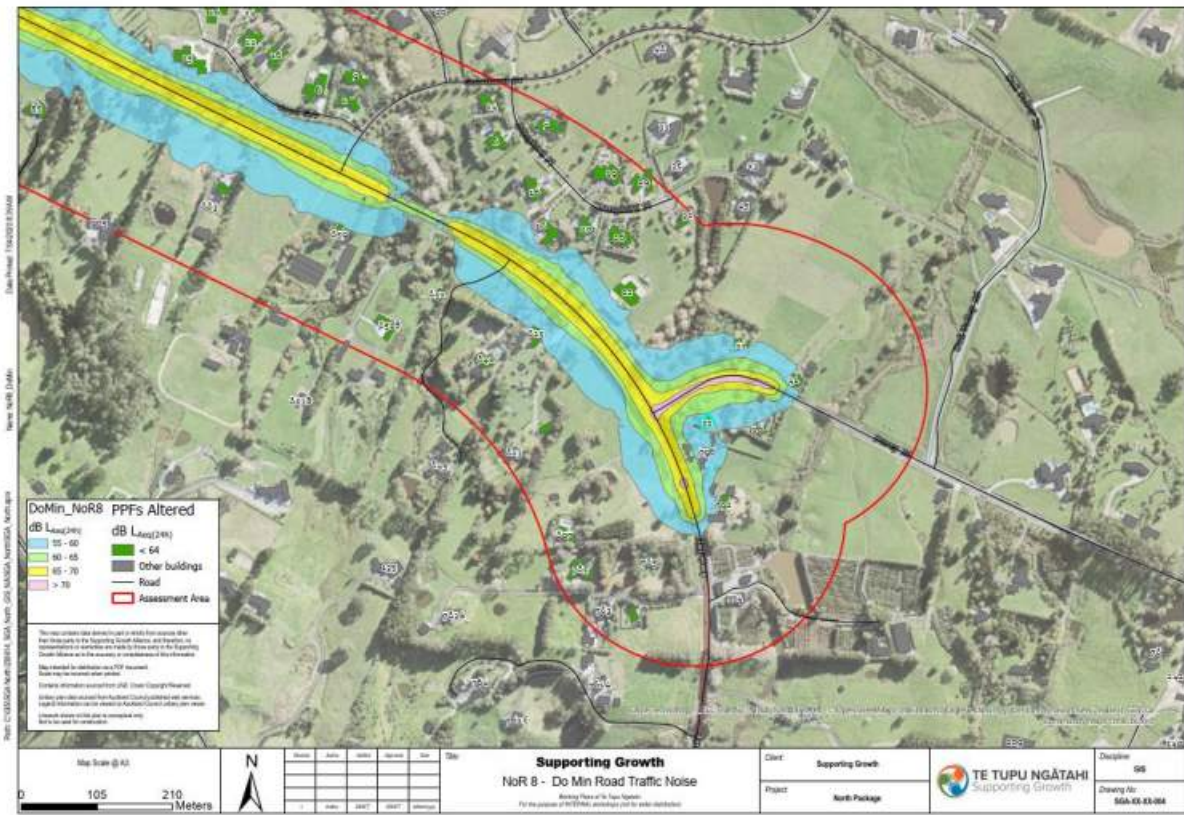
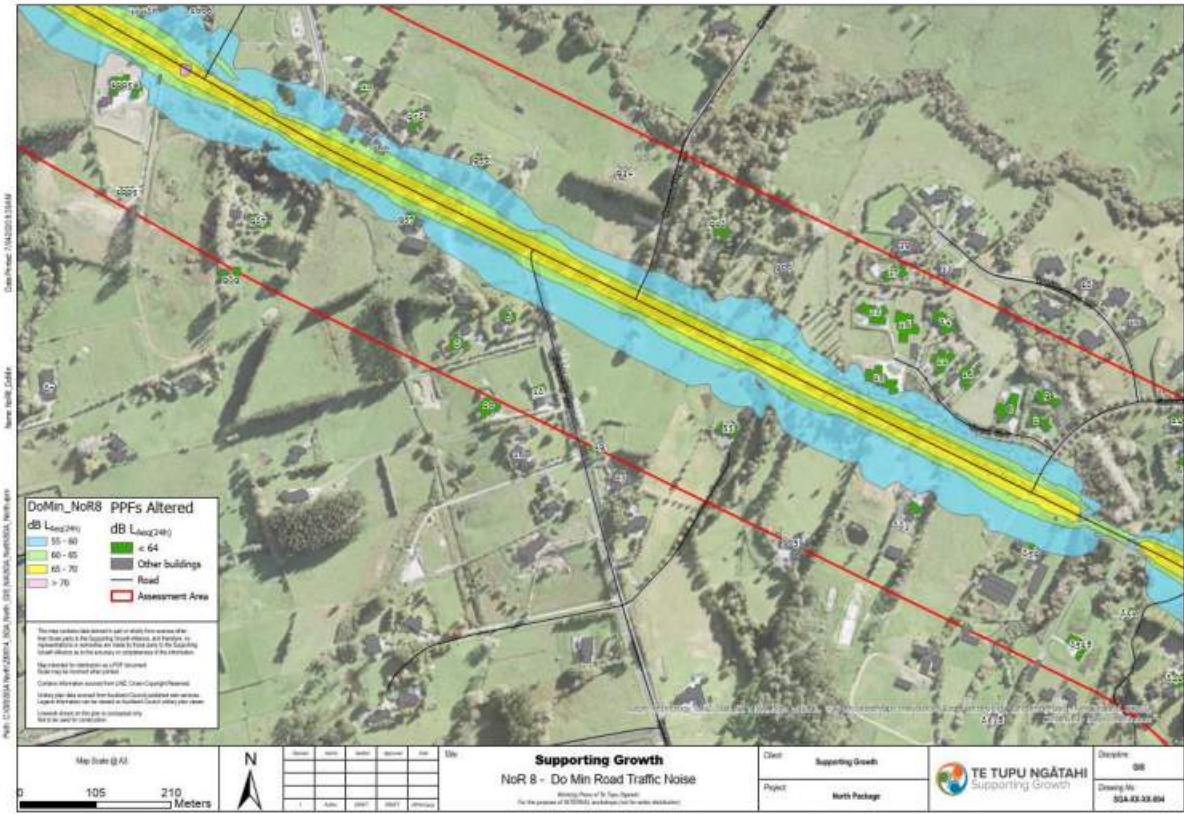
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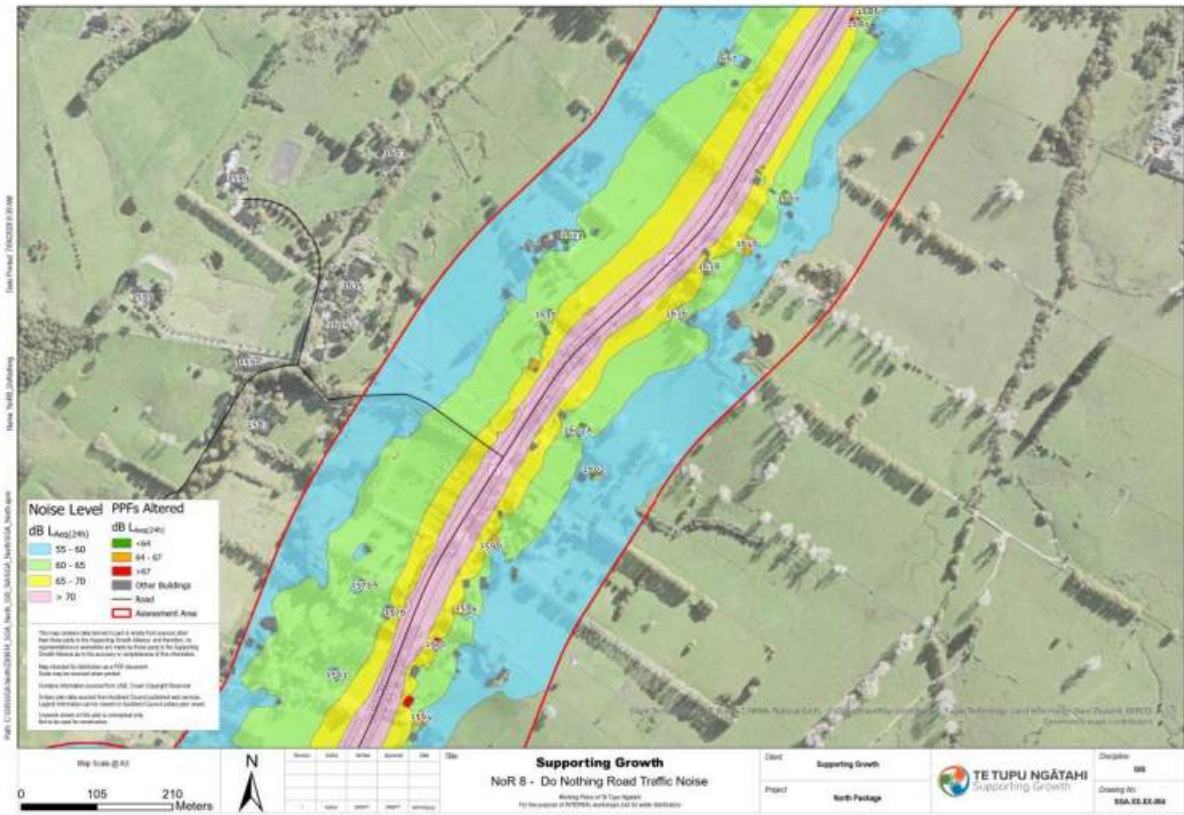
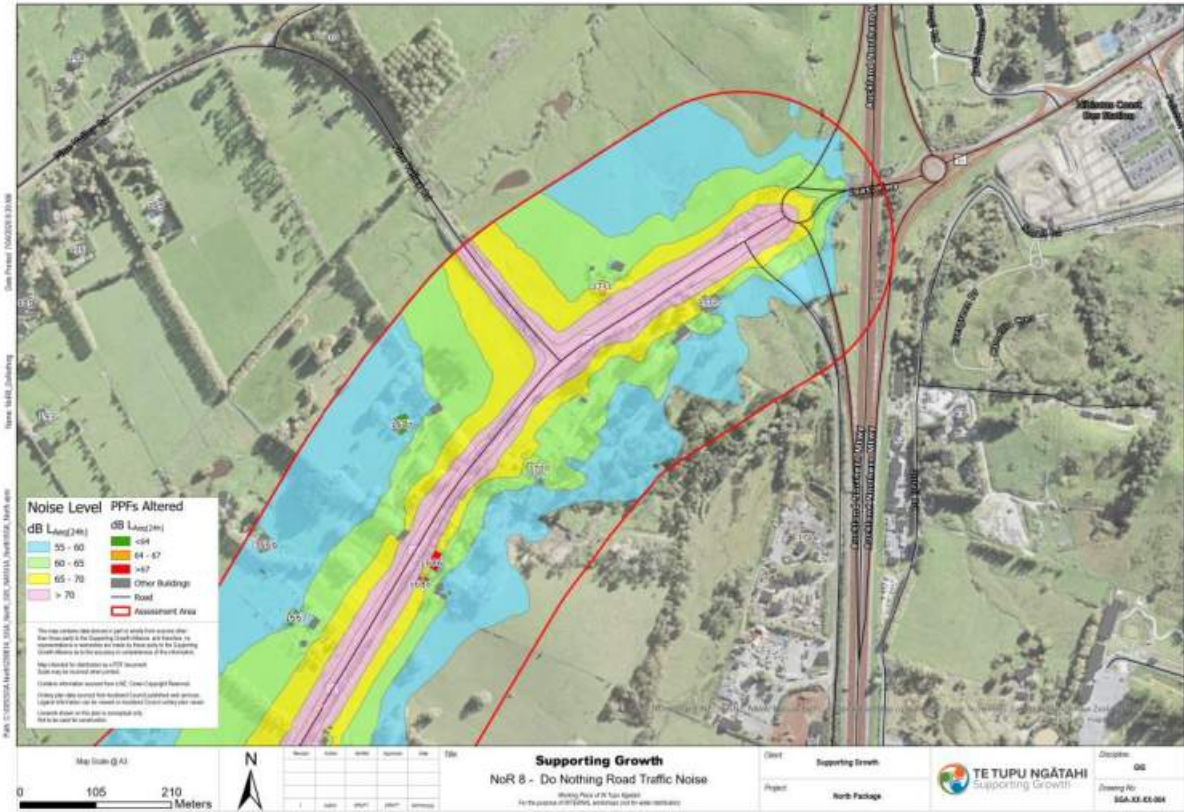


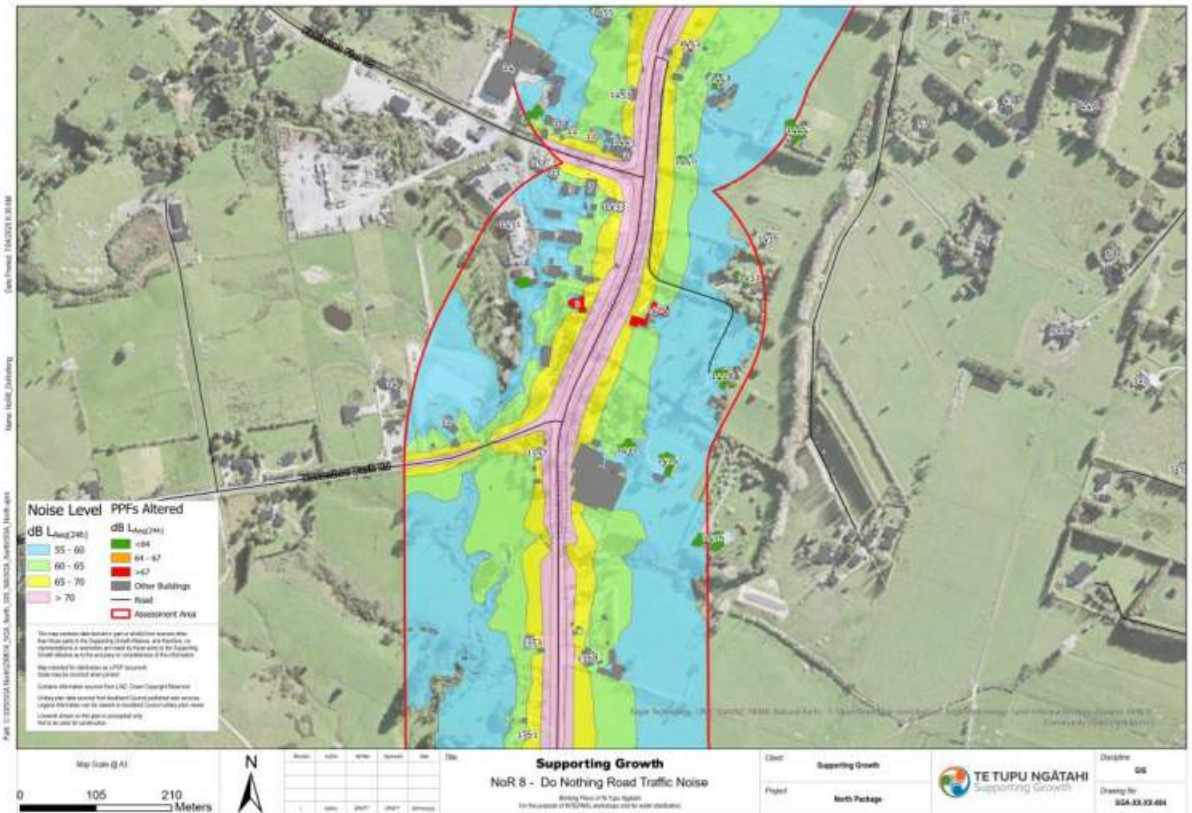
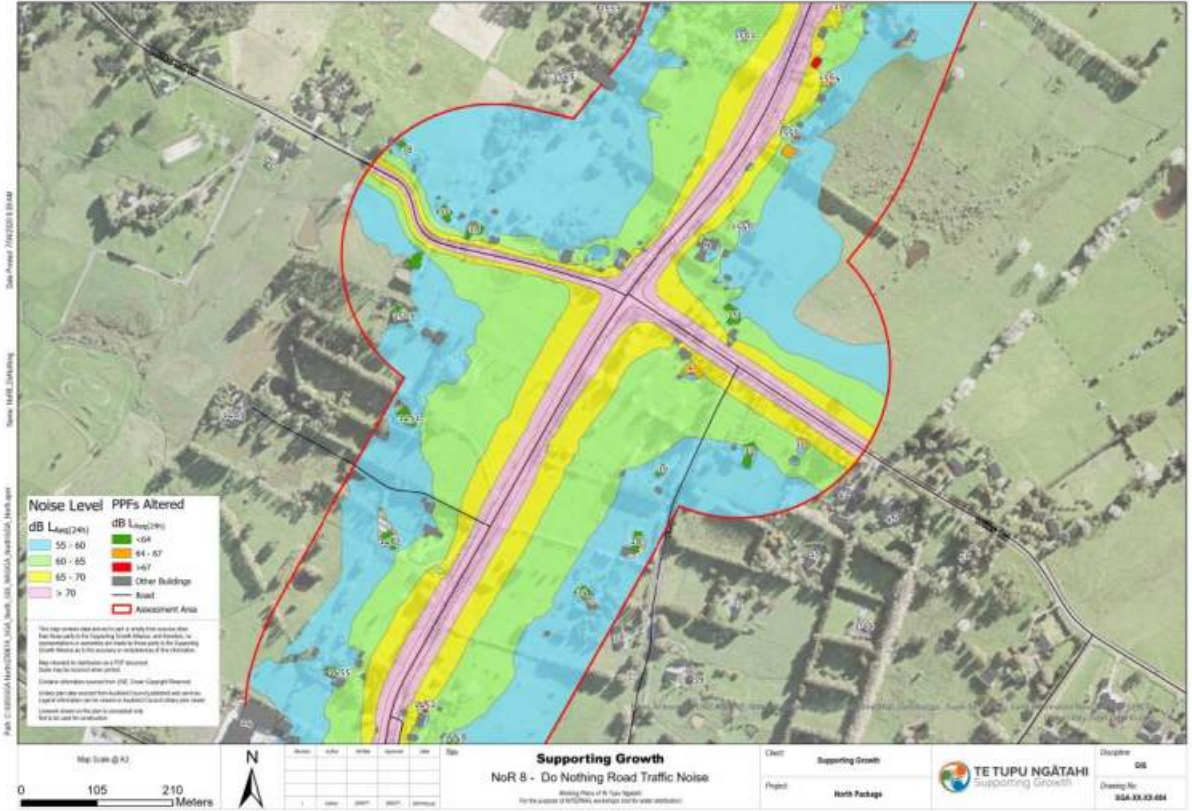


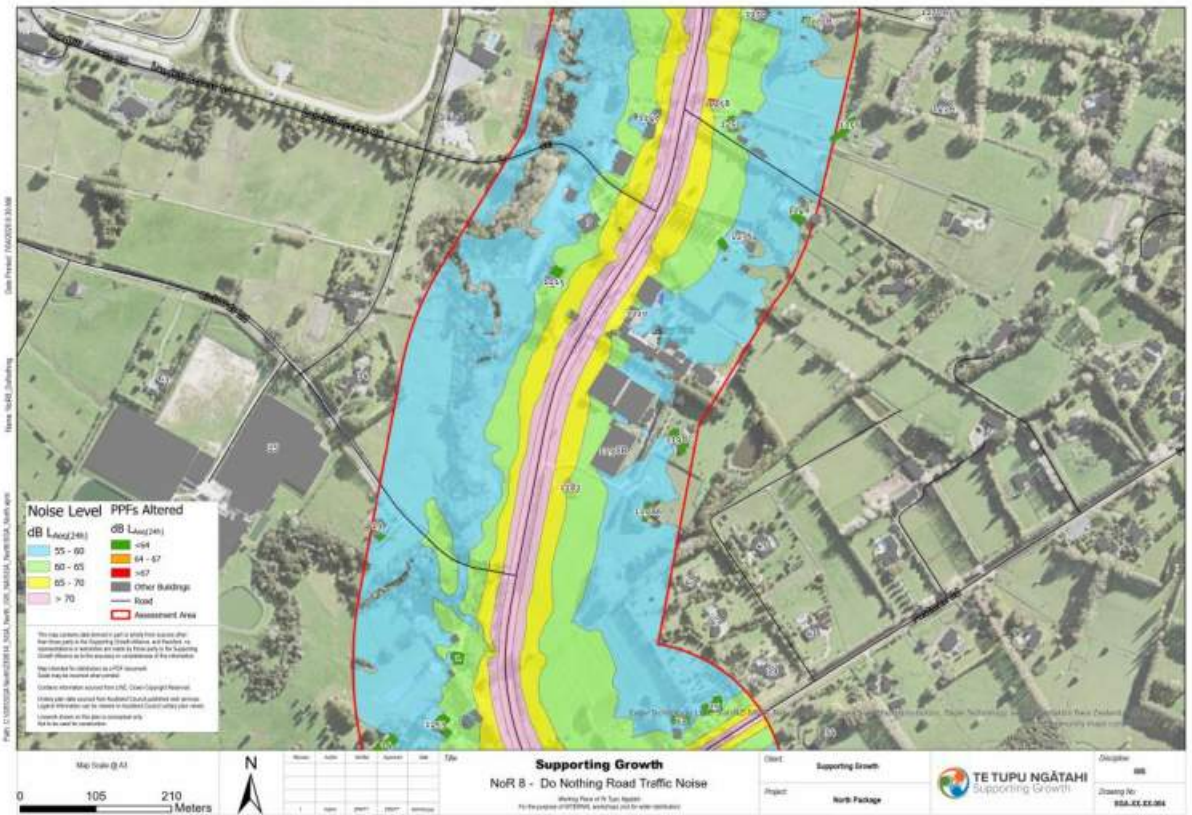
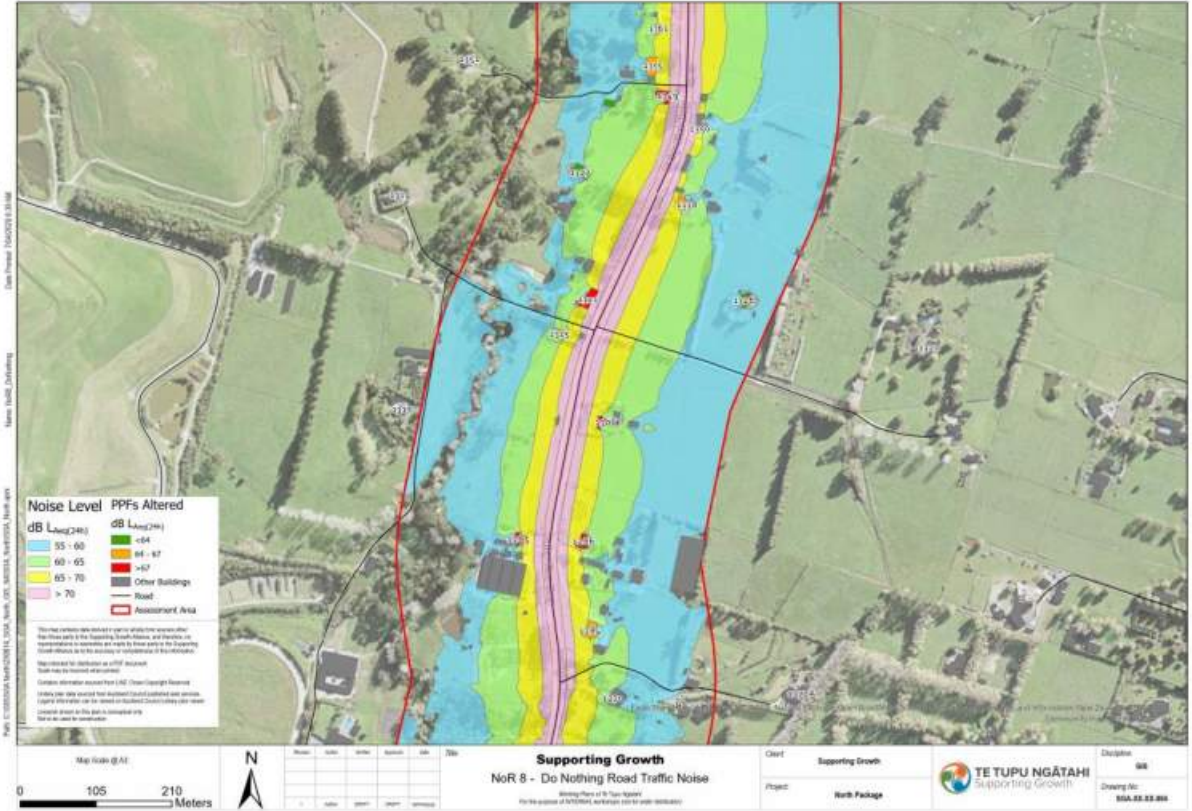


