

North West Redhills Riverhead

Assessment of Road Traffic Noise and Vibration Effects

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Version 1

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Abbreviations

Acronym/Term	Description
AADT	Annual Average Daily Traffic
AEE	Assessment of Effects on the Environment
ASH	Alternative State Highway
AT	Auckland Transport
AUP:OP	Auckland Unitary Plan Operative in Part
BCI	Brigham Creek Interchange
CC2W	City Centre to Westgate
FTN	Frequent Transit Network
FULSS	Future Urban Land Supply Strategy
FUZ	Future Urban Zone
NAL	North Auckland Line
NoR	Notice of Requirement (under the Resource Management Act 1991)
RMA	Resource Management Act 1991
RTC	Rapid Transit Corridor
RAMC	Regional Active Mode Corridor
RUB	Rural Urban Boundary
SG	Te Tupu Ngātahi Supporting Growth
SH16	State Highway 16
The Council	Auckland Council
Waka Kotahi	Waka Kotahi NZ Transport Agency

Glossary of Acronyms / Terms

Acronym/Term	Description
Auckland Council	Means the unitary authority that replaced eight councils in the Auckland Region as of 1 November 2010.
Redhills Riverhead Assessment Package	Two Notices of Requirement (for Don Buck Road and Coatesville-Riverhead Road) and one alteration to an existing designation (Fred Taylor Drive) for the Redhills Riverhead Package of Projects for Auckland Transport.
Altered Road	<p>As defined in NZS 6806:2010 Section 1.5.2:</p> <p>Subject to 1.5.4, an altered road means an existing road that is subject to the alterations of the horizontal or vertical alignment where at any assessment position at any one or more PPF meets criteria 1.5.2 (a) or (b).</p>
New Road	<p>As defined in NZS 6806:2010 Section 1.6:</p> <p>A new road is any road which is to be constructed where no previously formed legal road existed. A new road excludes any existing road and any altered road but includes the formation of previously unformed legal road.</p>

1 Executive Summary

This report provides an assessment of road traffic noise effects for the Redhills Riverhead Package covering three projects.

The report contains a review of the relevant traffic noise criteria, discussion of the criteria and assessment methodology for the Projects. Predictions of road traffic noise were carried out using the method recommended in New Zealand Standard 6806:2010 in accordance with rule E25.6.33 of the Auckland Unitary Plan – Operative in Part (AUP:OP).

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

As required by NZS 6806, the assessment methodology included the prediction of existing and future traffic noise levels, both without (Existing and Do Nothing scenarios) and with the Projects (Do Minimum scenario).

The Existing scenario represents the current road network with current traffic volumes, i.e. the existing environment as it is experienced at the time of writing of this report. The Do Nothing scenario represents the existing road network with future traffic volumes, assuming a full build out of the area. The Do Minimum scenario represents the proposed future road network, incorporating NoRs R1 to R3.

Noise effects of road traffic on existing noise sensitive locations, referred to as Protected Premises and Facilities (PPFs) in NZS 6806, have been assessed. The Projects falls within an urban area (as defined in Statistics New Zealand 2004) and all PPFs within a 100m radius of the urban area have been included. As all project areas for Redhills Riverhead are considered Altered Roads, they have been assessed by comparing the predicted noise levels in the design year without the Projects (Do Nothing) with the predicted noise levels in the design year with the Projects (Do Minimum).

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

Mitigation options have been considered for the Projects where required under NZS 6806. The Best Practicable Option (BPO) mitigation has been determined separately for each project and is a combination of road surface material and barriers. The BPO mitigation formed the basis of determining the relevant Noise Criteria Category for each PPF. Since the projects will be built in the more distant future, this BPO will be confirmed for all current PPFs at the time of construction. The review, confirmation and refinement of the BPO will aim to achieve the same noise criteria categories as determined with the current BPO as presented in Appendix 2.

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

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

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

Assessment assumptions

All predictions are based on traffic flow along New and Altered roads a significant time in the future (in the Design Year 2048). These traffic volumes rely on the urbanisation of the area and implementation of surrounding transport projects.