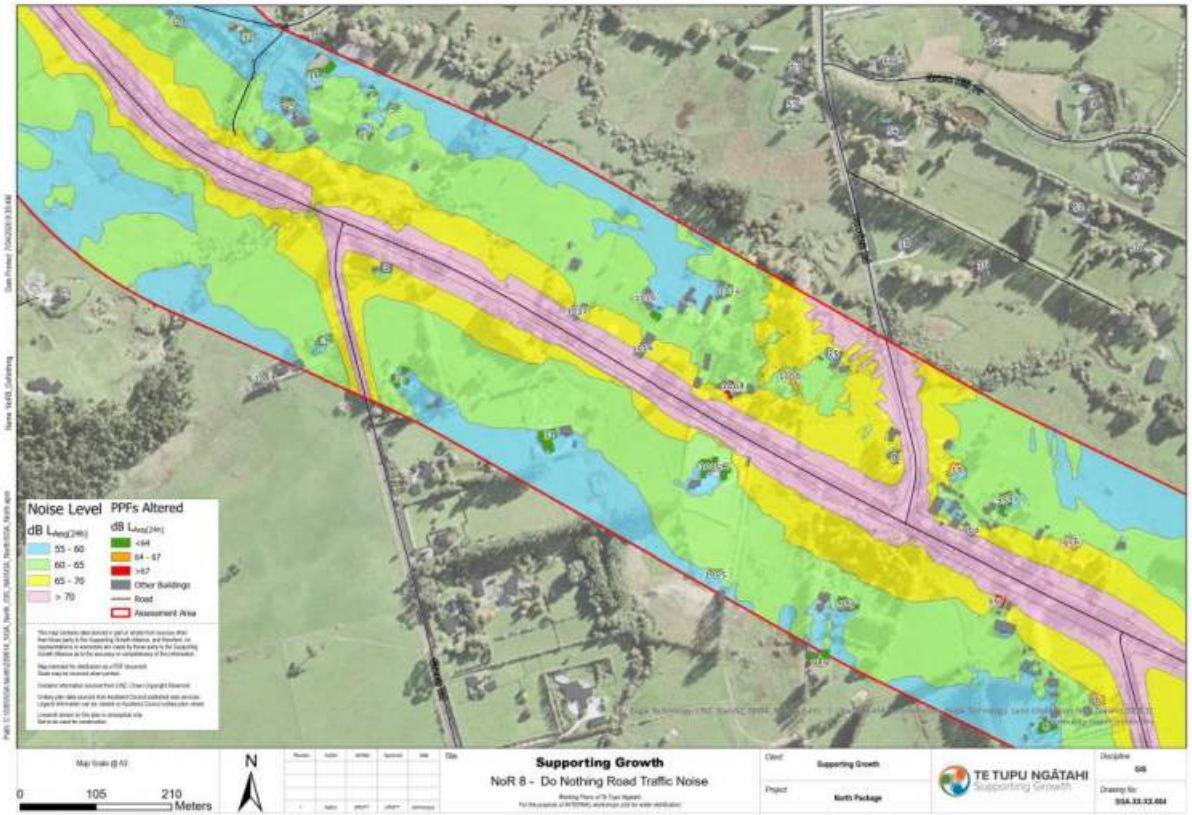
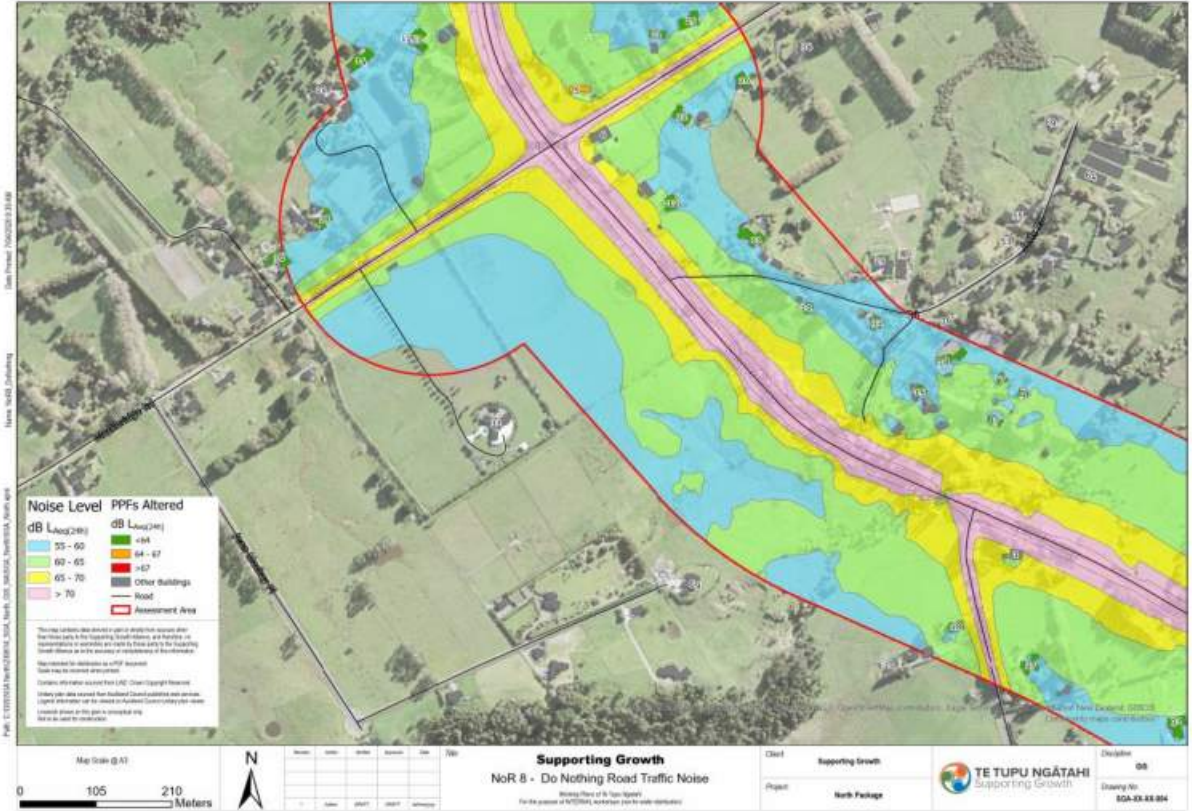


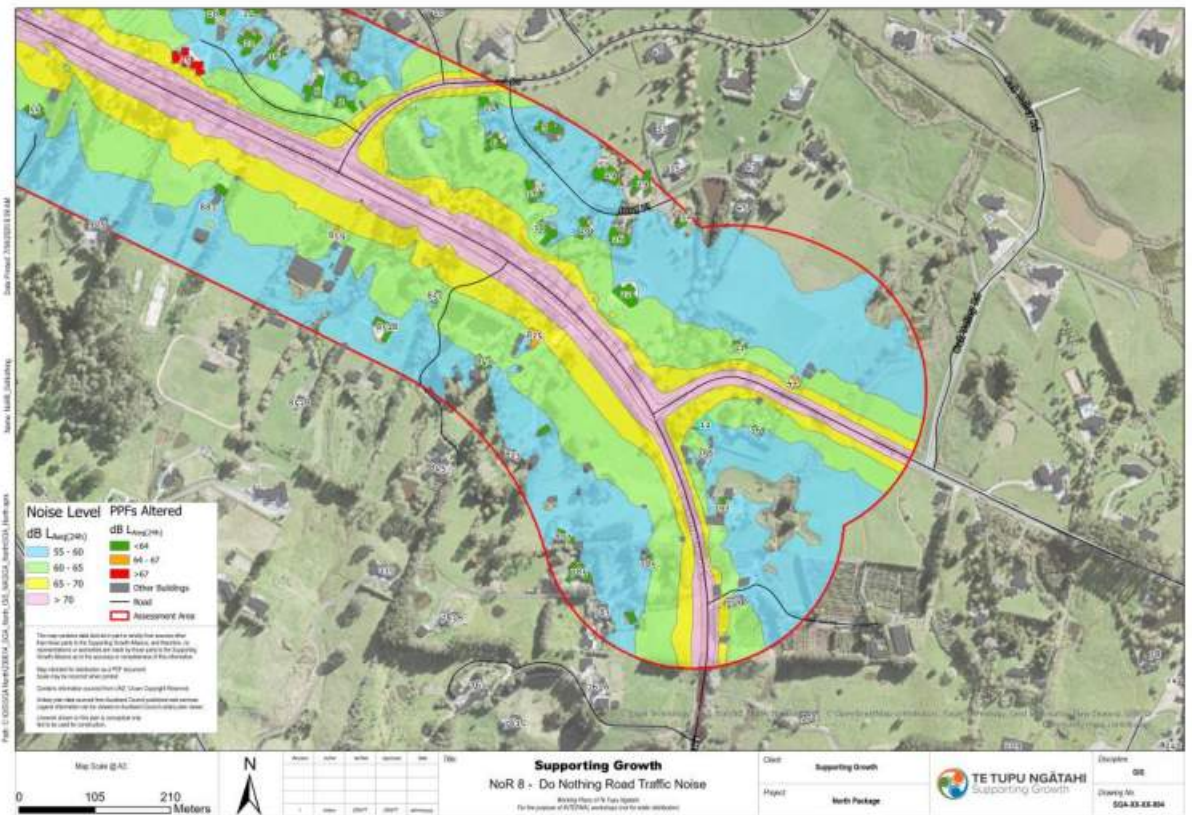
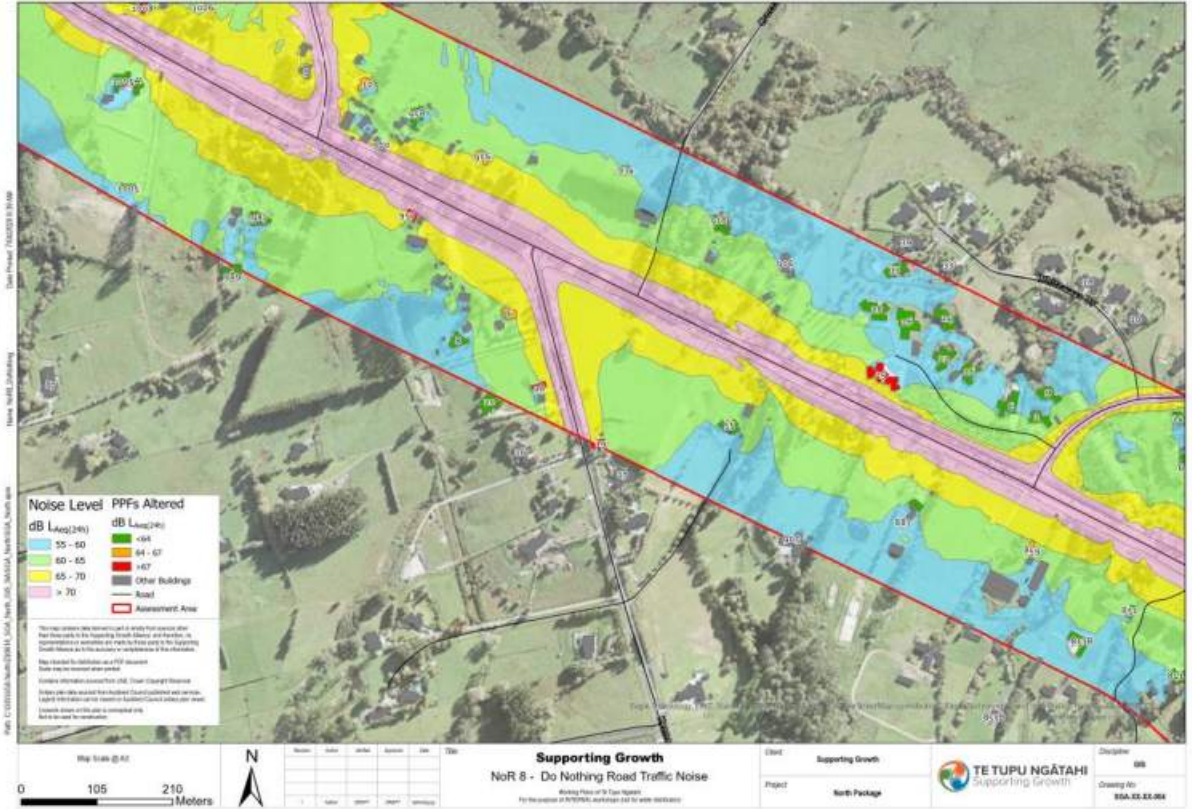


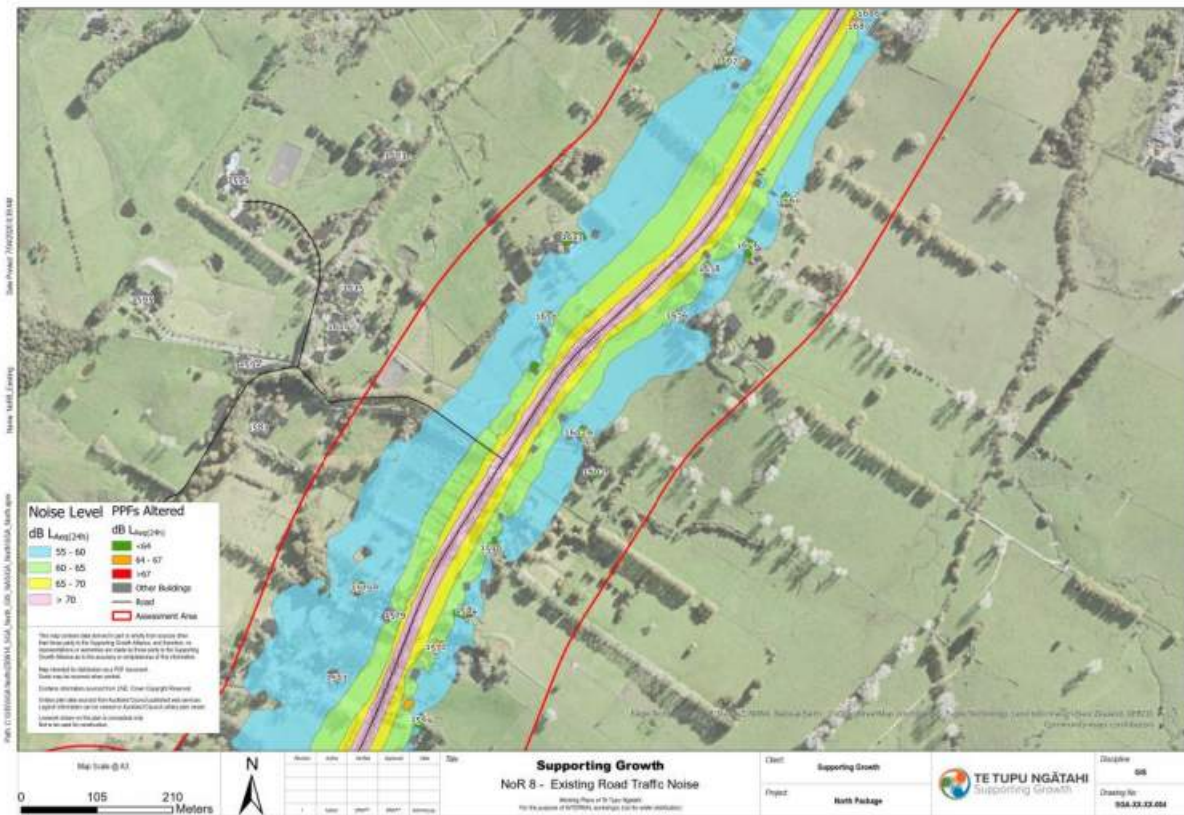
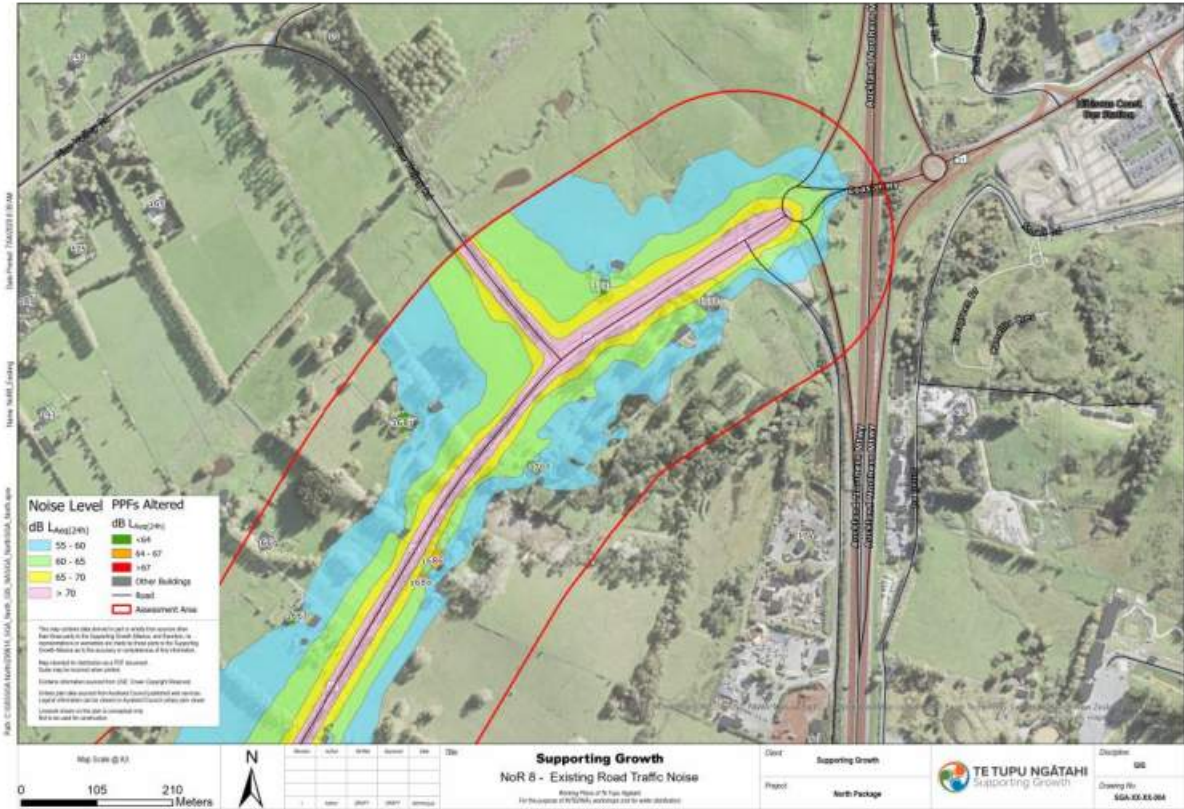


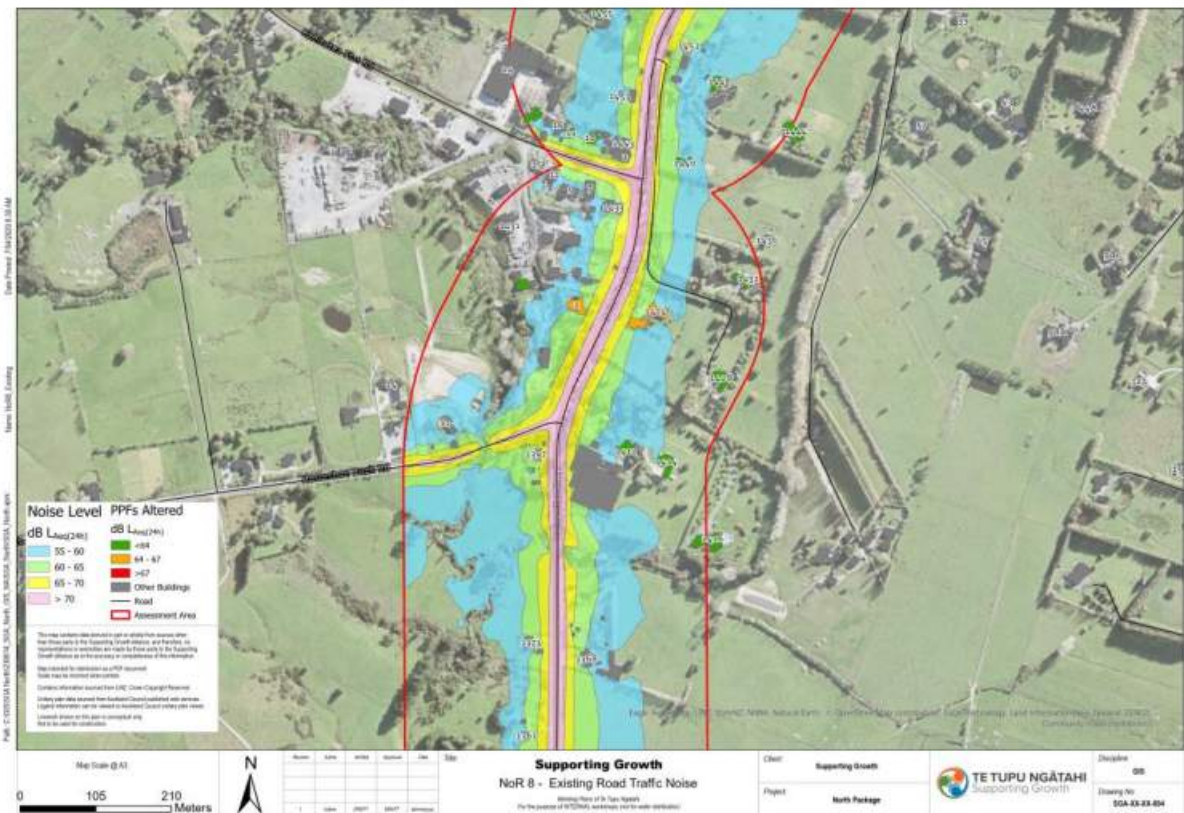
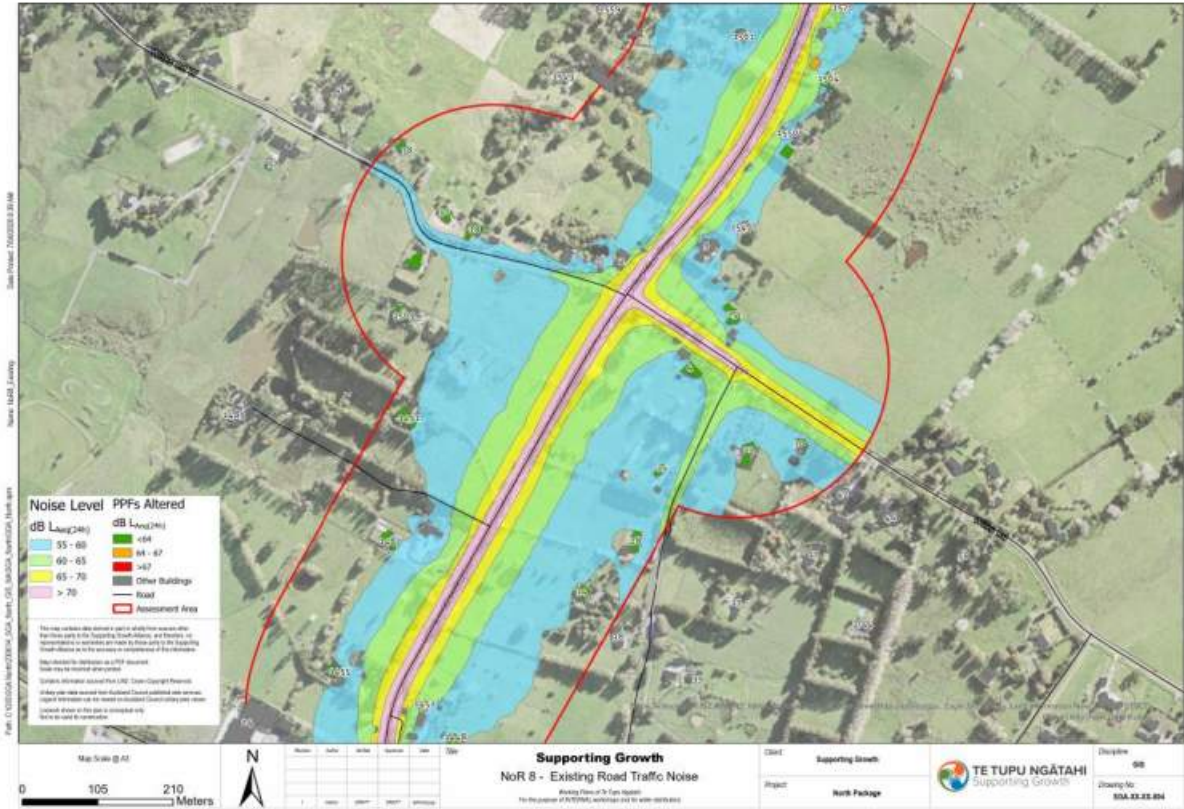


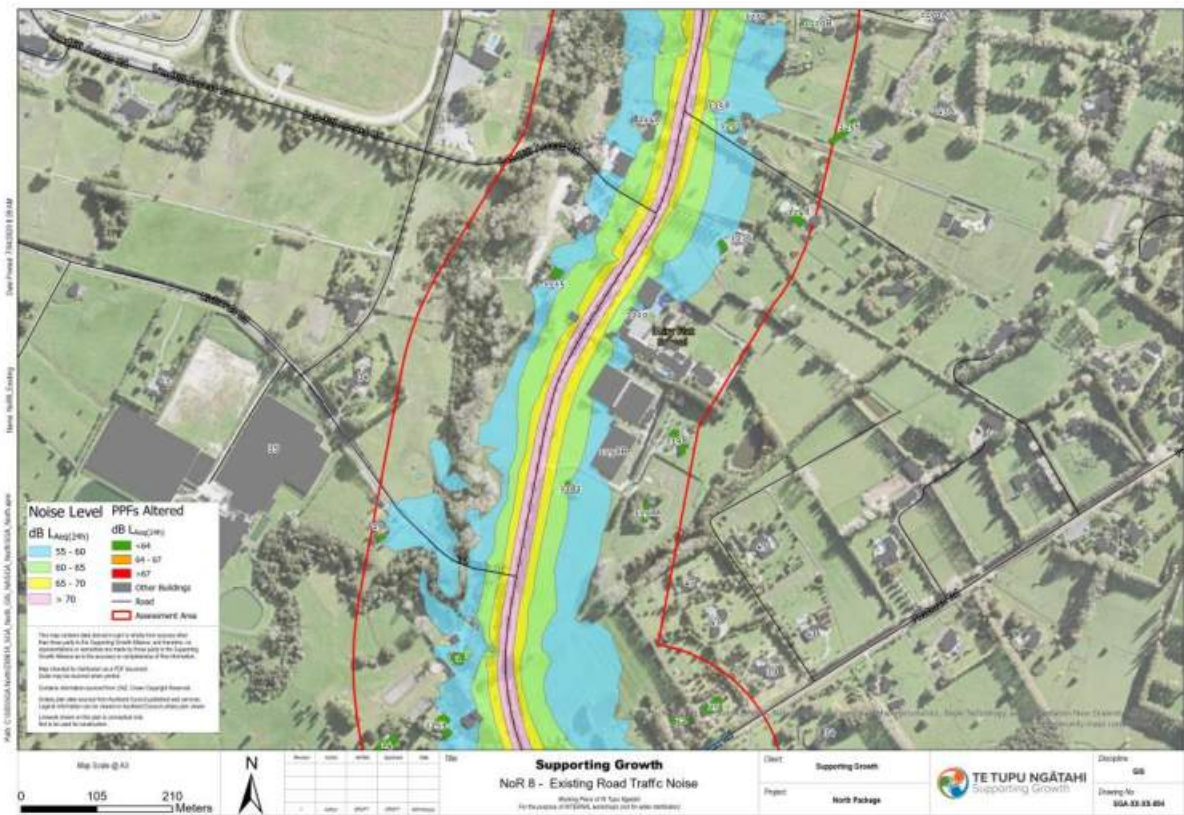
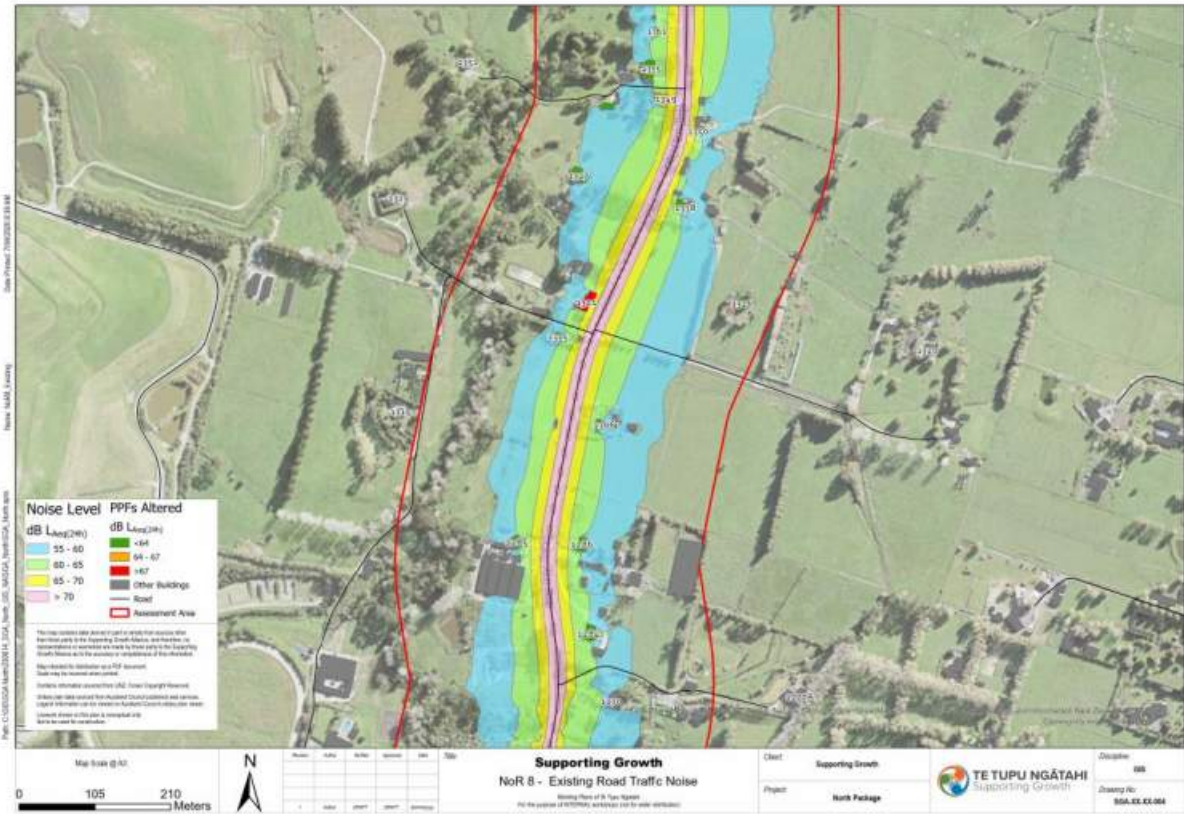


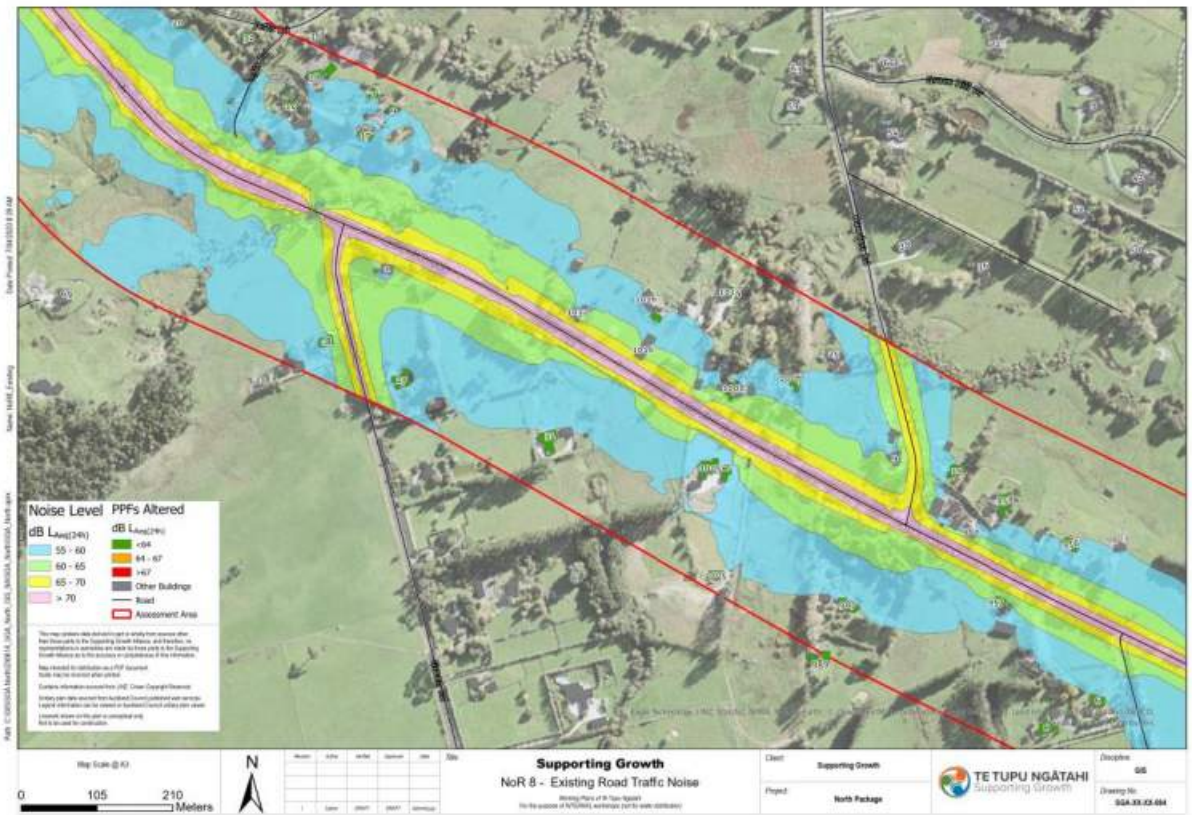
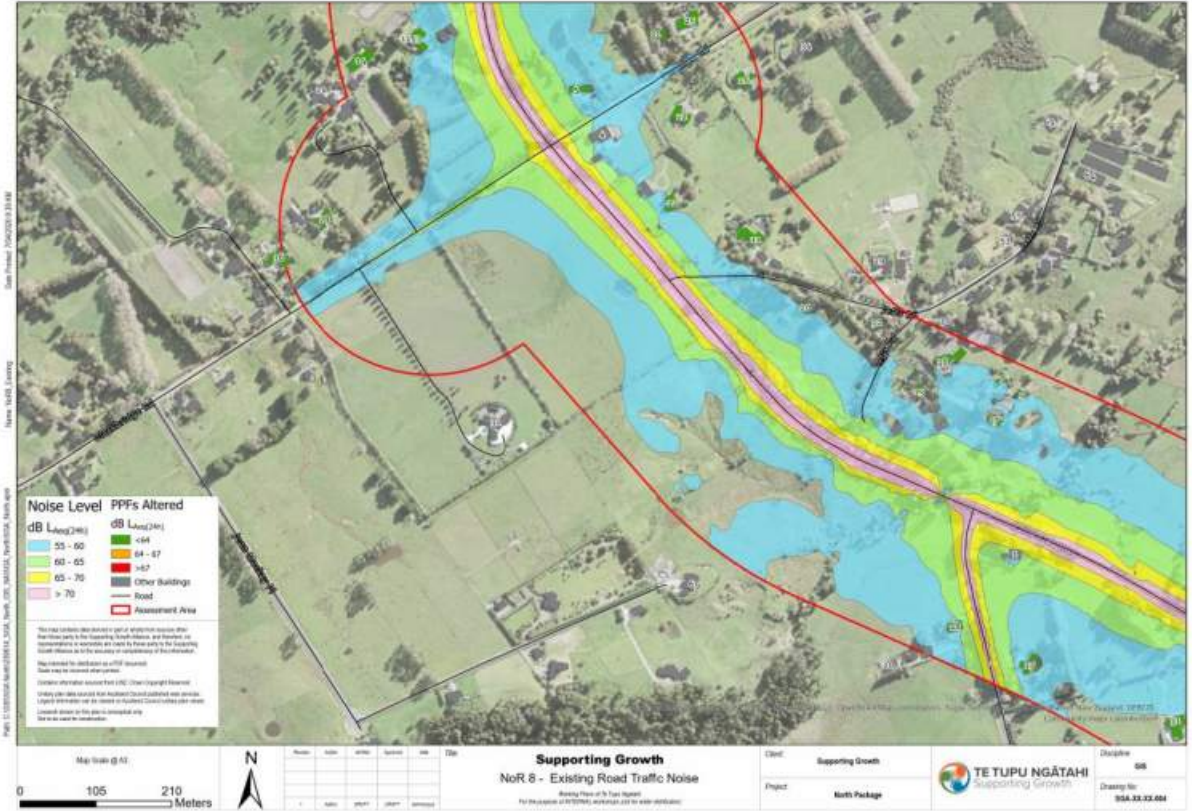


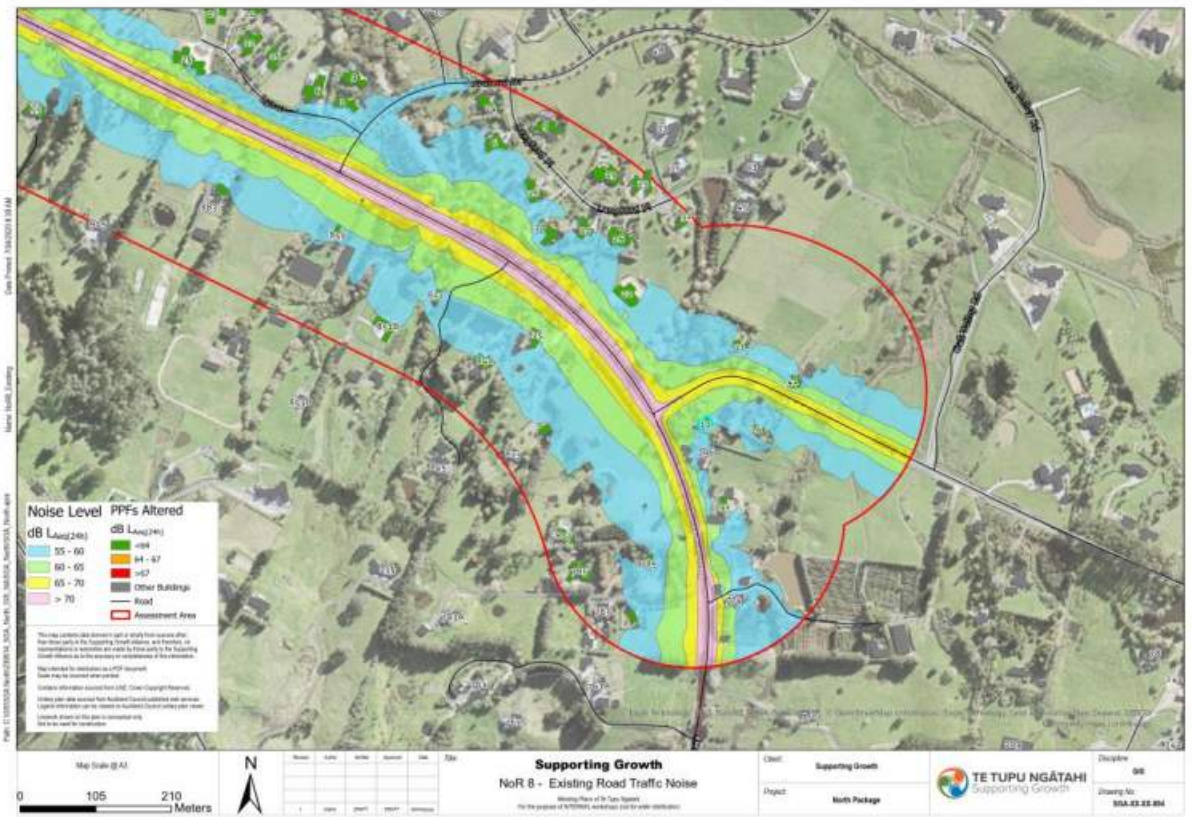
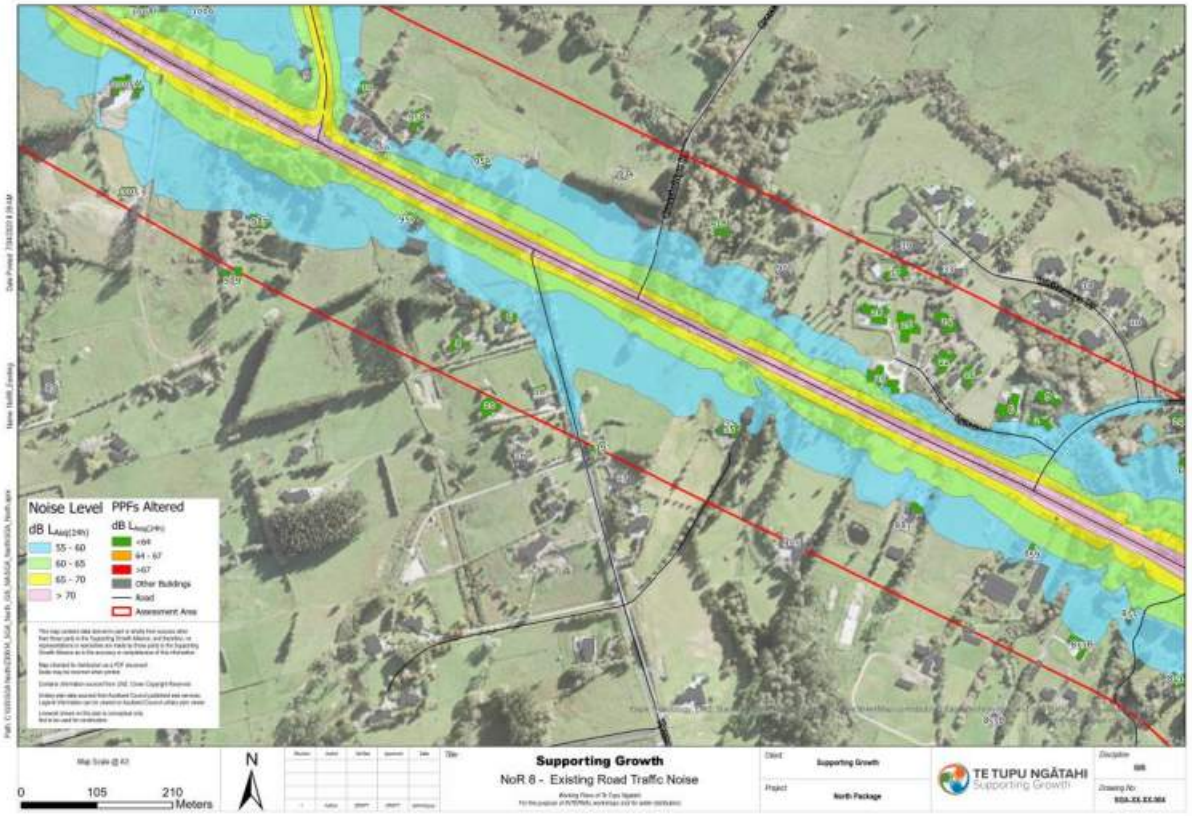




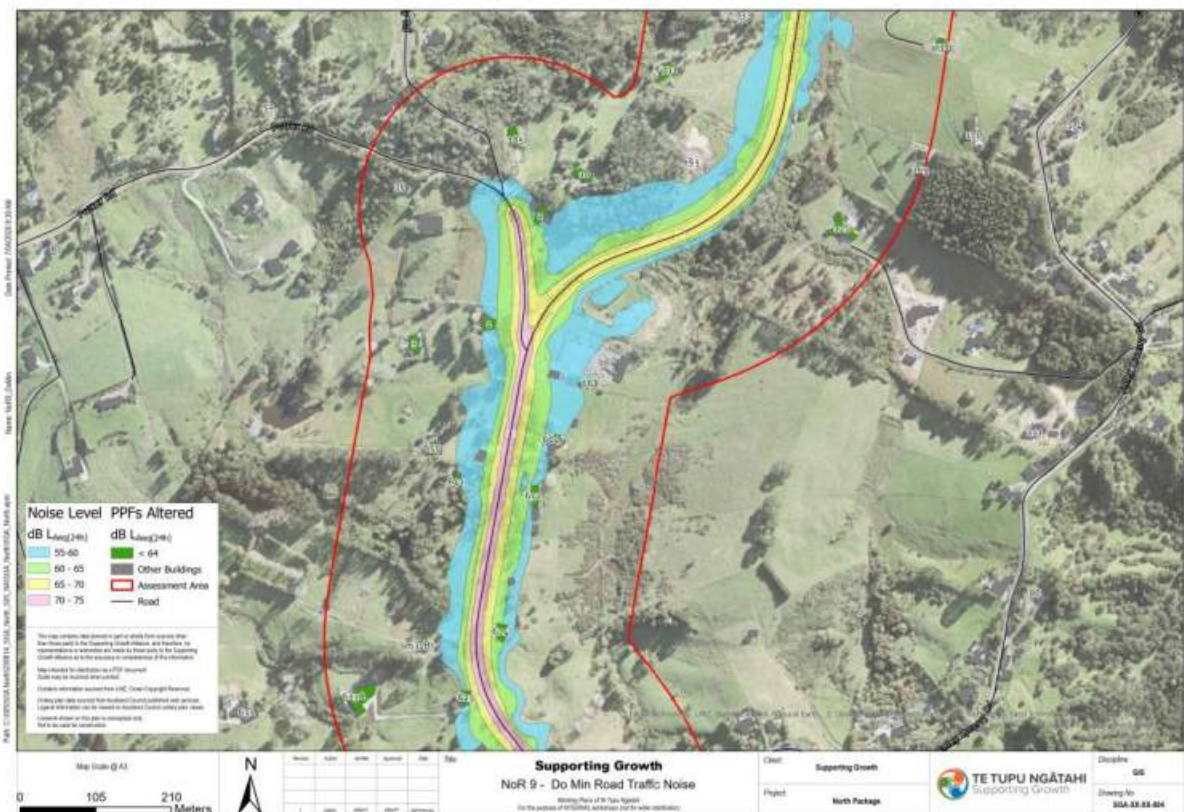
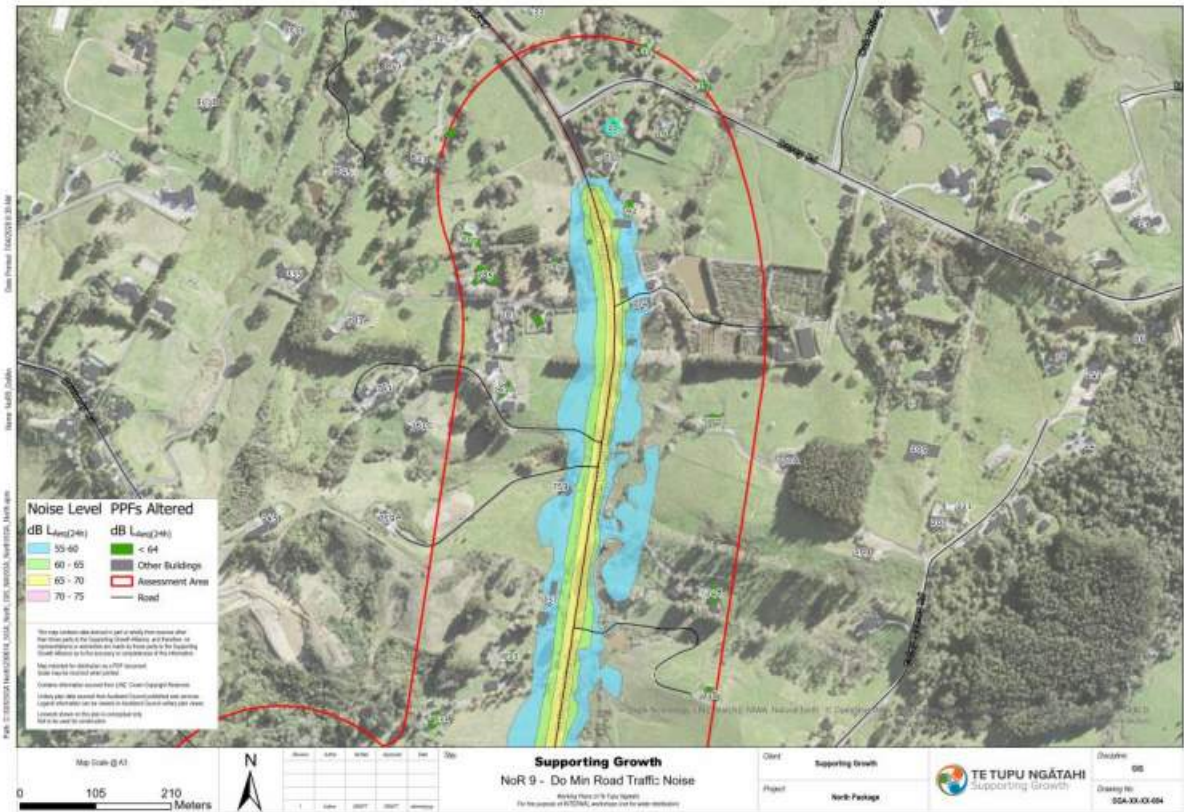