The traffic noise effects from the Projects assume that all NoRs are operational together, i.e. when the design year of NoR RE1 is reached, NoRs R2 and R3 are also operational. No allowance was made for individual NoRs being implemented, or some NoRs not being implemented at all. This is for two reasons; the transport models did not allow for these options, and the individual or combined assessment of NoRs would lead to a large number of combinations that could not all be assessed. Therefore, the decision was made to assess the furthest point in time, when all surrounding areas were developed to capacity and the associated roading network. A full list of assumptions is included in Appendix 1.

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

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

Results of assessment and recommended measures

NoR RE1

The Project involves the widening of Don Buck Road to a 30m wide four-lane local arterial with bus priority lanes and separated cycle lanes and footpaths on both sides of the corridor

For the Do Minimum scenario, 95 PPFs are predicted to fall within Category A, 11 PPFs are predicted to fall within Category B and 26 in Category C. Predicted noise levels range from 50 dB $L_{Aeq(24h)}$ to 72 dB $L_{Aeq(24h)}$.

Two mitigation options have been considered to reduce noise levels at PPFs. The options comprise of low noise road surface and localised barriers.

The recommended mitigation is the installation of AC-14 or an equivalent low noise road surface for the whole road alignment, which would reinstate the current low noise road surface, with localised noise barriers at 1 Rush Creek, 538, 540, 546 and 492 Don Buck Road. With the recommended mitigation option in place the majority of PPFs are predicted to experience a negligible change in

noise level. Upon implementation of the recommended mitigation, all PPFs will be in Category A, with the exception of eleven PPFs in Category B.

NoR RE2

The Project involves the upgrade of the Fred Taylor Drive to a 30m wide four-lane FTN arterial with separated walking and cycling lanes.

For the Do Minimum scenario, 58 PPFs are predicted to fall within Category A, 14 PPFs are predicted to fall into Category B and one PPF is predicted to fall into Category C. Predicted noise levels range from 40 dB $L_{Aeq(24h)}$ to 69 dB $L_{Aeq(24h)}$.

A mitigation option of installing AC-14 along the Altered Roads, which would reinstate the current low noise road surface, has been considered. This option results in all PPFs in Category A and is the recommended mitigation option for NoR RE2.

When comparing the Do Nothing and Mitigated scenarios six PPFs are predicted to experience a negligible change in noise level of 1 to 2 dB, 28 PPFs are predicted to experience a reduction in noise level of 3-4 dB resulting in slight positive effects. 38 PPFs are predicted to experience a 5-8 dB reduction in noise level resulting in moderate positive effects. One PPF is predicted to experience a 9-11 dB reduction in noise resulting in significant positive effects.

NoR R1

The Project includes upgrading the southern section of the Coatesville-Riverhead Highway to a 33m two-lane low speed rural arterial with active mode space on the western side and upgrading the northern section of the alignment to a 24m two-lane urban arterial with walking and cycling facilities on both sides.

For the Do Minimum scenario, 85 PPFs are predicted to fall within Category A, six PPFs are predicted to fall into Category B and one in Category C. Predicted noise levels range from 46 dB $L_{Aeq(24h)}$ to 69 dB $L_{Aeq(24h)}$.

A mitigation option of installing AC-14 along the Altered Roads has been considered. This option results in all PPFs in Category A and is the recommended mitigation option for NoR R1.

When comparing the Do Nothing and Mitigated scenario 47 PPFs are predicted to experience a negligible change in noise level, 28 PPFs are predicted to experience a reduction in noise level of 3-4 dB resulting in slight positive effects and 17 PPFs are predicted to experience a 5-8 dB reduction in noise level resulting in moderate positive effects.

2 Introduction

This road traffic assessment has been prepared for the North West Redhills and Riverhead Local Arterials Notices of Requirement (**NoRs**) for Auckland Transport (**AT**) (the “**Redhills Riverhead Assessment Package**”). The NoRs are to designate land for future strategic and local arterial transport corridors as part of Te Tupu Ngātahi Supporting Growth Programme (**Te Tupu Ngātahi**) to enable the construction, operation and maintenance of transport infrastructure in the North West area of Auckland.