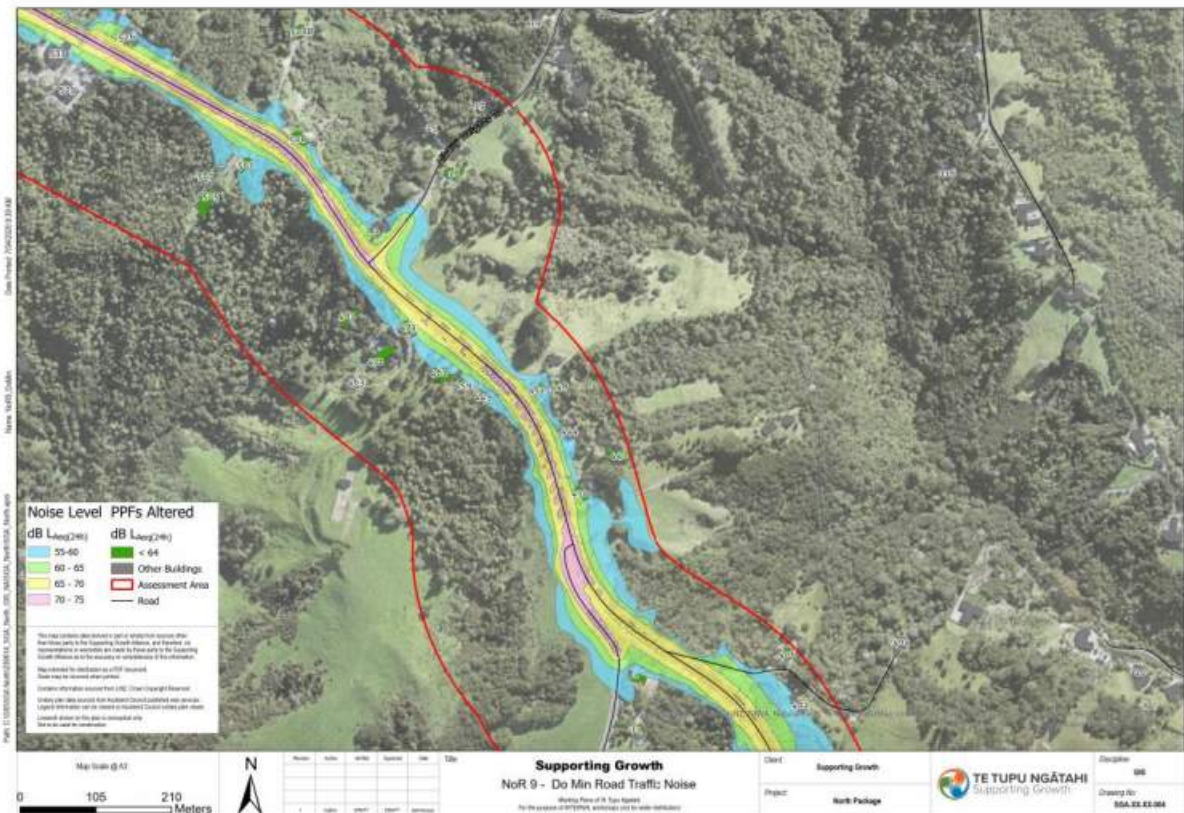
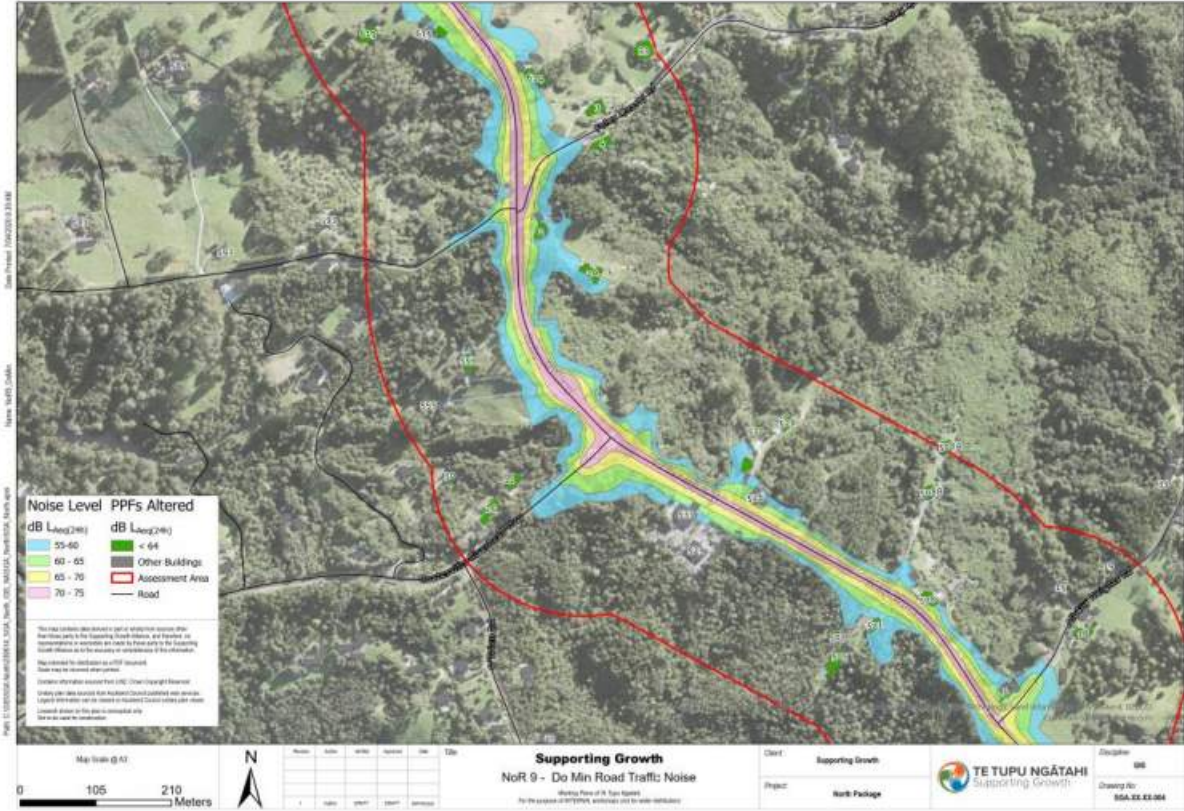


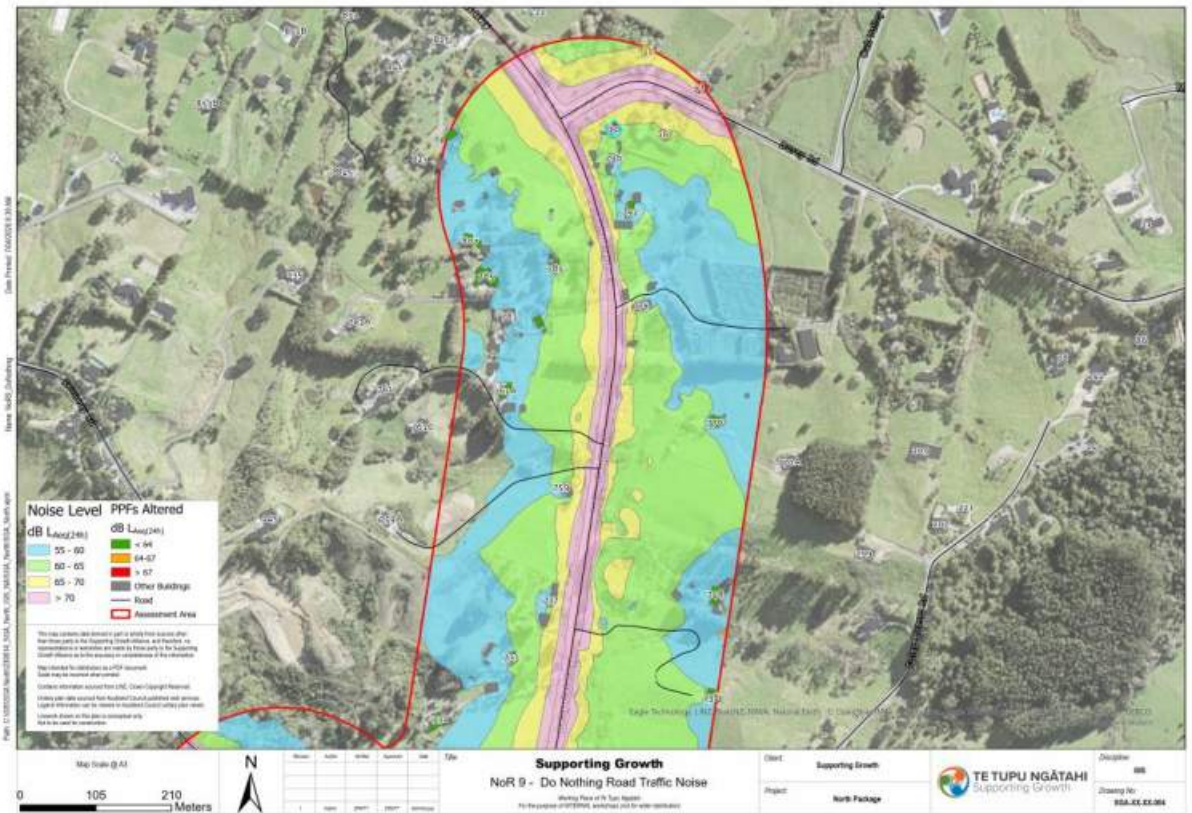
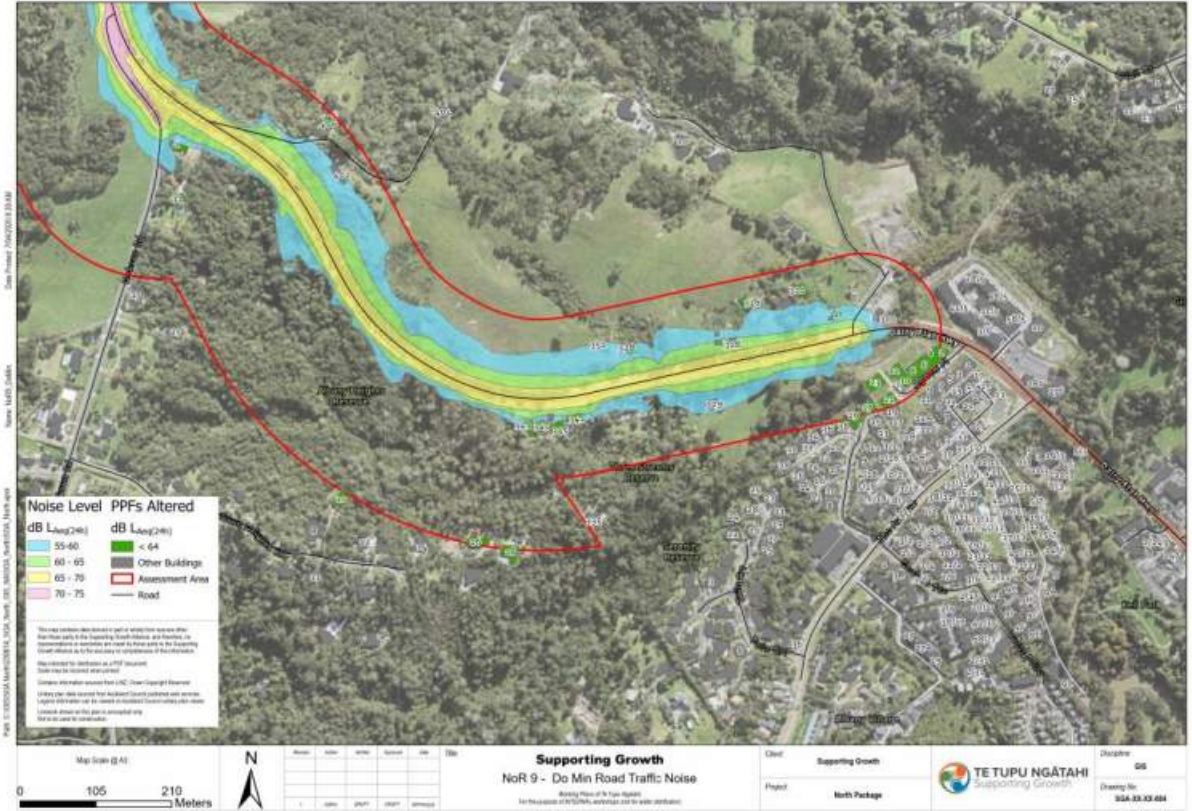


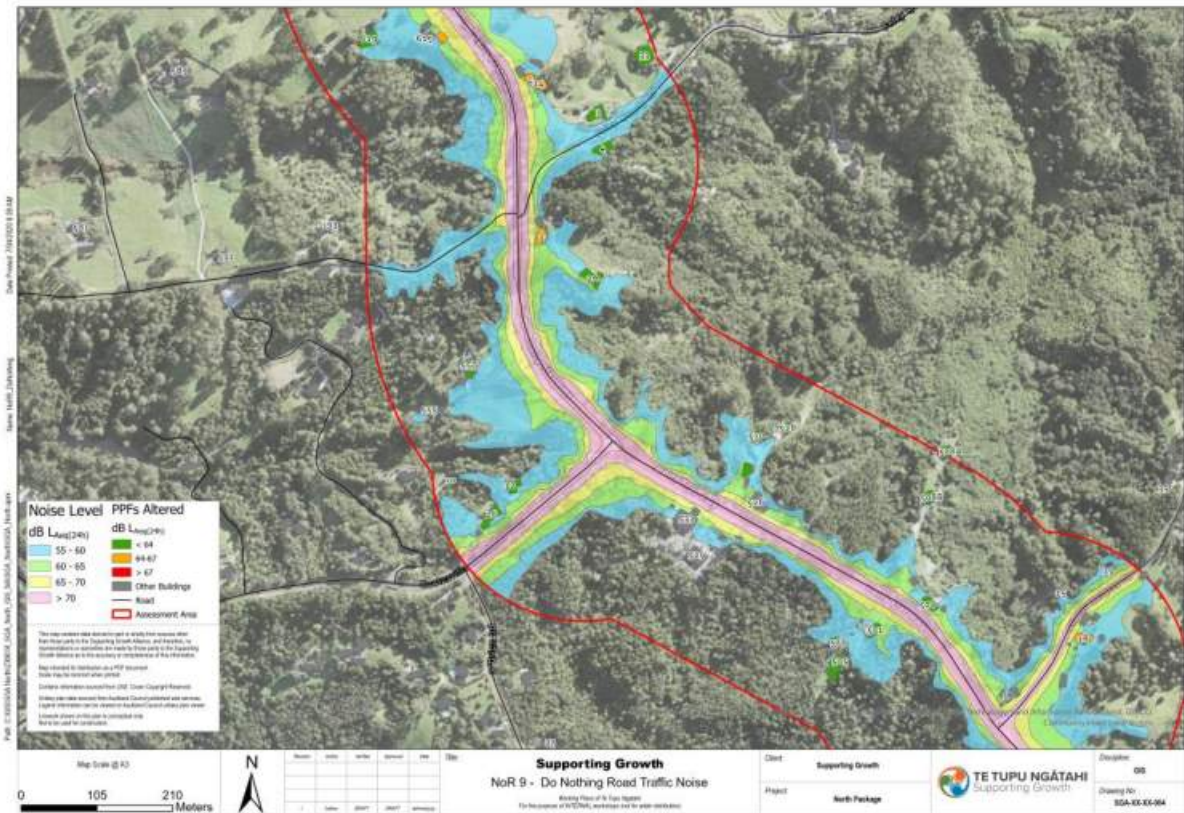
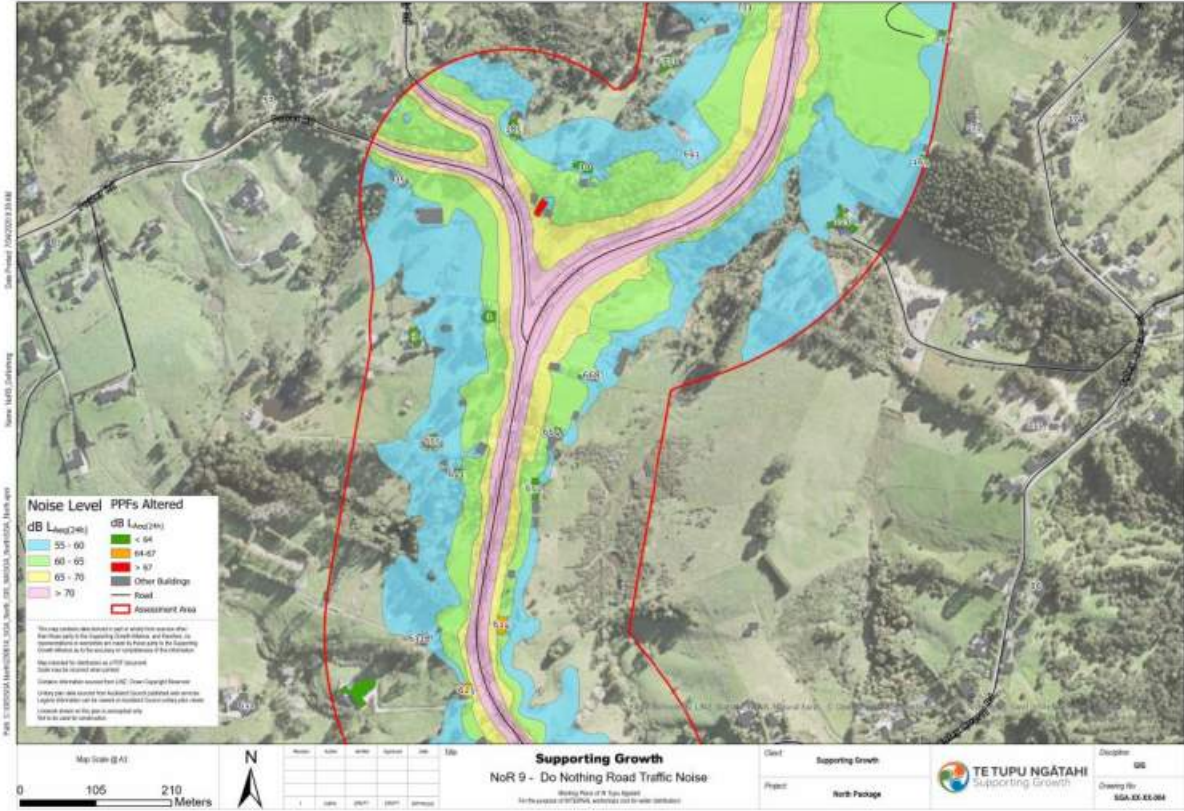