The North West growth area is approximately 30 kilometres north west of Auckland’s central city. It makes a significant contribution to the future growth of Auckland’s population by providing for approximately 42,000 new dwellings and employment activities that will contribute 13,000 new jobs across the North West. Redhills Riverhead is one of these growth areas, Redhills is a largely rural area located to the east of Don Buck Road. The area is largely rural with low density countryside living type residential development. The area is live zoned for development with a Precinct overlay. Riverhead is located to the north of SH16, via Riverhead Road or the Coatesville-Riverhead Highway. The existing developed area is largely Residential Single House Zoned with areas of business (Town Centre and Business – Mixed Use zoning). Open Space zoning is found within Riverhead and the Coastal Marine Zone is located to the east.

This report assesses the road traffic noise effects of the North West Redhill Riverhead Assessment Package identified in Section 5 and Table 2-1 below.

The Riverhead Assessment package comprises three separate projects which together form the North-West Redhills Riverhead Arterial Network. The network includes provision for general traffic, walking and cycling, and frequent public transport.

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

Table 2-1: North West Redhills Riverhead Assessment Package – Notices of Requirement and Projects

Notice	Project
NoR RE1	Don Buck Road FTN Upgrade
NoR RE2	Fred Taylor Drive (alteration to existing designation 1433)
NoR R1	Coatesville-Riverhead Highway Upgrade

2.1 Purpose and Scope of this Report

This assessment forms part of a suite of technical reports prepared to support the assessment of effects within the Redhills Riverhead Assessment Package. Its purpose is to inform the AEE that accompanies the Redhills Riverhead Assessment Package sought by Waka Kotahi and AT.

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

The key matters addressed in this report are as follows:

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

2.2 Report Structure

The report is structured as follows:

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

This report should be read alongside the AEE, which contains further details on the history and context of the Project. The AEE also contains a detailed description of works to be authorised for the Project. These have been reviewed by the author of this report and have been considered as part of this assessment of road traffic 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.

2.3 Preparation for this Report

A meeting was held with the Project Transport Planners, who authored the Assessment of Transport Effects, to determine the most practicable road traffic data for use within the assessment. The agreed methodology is in line with the wider Te Tupu Ngātahi work.

3 Assessment Criteria

3.1 Road Traffic Noise

Rule E25.6.33 of the Auckland Unitary Plan (AUP:OP) requires that New roads and Altered roads which are within the scope of NZS 6806:2010 comply with the requirements of that standard. The assessment of all NoRs has used NZS 6806.

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

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

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

- The Do Minimum (refer Section 3.1.4) noise environment would be greater than or equal to 64 dB $L_{Aeq(24h)}$ and, if no specific noise mitigation was undertaken, the alterations would increase road-traffic noise at the assessment position by 3 dB $L_{Aeq(24h)}$ or more at the design year, when compared with the Do Nothing noise environment; or
- The Do Minimum noise environment is greater than or equal to 68 dB $L_{Aeq(24h)}$ and, if no specific noise mitigation was undertaken, the alterations would increase road-traffic noise at the assessment position by 1 dB $L_{Aeq(24h)}$ or more at the design year, when compared with the do-nothing noise environment.

Where the definition is not met and the road is not a new road, NZS 6806 does not apply, and mitigation is not required.

3.1.1 Protected Premises and facilities

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

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

- Urban Areas (A main urban area, a satellite urban community, or an independent urban community as per Statistics New Zealand 2004) – 100 metres from the edge of the nearside traffic lane.
- Rural Areas (defined as areas not considered Urban areas in NZS 6806) – 200 metres from the edge of the nearside traffic lane

These distances ensure the assessment is made at the most relevant receivers. Potential noise effects are still controlled at receivers further away by virtue of noise criteria applying at receivers nearest to the road.

3.1.2 NZS 6806 Noise Criteria

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

Category	Criterion	Altered road	New Roads
A	Primary	64 dB $L_{Aeq(24h)}$	57 dB $L_{Aeq(24h)}$
B	Secondary	67 dB $L_{Aeq(24h)}$	64 dB $L_{Aeq(24h)}$
C	Internal	40 dB $L_{Aeq(24h)}$	40 dB $L_{Aeq(24h)}$

The Projects within the Redhills Riverhead Assessment Package only have “Altered roads” as defined by NZS 6806:2010. Definitions have been included in the Glossary of this report.