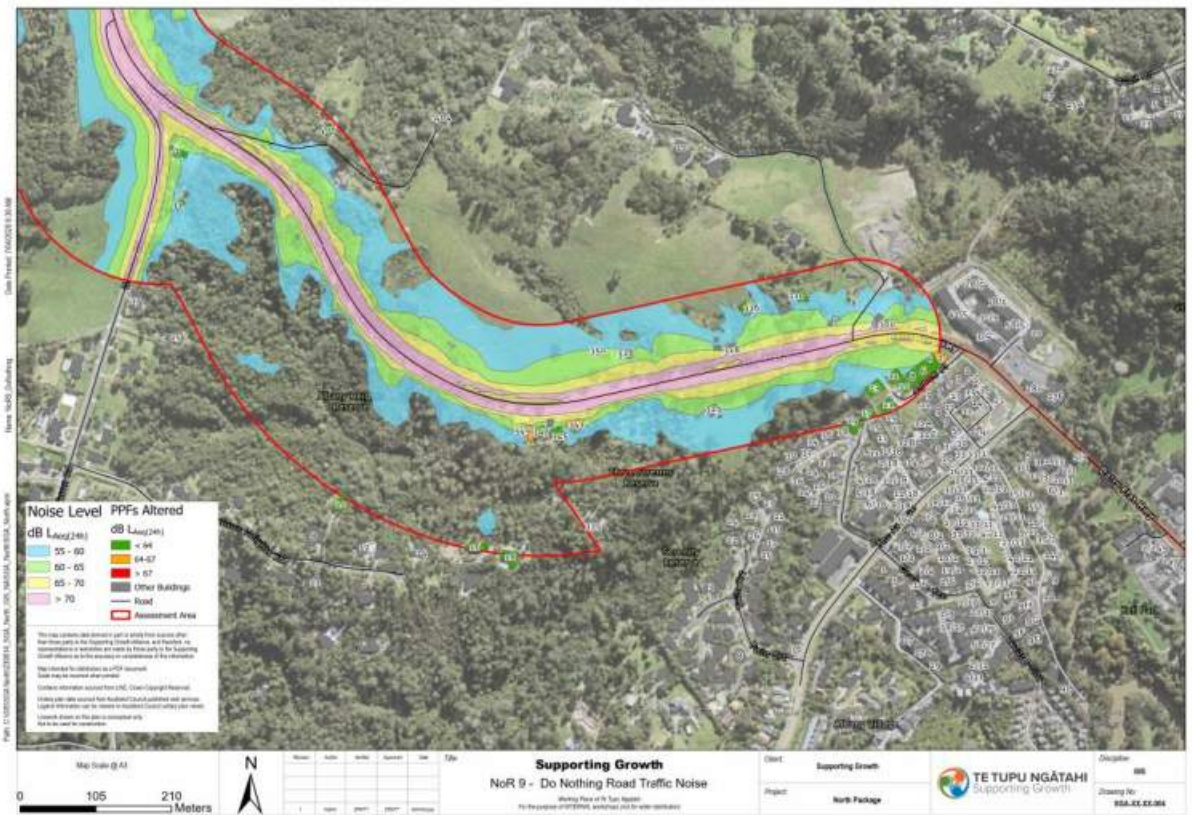
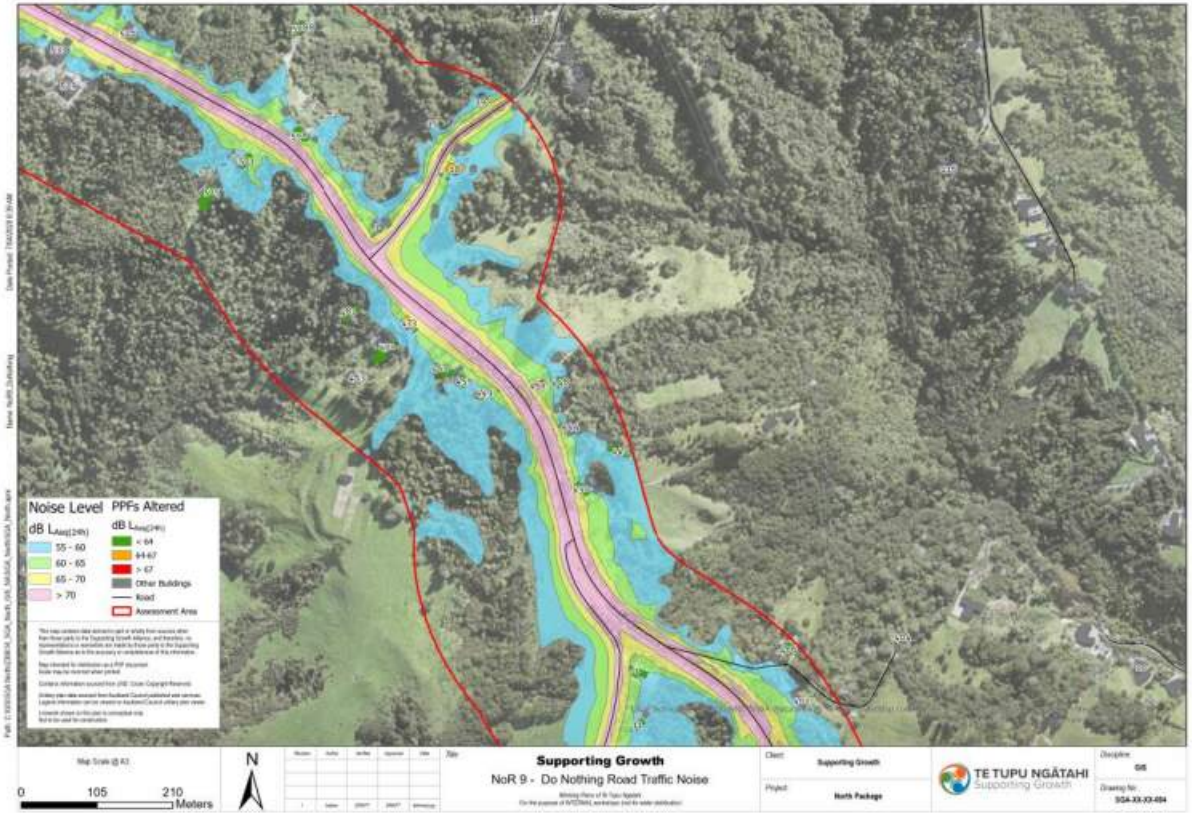
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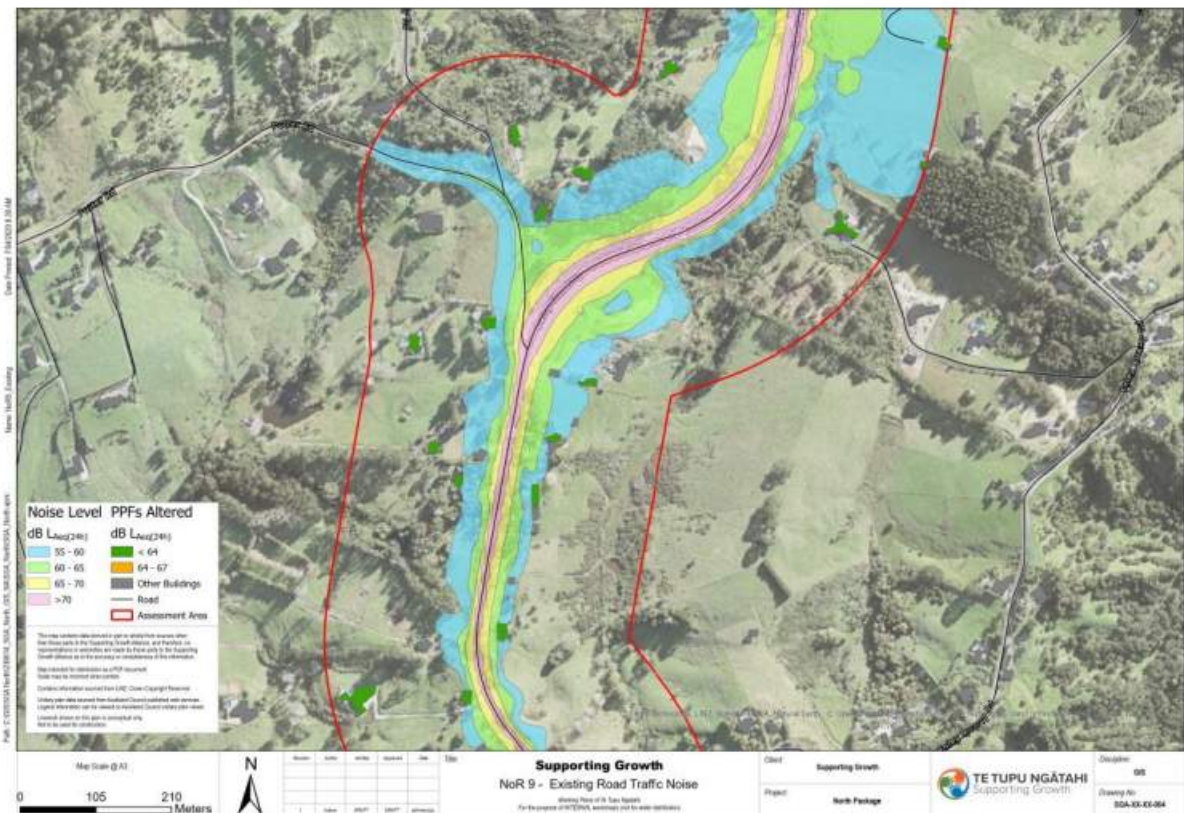
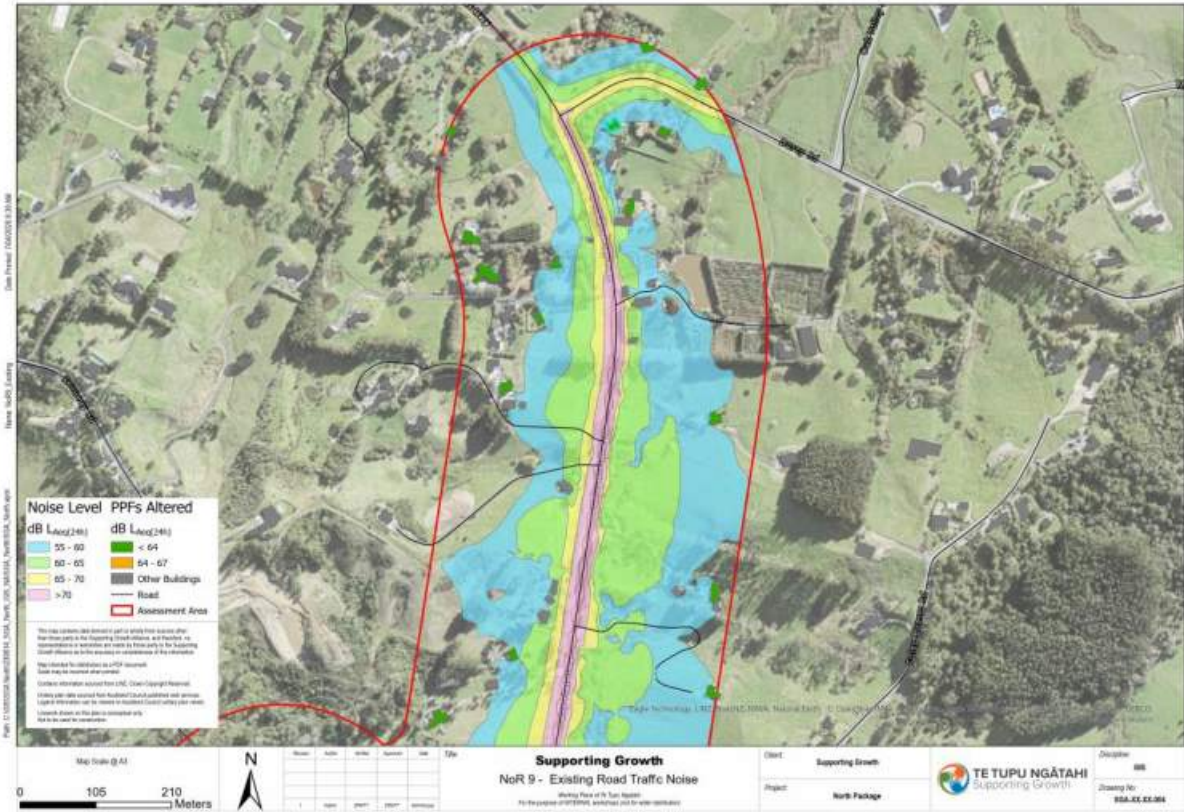


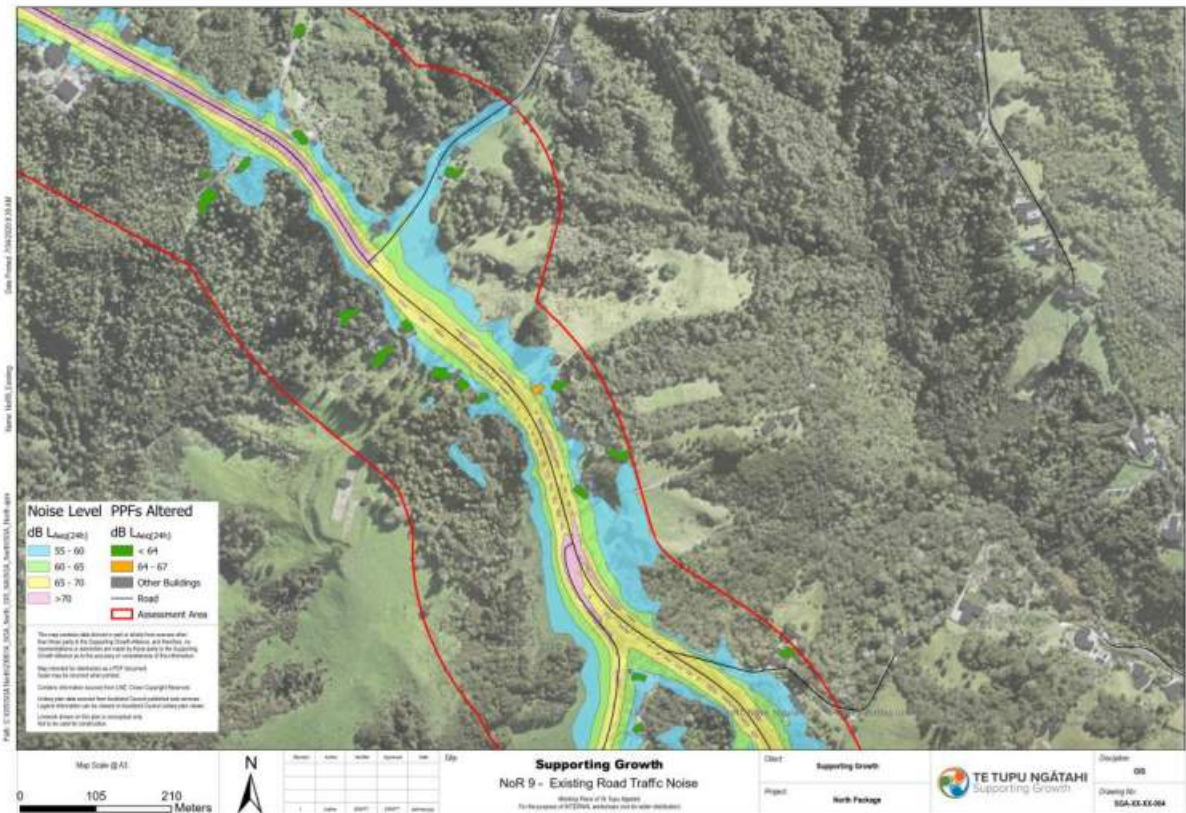
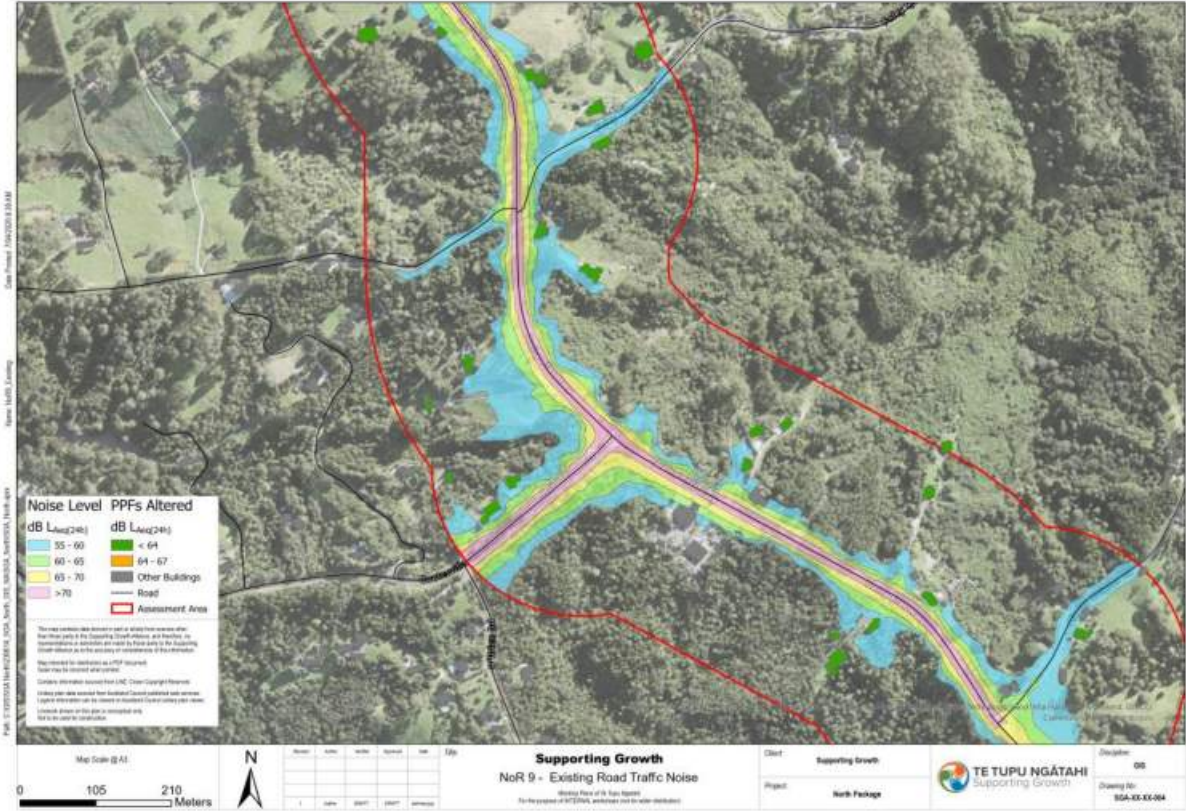


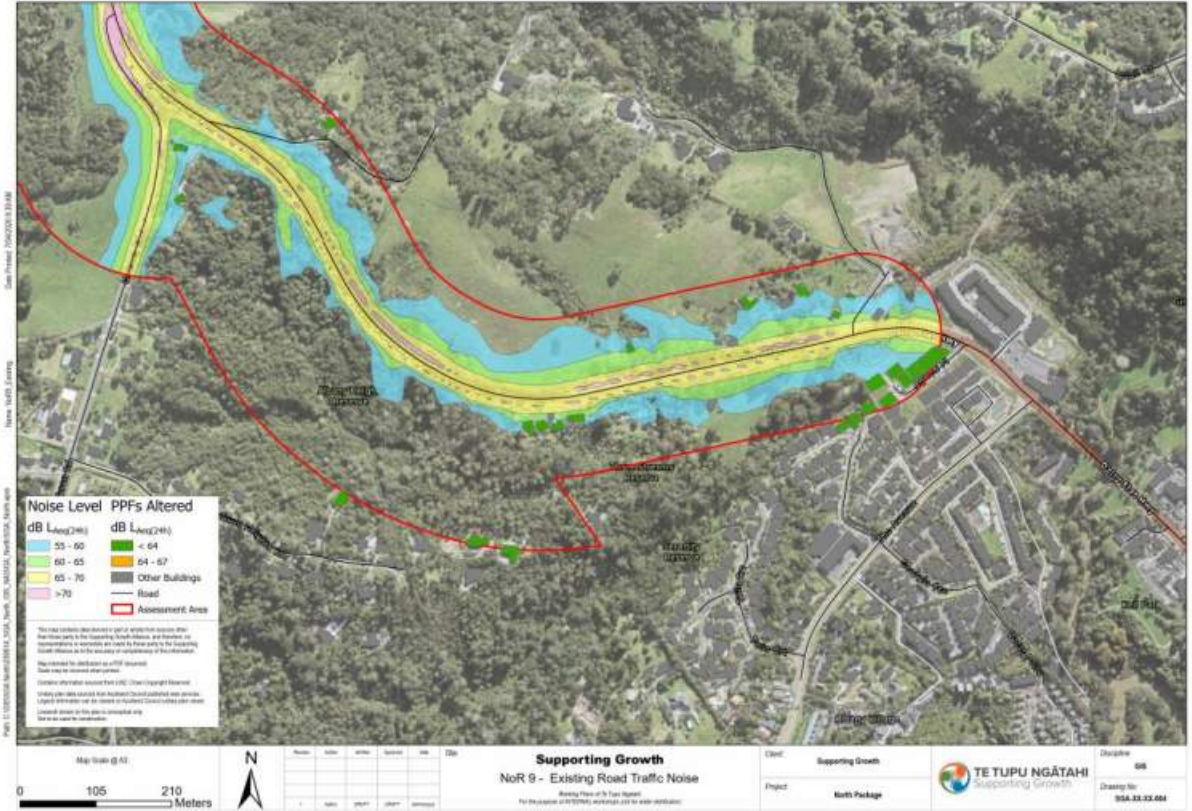




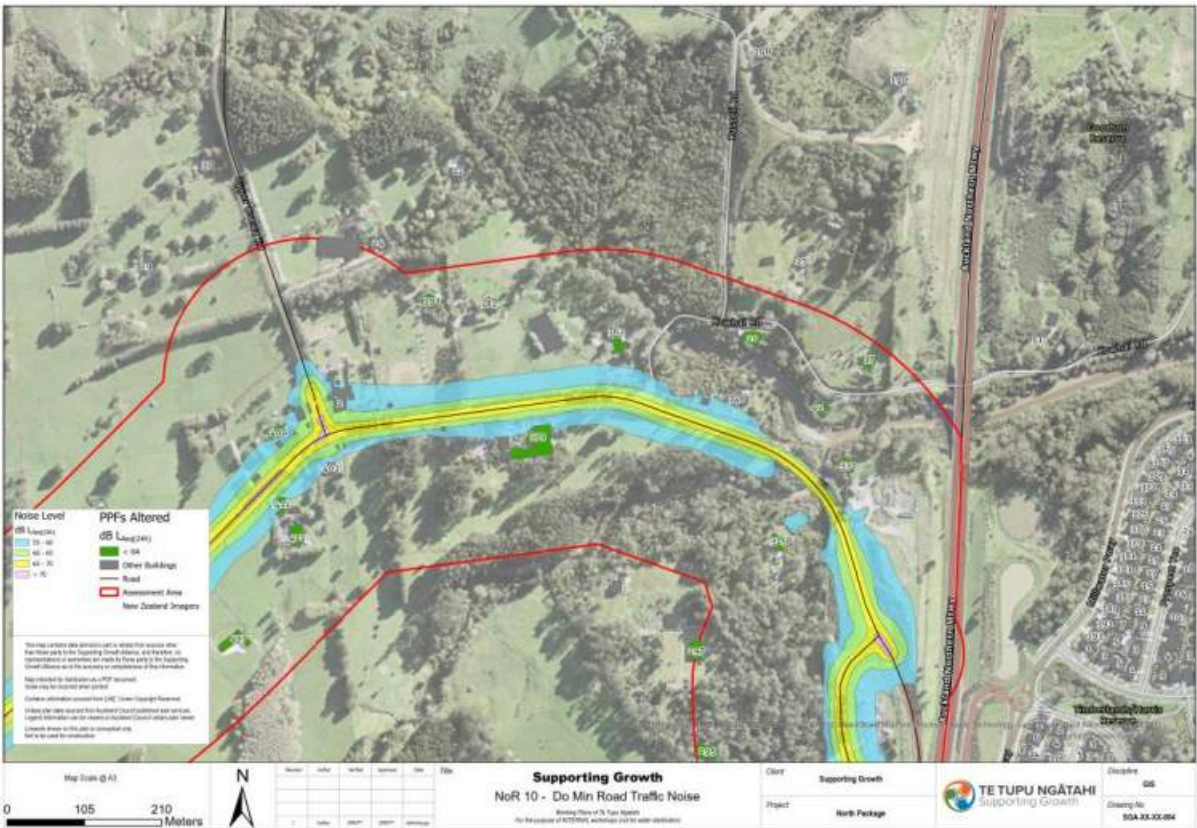


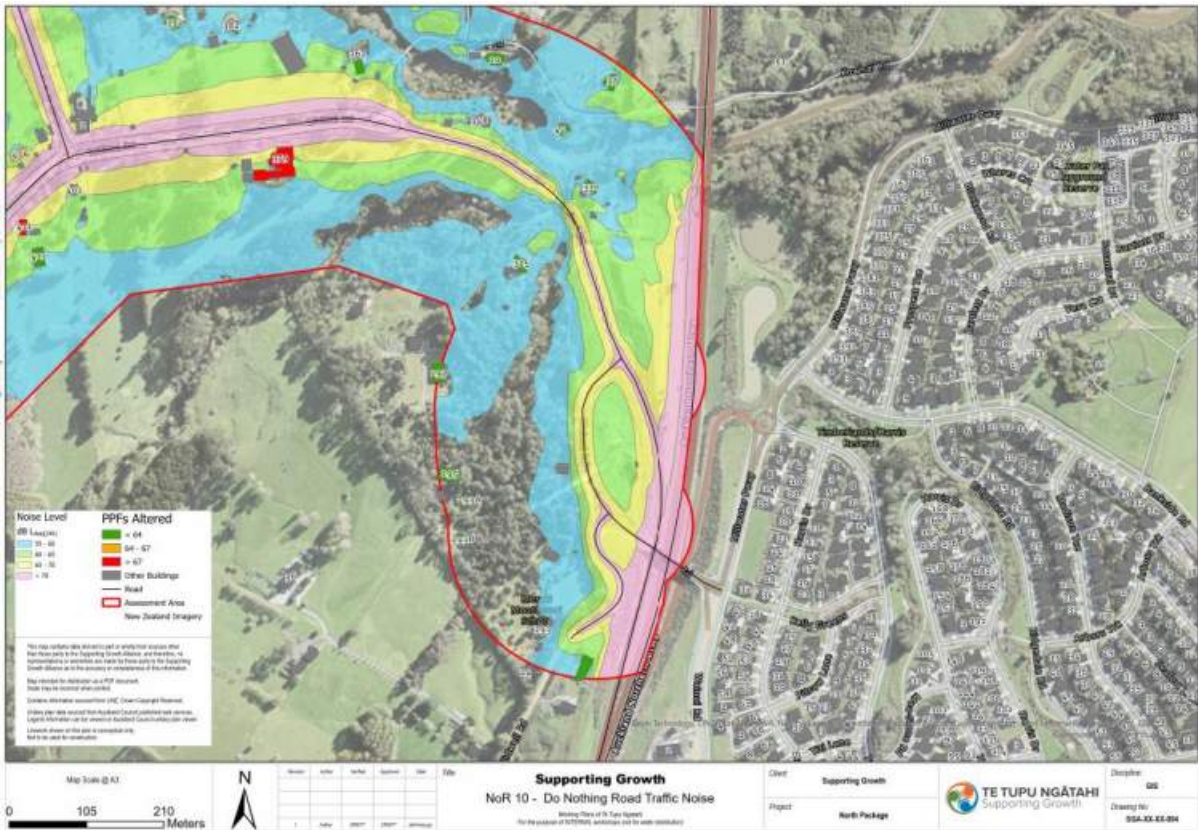
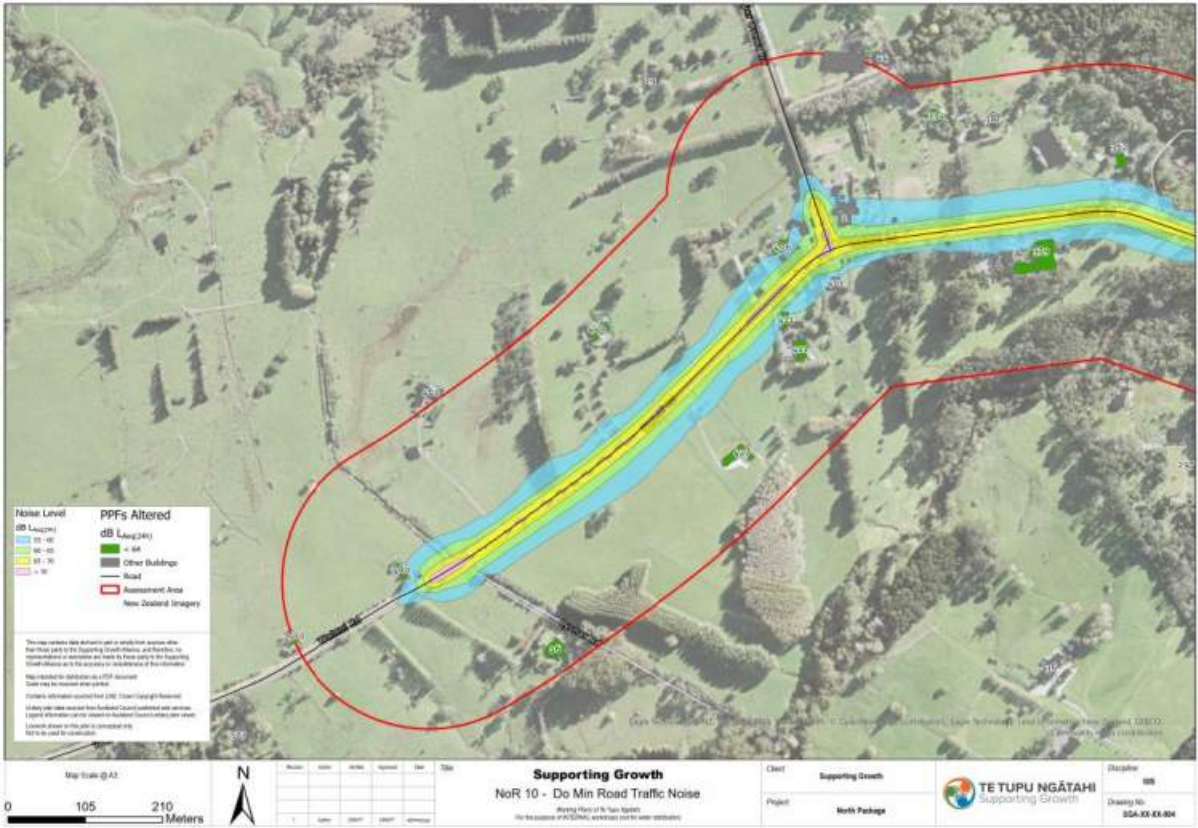


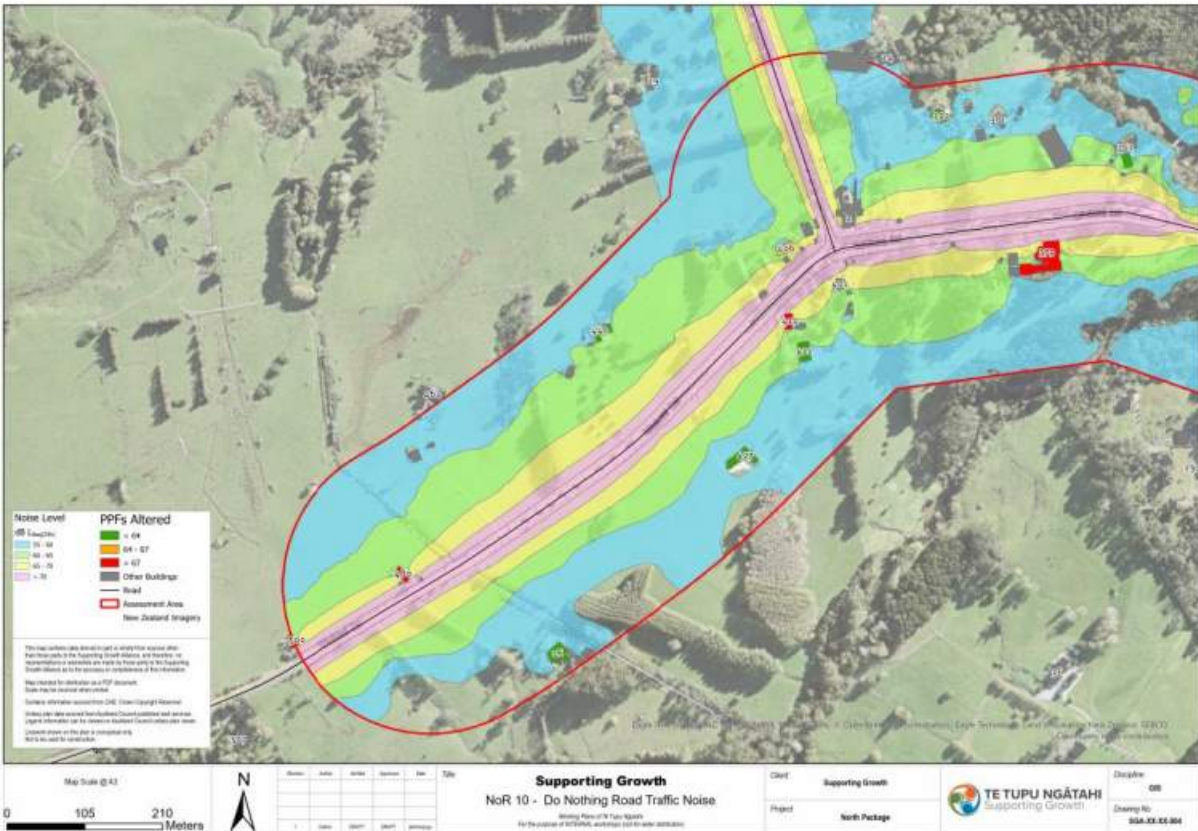
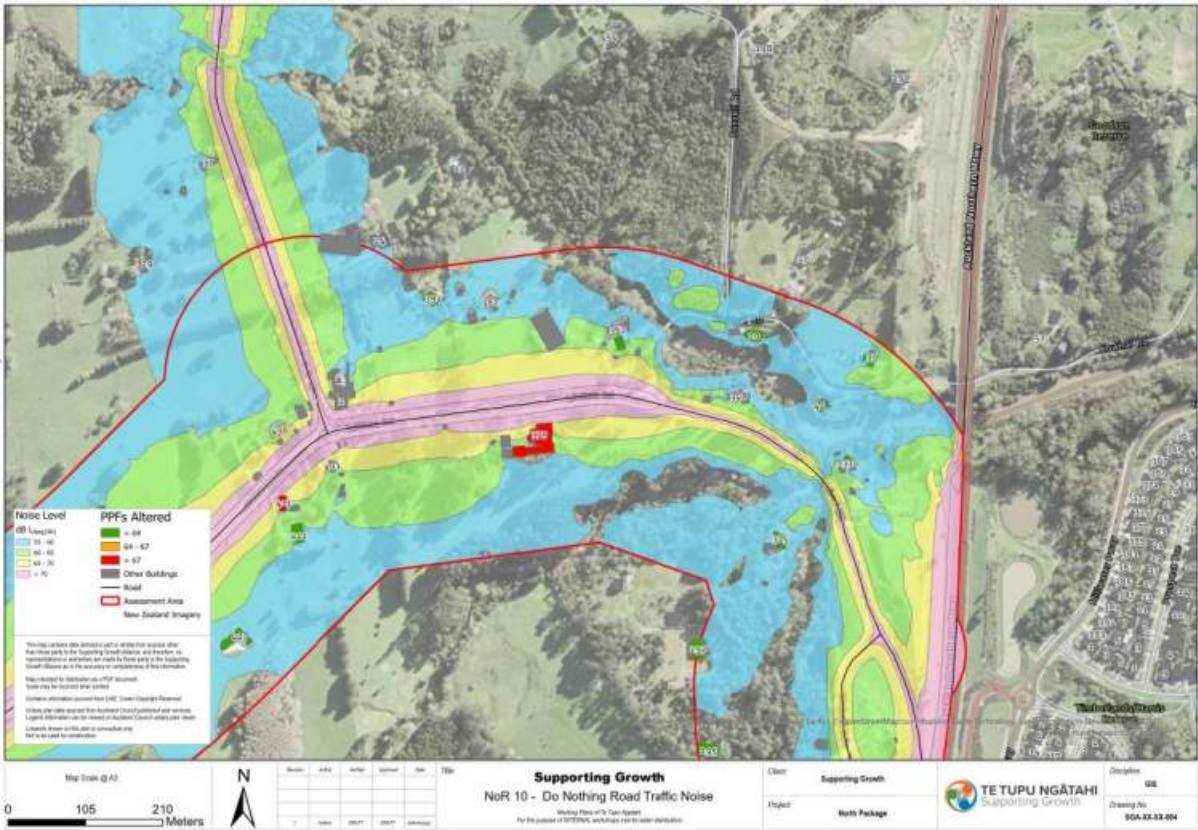


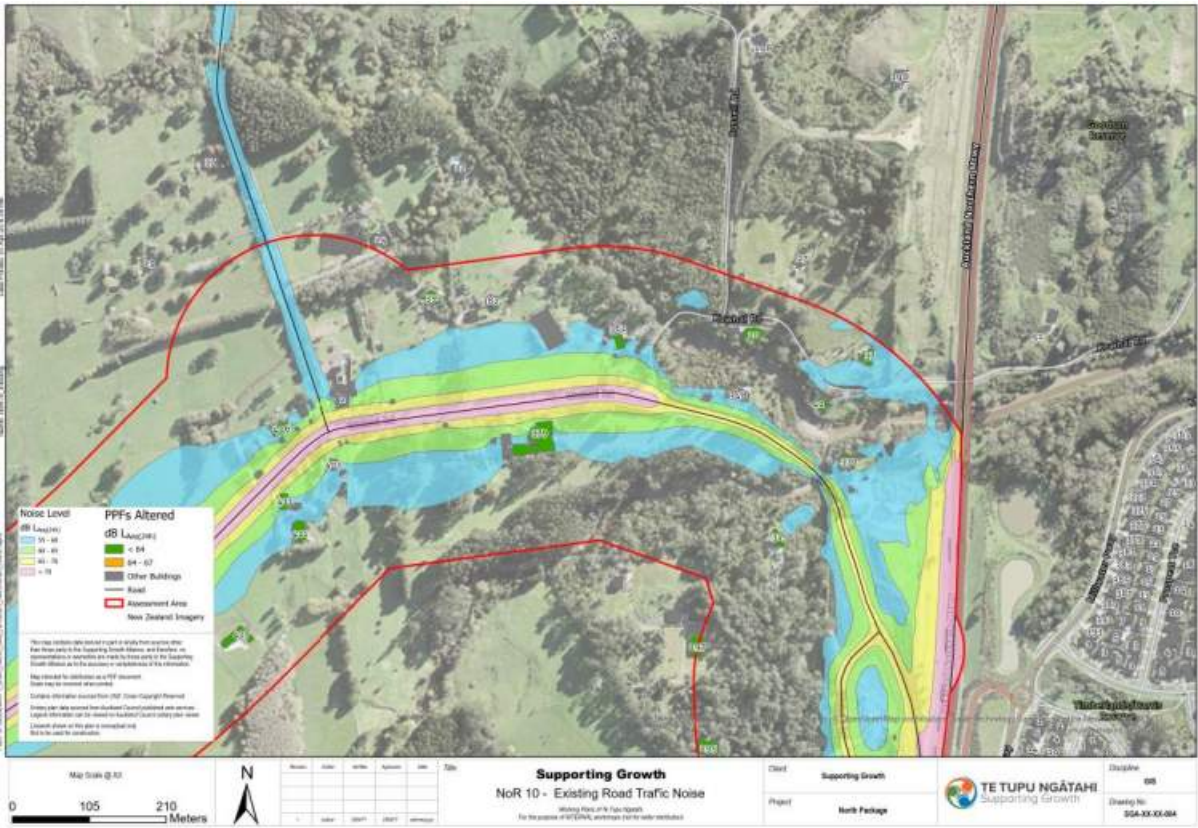
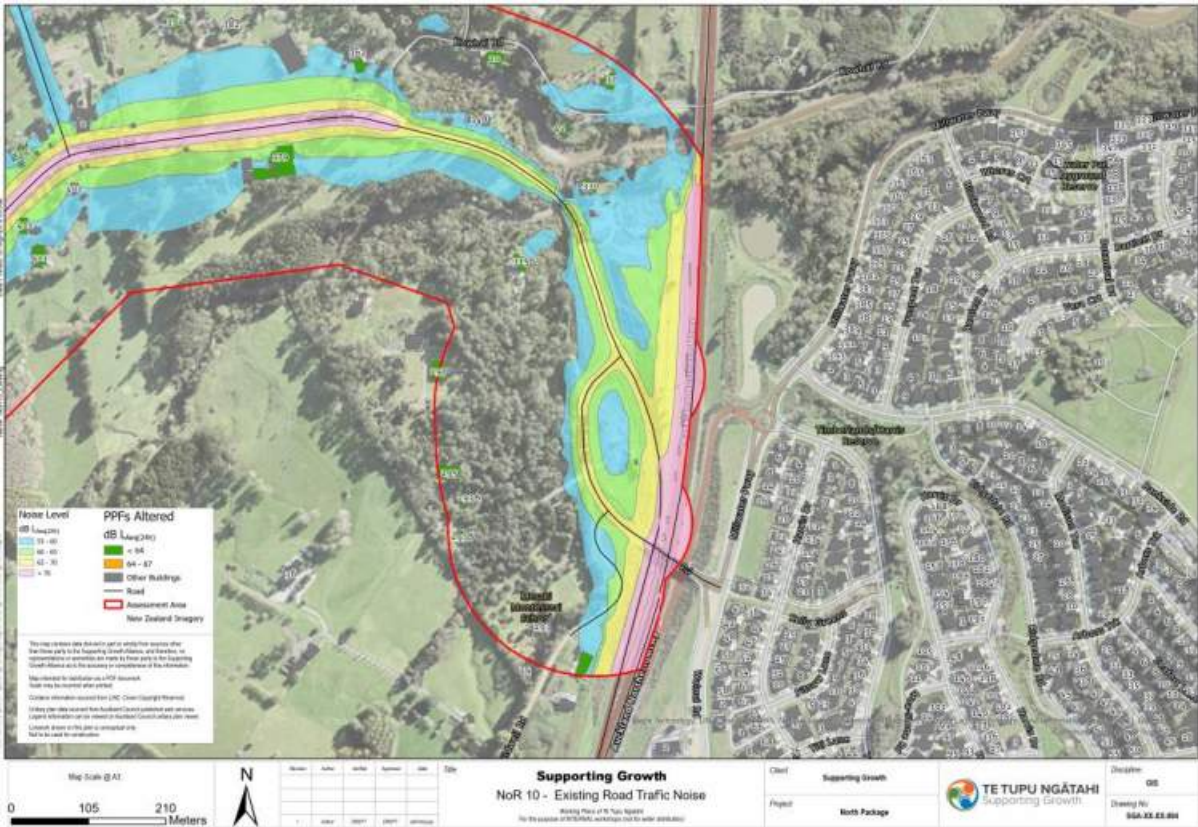