3.1.3 Design Year

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

- The design year traffic data incorporates and assumes all other projects (funded and otherwise) in the North West Auckland area have been constructed; these projects directly influence traffic flow through the Whenuapai Project areas.
- The 2048 design year, whilst not the most conservative scenario in terms of the traffic volume for every Project road, provides the most complete overview reflective of the development intended for the areas. If some projects do not go ahead then traffic flows within the Project alignment will likely change.

The decision to use 2048 as the design year was made in conjunction with the Project team and further discussed in Section 4. A full list of assumptions included within the design year has been included in Appendix 1.

3.1.4 Noise Predicted Scenarios

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

- The “Existing” noise environment, which is the ambient noise levels at the date of assessment.
- A “Do Nothing” scenario, which represents the traffic noise levels at the PPFs at the design year assuming no alterations are made to the existing road.

- A “Do Minimum” scenario, which represents the traffic noise levels at the PPFs at the design year with the Project implemented, but without any specific noise mitigation. Road surfaces, safety barriers and other structures which are required for non-acoustic purposes may provide incidental noise mitigation and are included in this scenario.
- “Mitigation” scenarios, which represent the traffic noise levels at the PPFs at the design year with various specific noise mitigation options implemented with the aim of achieving the noise criteria categories.

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

The Do Minimum scenario represents the proposed future road network, incorporating NoRs R1 to R3 and other transport projects in the area (refer to the discussion on Assessment Assumptions below). This scenario assumes a full build out of the area, and the transport infrastructure to enable the development. This is a realistic scenario at a point in time when all NoRs are operational. Considering the wider distribution of future traffic over an increased road network enabled by the NoRs, traffic volumes appear to reduce on individual roads when compared with the (theoretical) Do Nothing scenario.

Network assumptions that are included or excluded from each scenario are summarised in Appendix 1.

3.1.5 Noise Mitigation

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

Where a requirement to consider mitigation measures is identified, NZS 6806 states that structural mitigation should only be implemented if it achieves the following:

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

In circumstances where noise mitigation is warranted, NZS 6806 adopts a “Best Practicable Option” (BPO) approach. BPO considers the extent to which a mitigation option will achieve compliance with the relevant noise criteria and result in a noticeable noise reduction at assessment locations. The

value-for-money of the option and the potential visual, shading and safety effects are also considered, amongst other things.

3.2 Road Traffic Vibration

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

4 Assessment Methodology

Road traffic data provided for the Redhills Riverhead package relies on the development and urbanisation of the local areas, as well as other funded projects going ahead throughout the North West area, as it forms part of the wider strategic transport network. Some projects will have a direct impact on the traffic flow.

The purpose of this assessment is to determine the future potential impacts to support the future growth within the Redhills Riverhead area. Therefore, it has been assumed all transport infrastructure developments will be constructed by the design year 2048. It should be noted an urban speed reduction is expected within the transport model at the time of growth and at the Do Nothing scenario (design year without Project). This differs from the NZS 6806 standard where the Do Nothing scenario should include no alterations to the roads assessed. Therefore, in accordance with the standard, speed change has been applied at the Do Minimum scenario only. As noted previously, the Do Nothing scenario is a theoretical scenario for these Projects as the existing road network would not be able to accommodate the traffic volume expected from the full future development of the area.

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

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

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

Although the NZS 6806 assessment does not consider sites unless they contain, or have building consent for, a PPF, the predicted noise levels shown in the grid noise maps in Appendix 3 are considered indicative of the noise environment at adjacent sites without a PPF, including the future urbanisation areas.

4.1 Road Traffic Noise Model

A computer noise modelling software SoundPLAN (Version 8.2) has been used to predict road traffic noise impacts. The road traffic noise modelling employs the “Calculation of Road Traffic Noise” (CoRTN) algorithm, as recommended in NZS 6806. The CoRTN methodology has been adjusted for New Zealand Road Surfaces in accordance with LTNZ Report No. 326 and the Waka Kotahi Guide to state highway road surface noise. The model settings are described in Table 4-1

Table 4-1 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 grassed 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 CoRTN algorithm gives results in $L_{A10(18h)}$. To convert these results to $L_{Aeq(24h)}$ a minus 3 dB adjustment has been made. This adjustment has been implemented in the software in conjunction with the road surface adjustment detailed below.