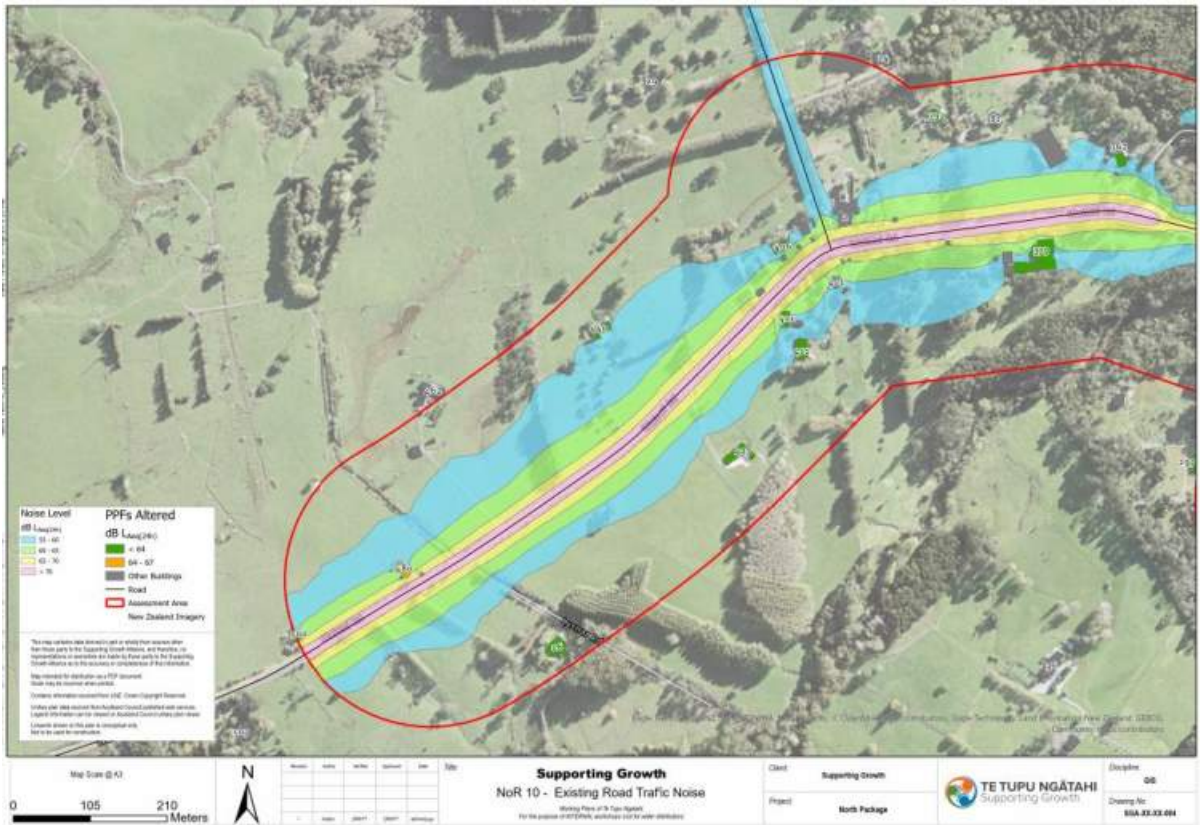
3.7 NOR 10



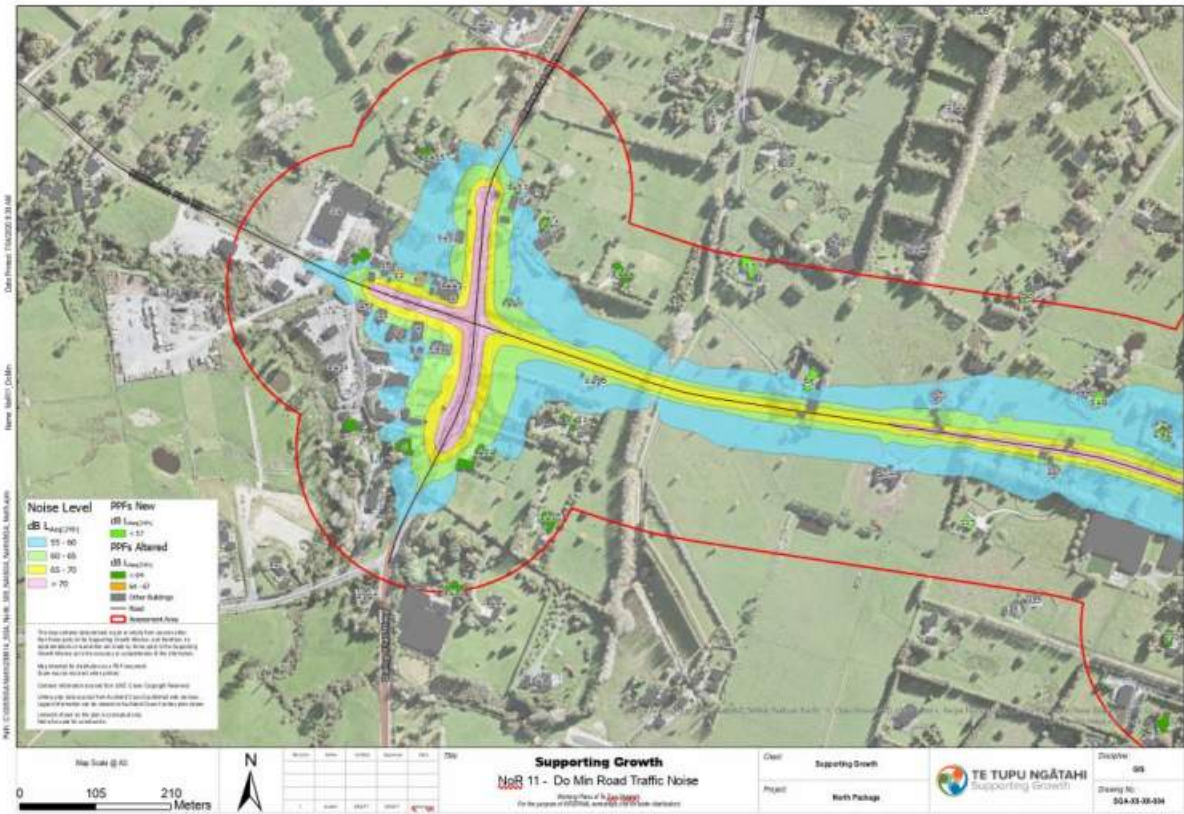


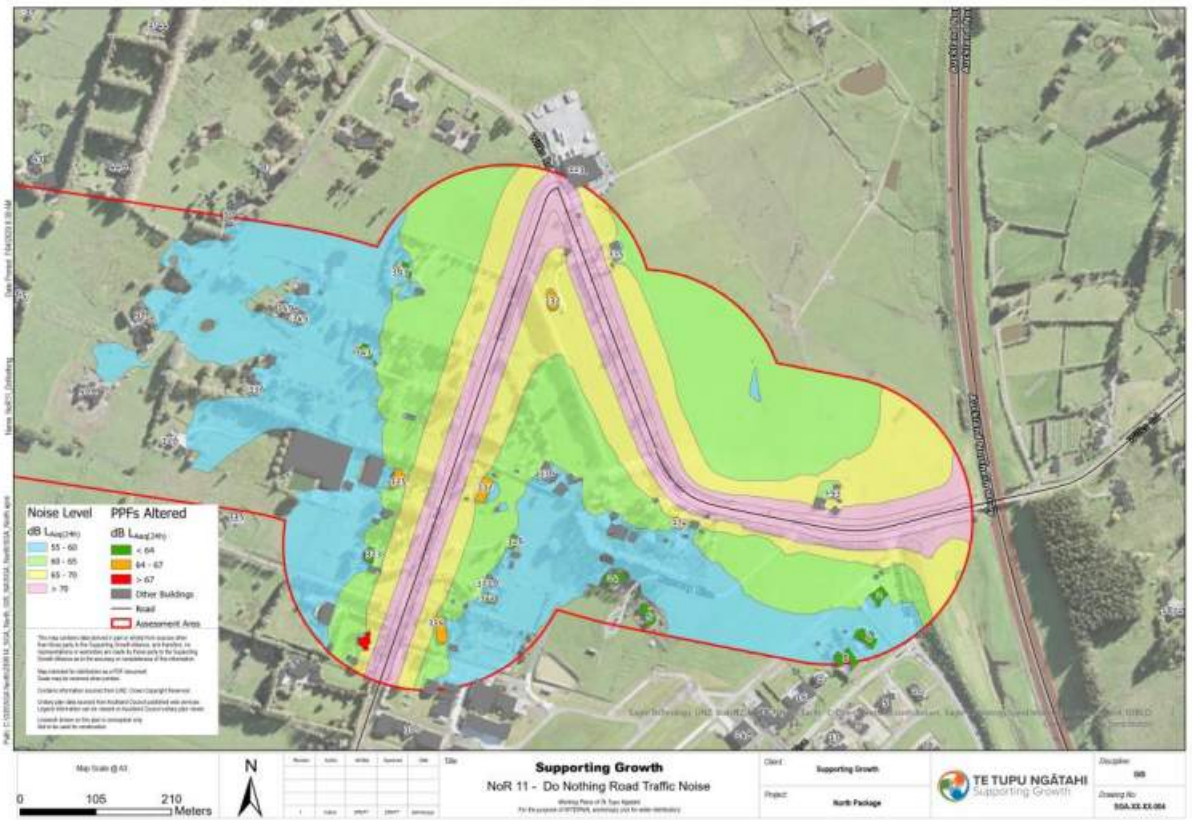
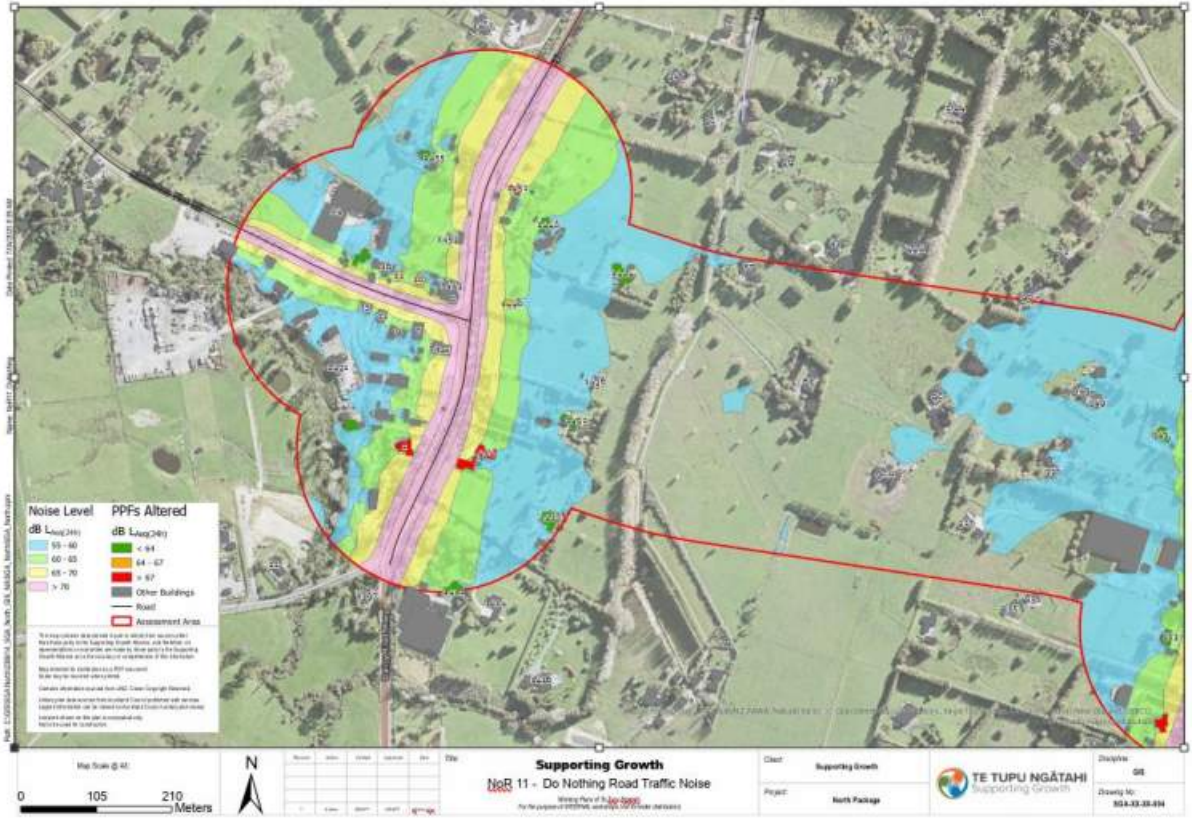


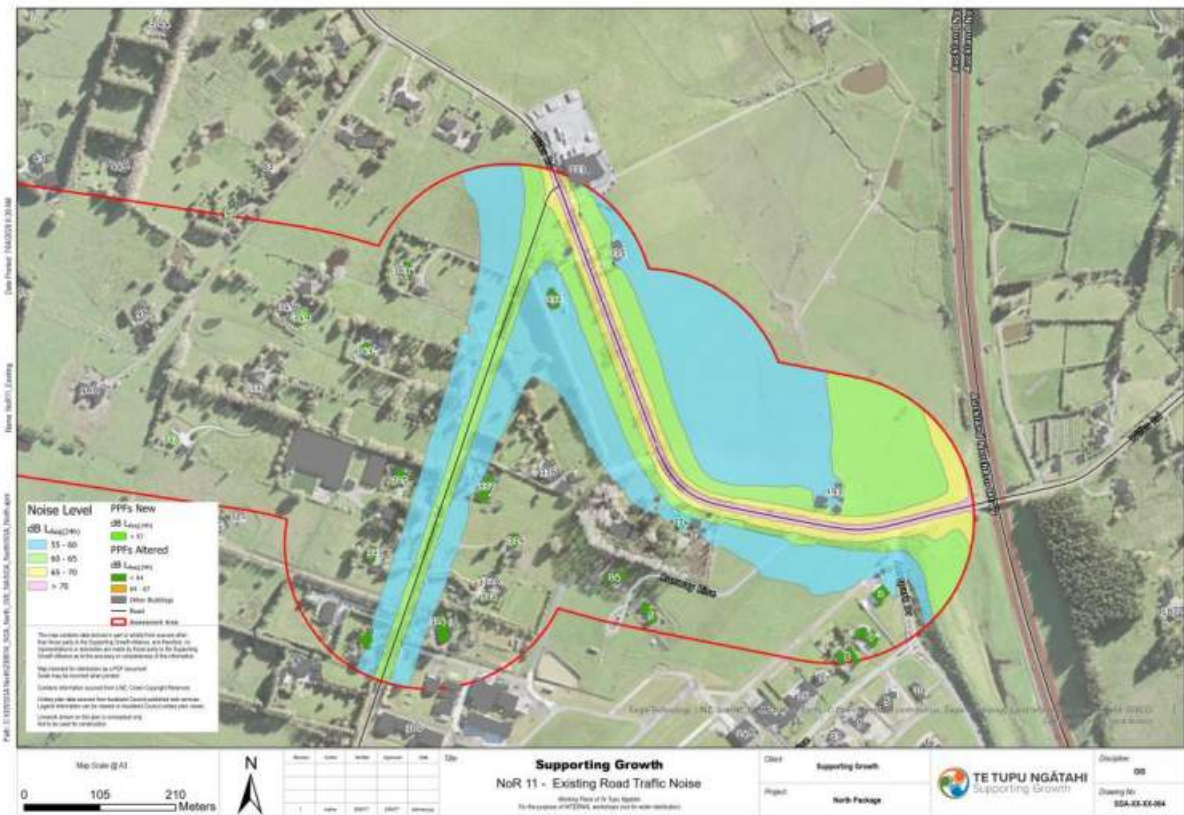
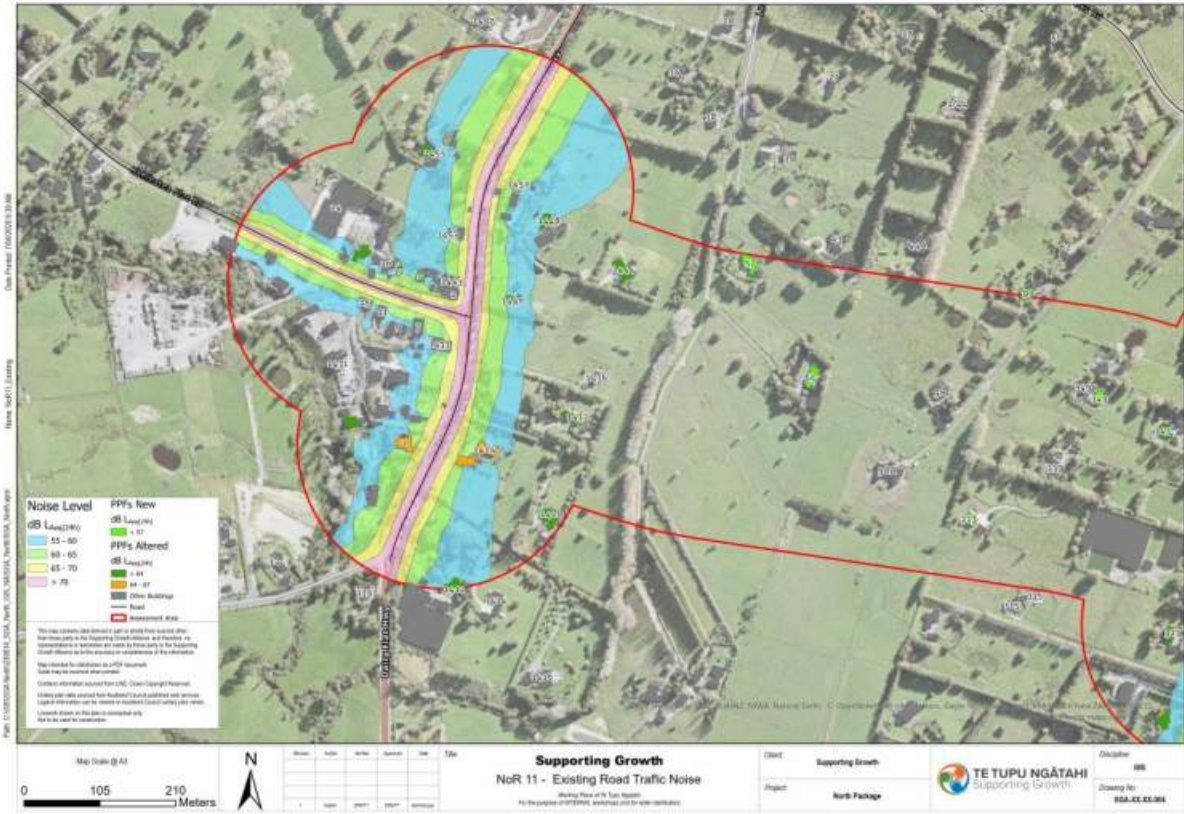




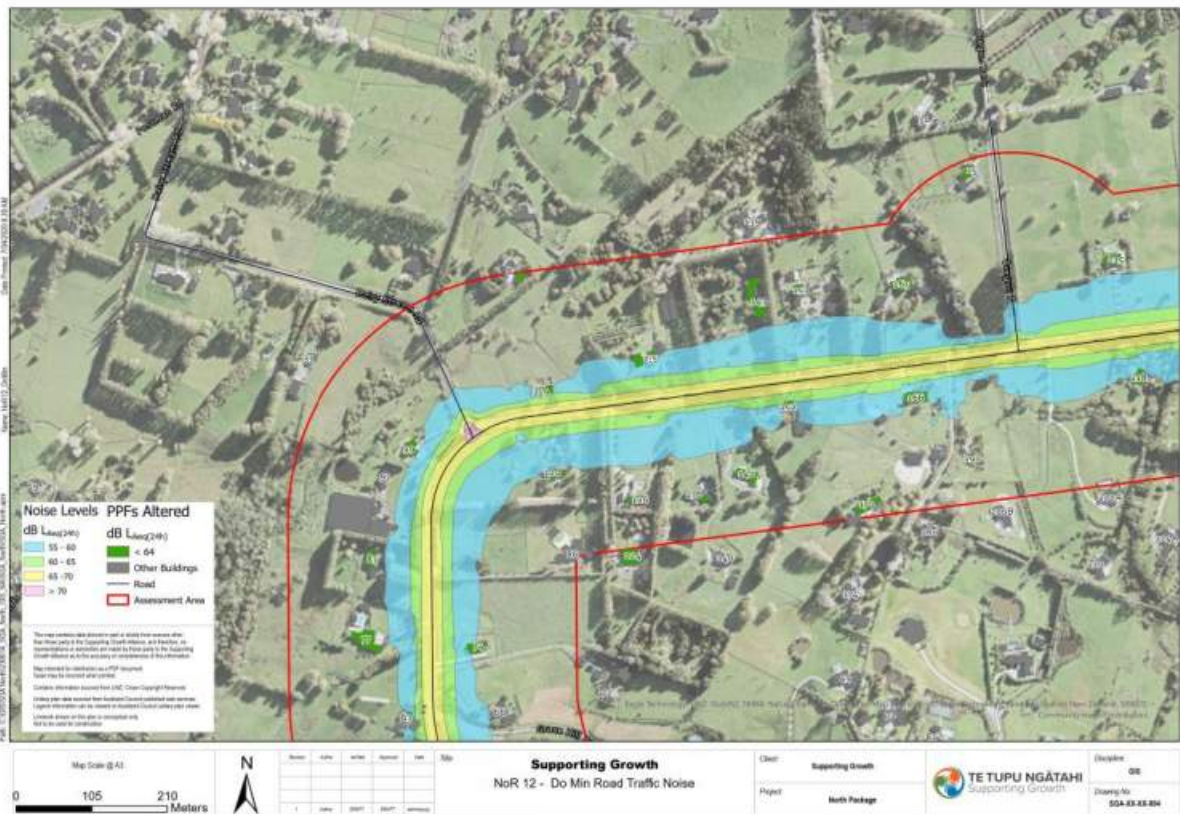
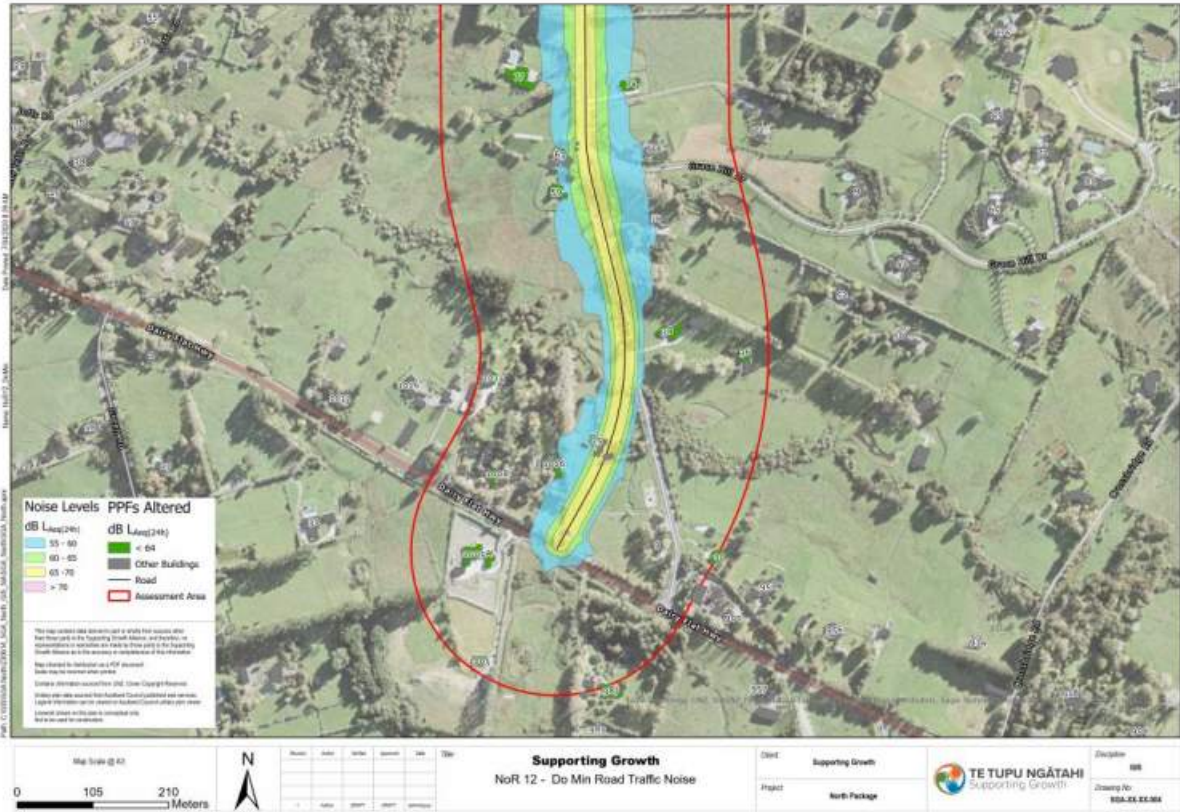
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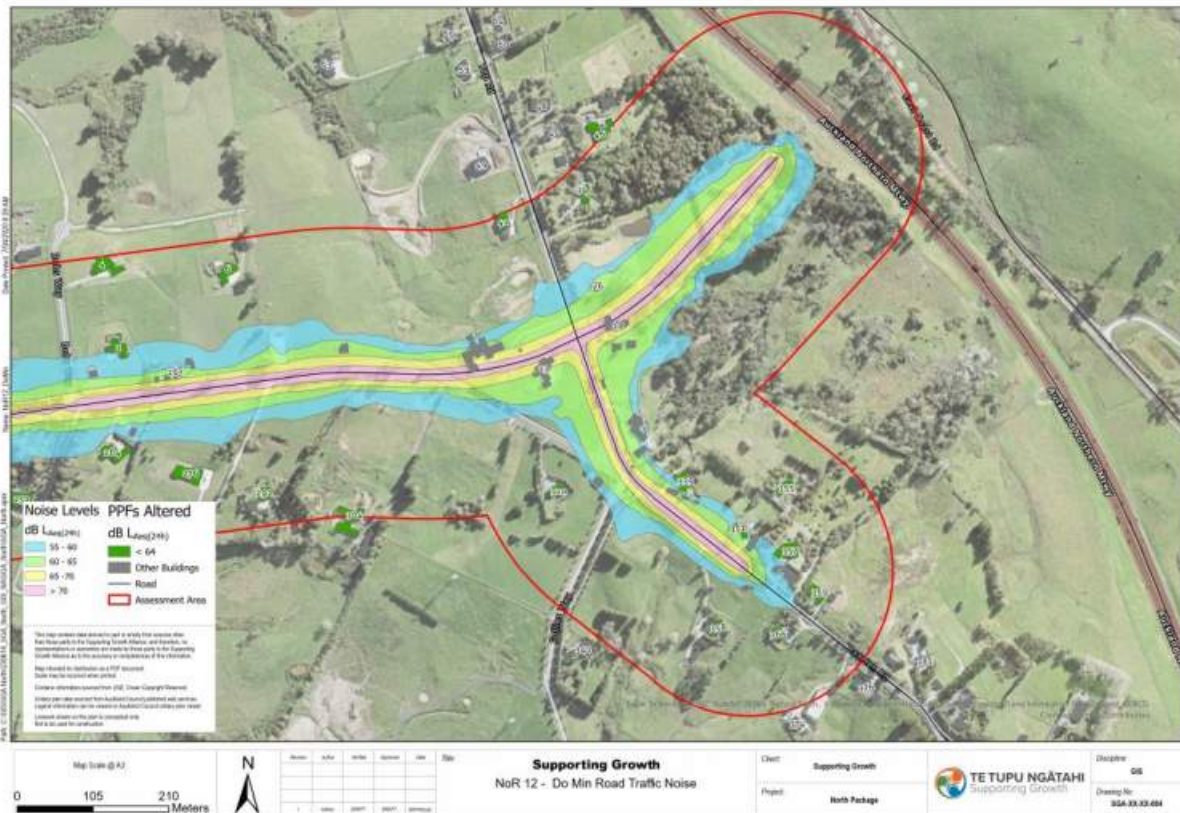
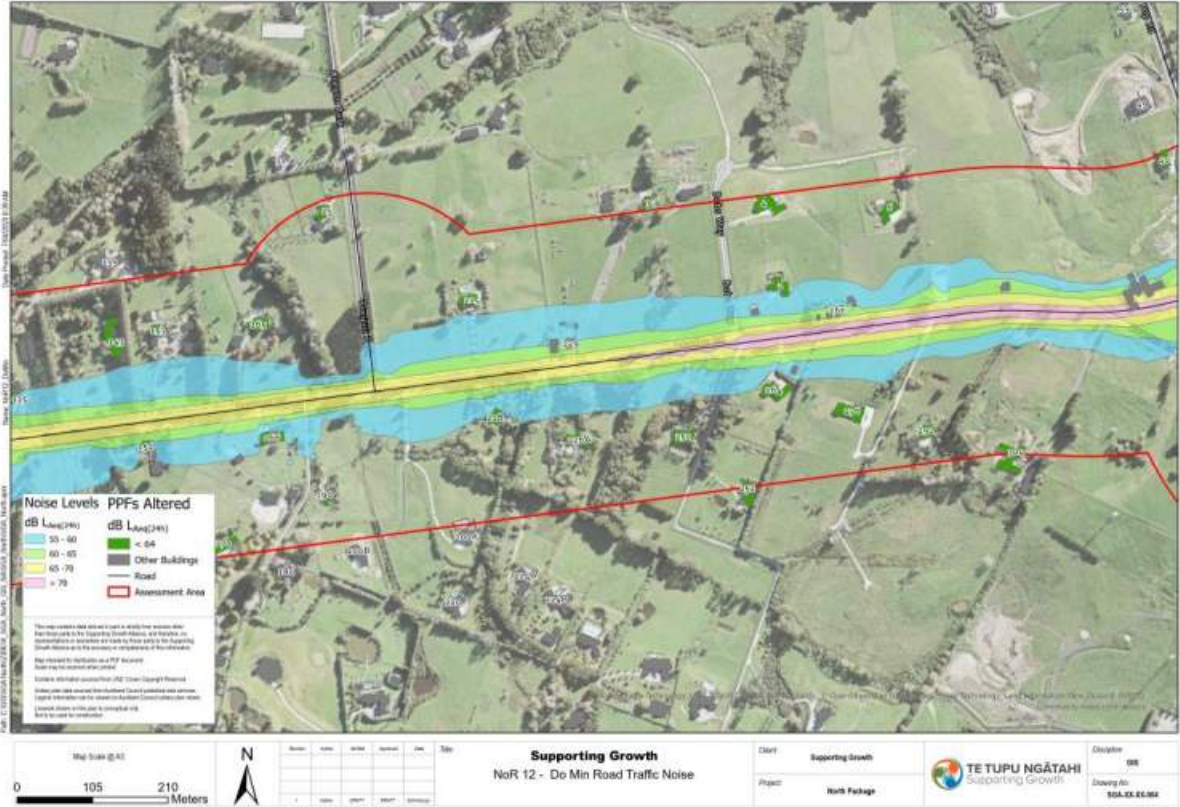


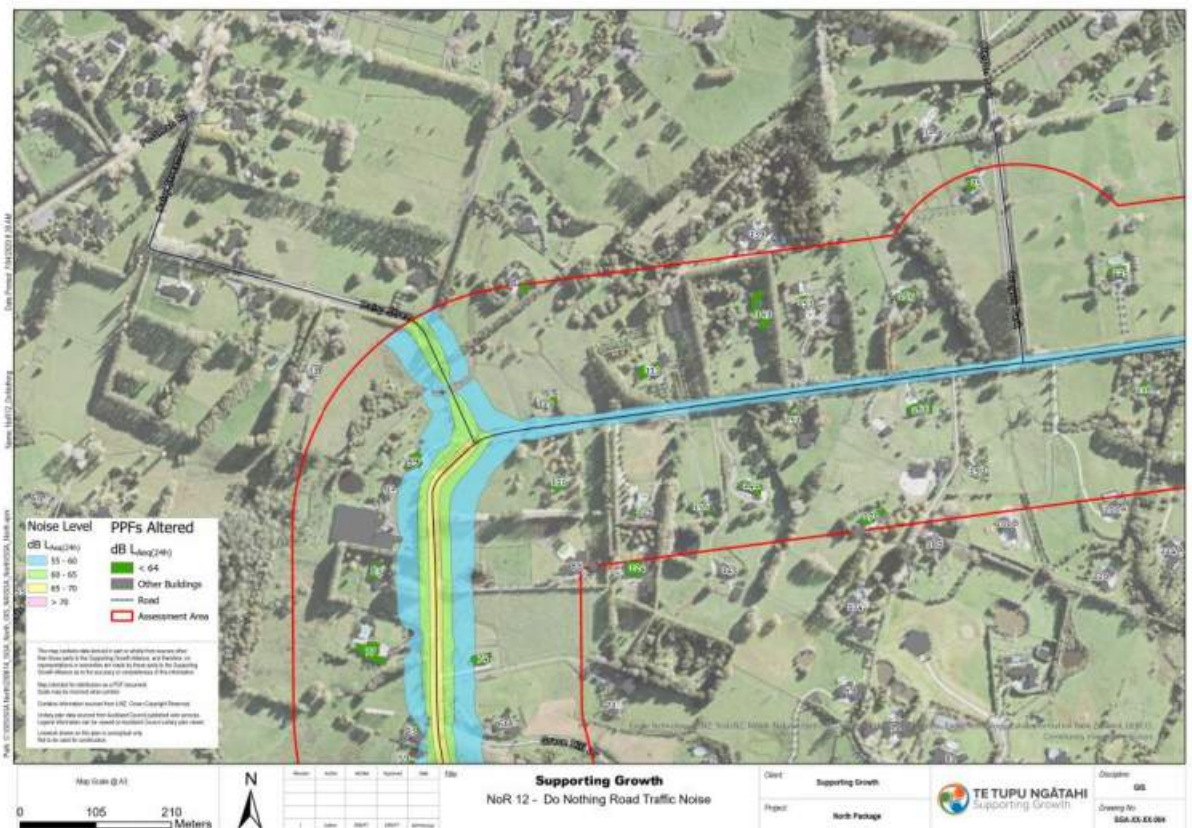
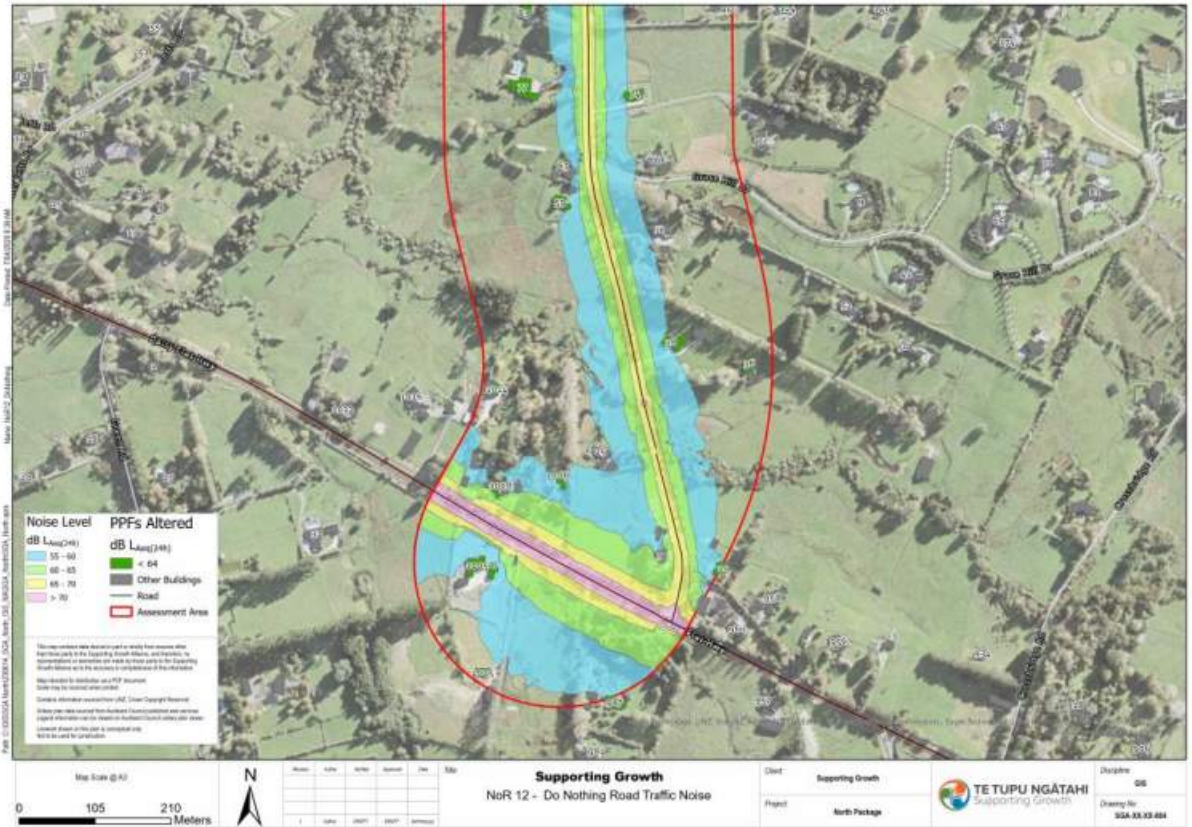


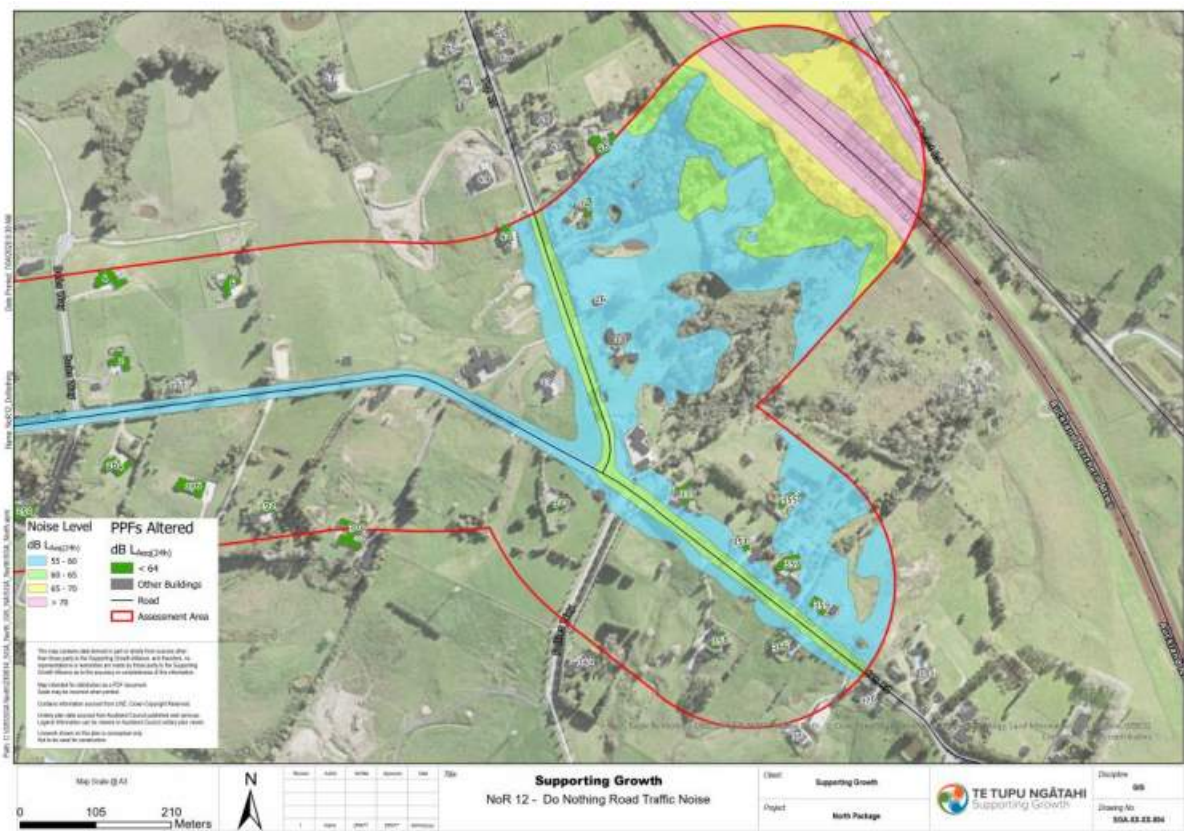
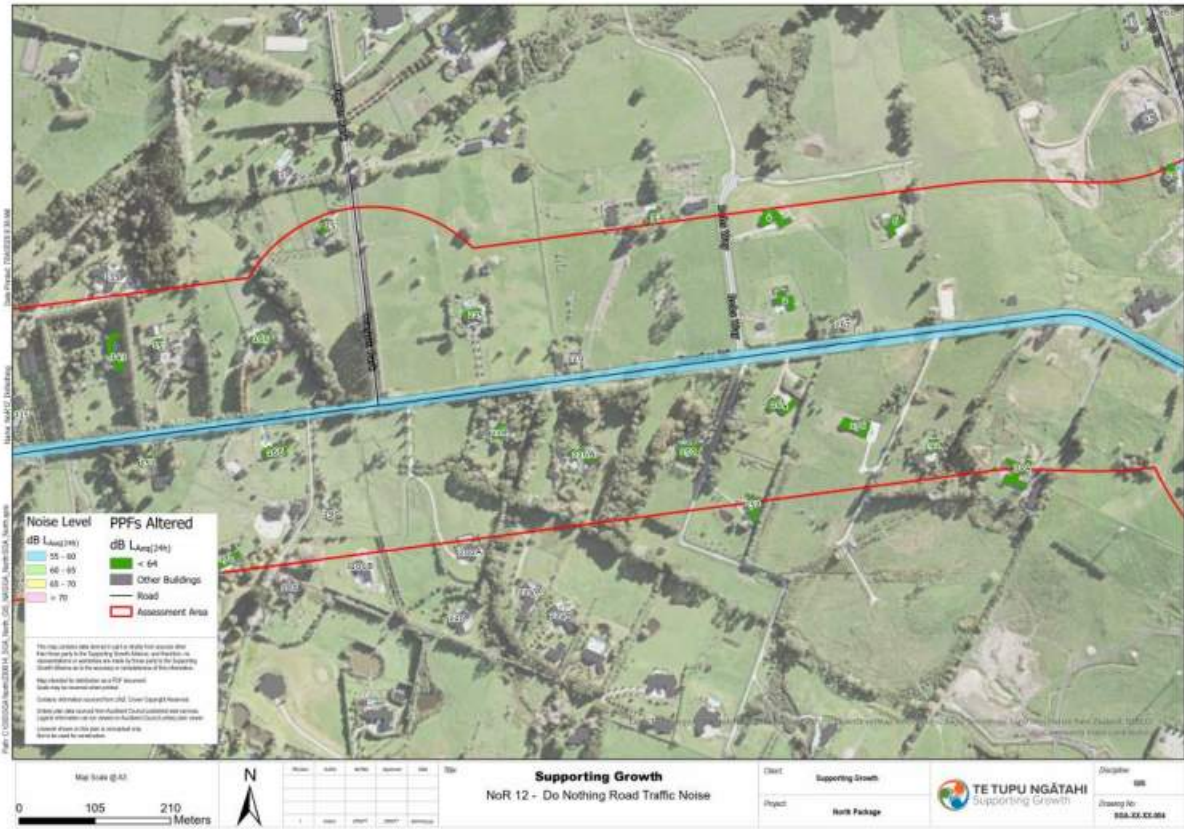


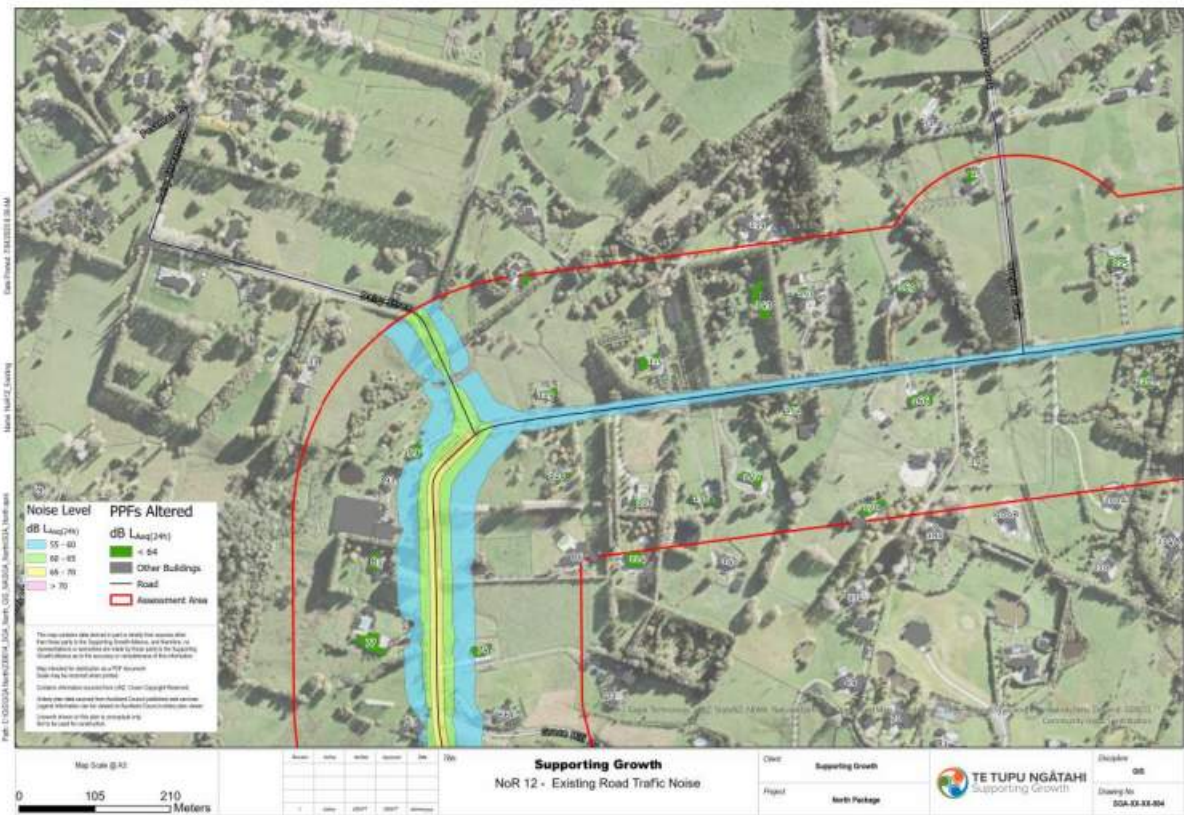
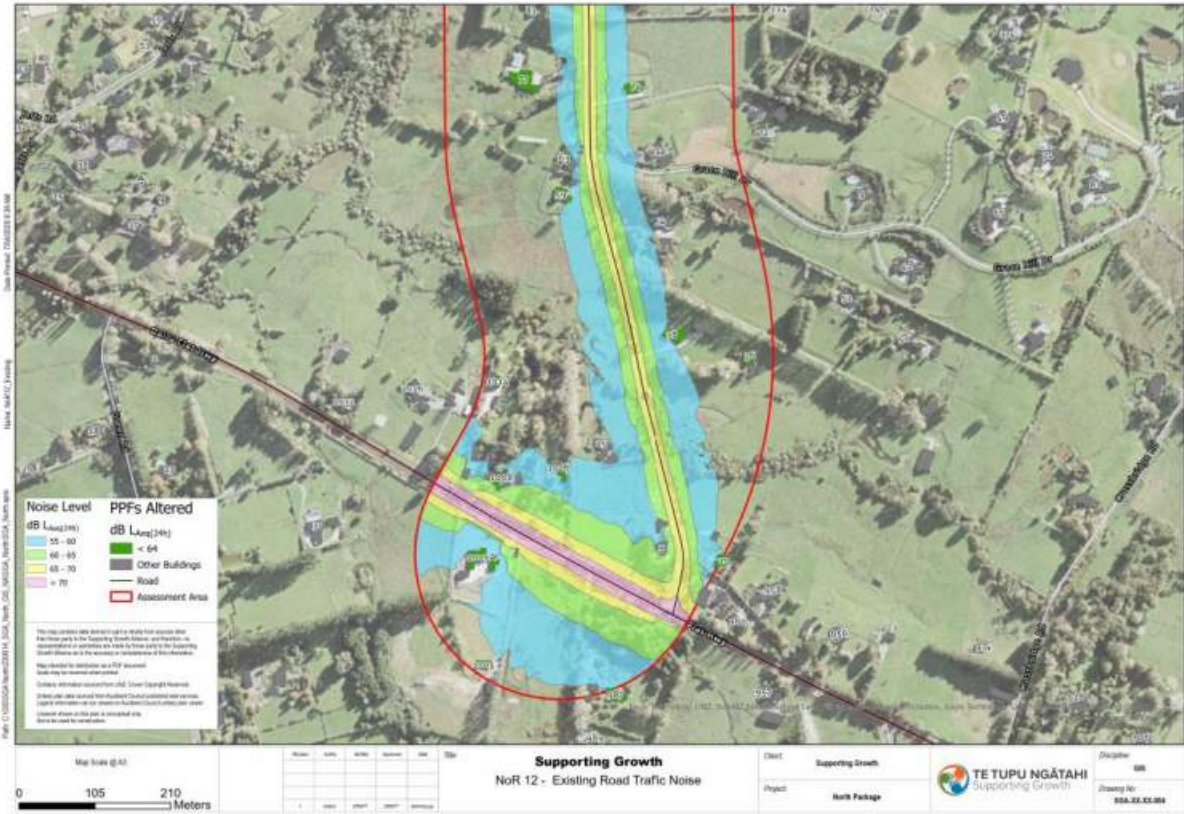
3.9 NOR 12

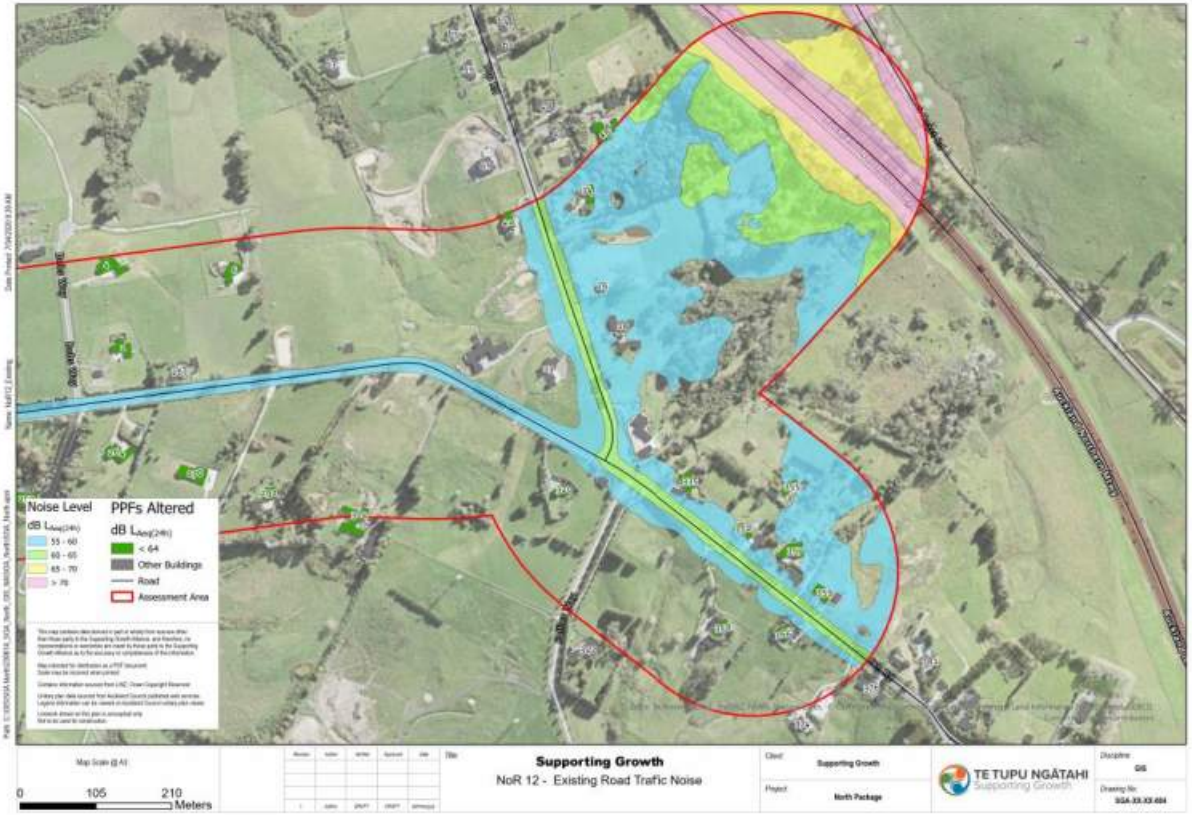
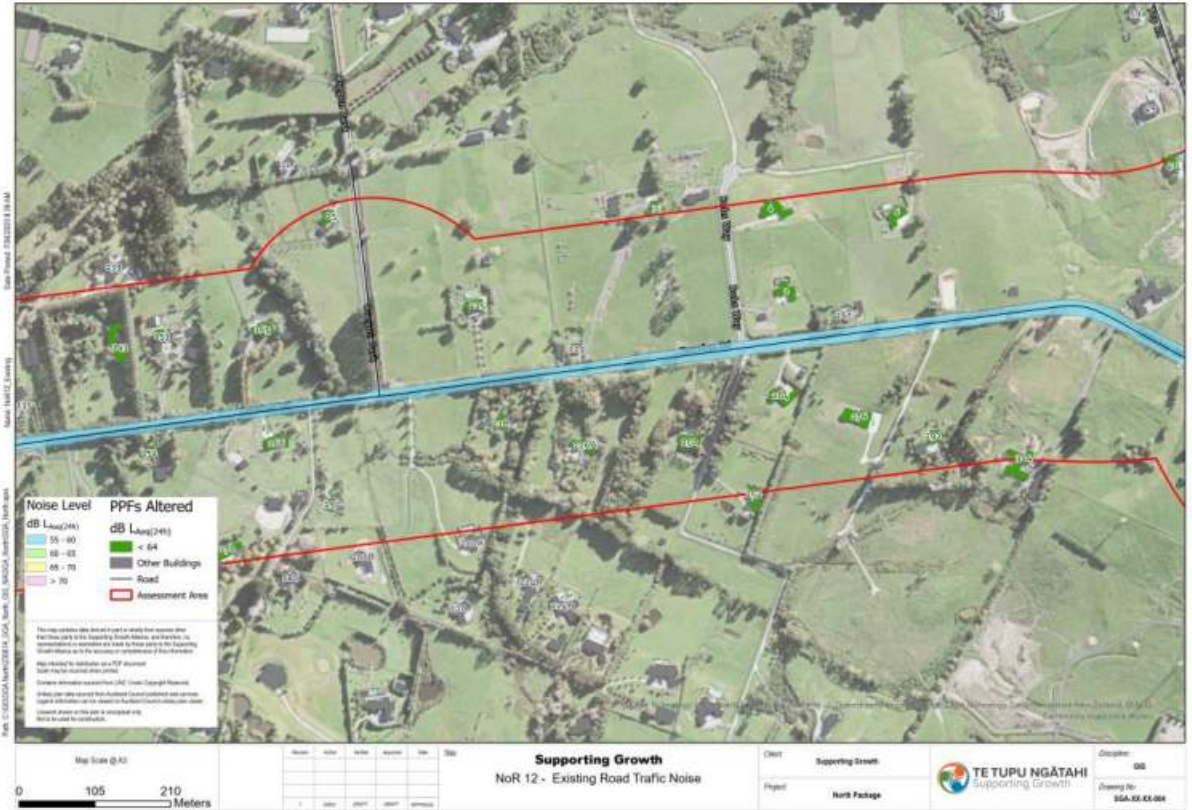












3.10 NOR 13