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

4.1.1 Traffic data

All traffic data including AADT, percentage of heavy vehicles and posted speed limit has been sourced from the Project team based on the Saturn Model. The Existing scenario has been based on 2015 data as provided. Traffic modelling methodology and results are described in the Redhills Riverhead Arterial Network Transport Assessment.

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

4.1.2 Topography

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

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

4.1.3 Buildings

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

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

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

4.1.4 Road alignments

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

4.1.5 Road Surfaces

Surfaces of existing roads have been modelled as the current surfaces which is two-coat chipseal for the majority of Coatesville-Riverhead with the top section being Asphalt Concrete (AC-14). Fred Taylor Dr and Don Buck Rd were modelled as AC-14. For the Do Minimum scenario, the road surfaces have been modelled assuming all surface to be two-coat chipseal, as advised by Auckland Transport.

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

- In accordance with Transit Research Report 28, a minus 2 dB adjustment has been made for an asphaltic concrete road surface compared to CoRTN.
- Surface corrections relative to Asphaltic Concrete (AC-14) have been made in accordance with LTNZ Research Report 326 and the Waka Kotahi Guide to state highway road surface noise. The combination of surface corrections for cars and heavy vehicles has been made using the equation in the Waka Kotahi Guide to state highway road surface noise.
- The combined correction, including the adjustment from $L_{A10(18h)}$ to $L_{Aeq(24h)}$, has been entered in the modelling software as a total road surface correction.

4.1.6 Existing noise barriers

There are no existing noise barriers in the Project areas covered by the Redhills Riverhead Assessment Package.

Existing boundary fences on private properties have not been included in the noise model as their condition is unknown and they may not provide effective acoustic shielding.

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

4.2 Uncertainties and Limitations

The predicted road traffic noise levels presented in the following sections are based on a road traffic noise model developed in accordance with NZS 6806 and relevant guidance. The accuracy of the model is largely dependent upon the limitations of the available input data as detailed above. Uncertainties in the modelled noise levels can occur for a number of reasons. Uncertainties are typically related to the effects of topographical screening, appropriateness of the traffic data in terms of volumes of light and heavy vehicles, speeds (observed vs posted) and road surface type.

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

The traffic data has been sourced from the Project Transport team and it is accepted that the forecasting of future traffic flows may not necessarily reflect the actual flows when the Design Year is reached. The sensitivity of the noise predictions to changes in traffic data is not as significant as the effects of topographical screening. For example, if all other factors of the traffic data remain unchanged (speed and % of heavy vehicles), then a doubling or halving of the traffic data will only

result in a 3 dB change which is only just perceptible by most people. A change in traffic volume data by +25 % or -25% will result in a 1 dB change in predicted noise level, which would be imperceptible.

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

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

Noise monitoring could not be undertaken at the time of the assessment due to Covid-19 related restrictions which means current traffic flows are not representative of the typical traffic flows. However, from experience we consider that the predicted noise levels are in line with similar projects and are as expected for the traffic volume, speed and road surface for these Projects.

4.3 Potential Traffic Noise Mitigation Options

For those PPFs where the NZS 6806 Category A criterion is predicted to be exceeded, the effect of the mitigation options on road-traffic noise levels at each PPF were modelled.

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

4.3.1 Road surfaces

The noise mitigation measure with the largest influence on the generation of road traffic noise is the road surface material.

The Do Minimum road surface for all of the Projects has been modelled as two- coat chip seal as advised by Auckland Transport. Where mitigation of noise through selection of a low-noise road surface has been investigated, AC-14 has been used.

4.3.2 Noise barriers

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

4.3.3 Building modification

NZS 6806 requires that structural mitigation, such as noise barriers and low-noise road surfaces, should be implemented in preference to building modification mitigation. Building modification can potentially inconvenience residents and does not provide any protection to outdoor amenity.

However, if low-noise road surfaces and noise barriers are not practicable or do not provide the required level of noise reduction, building modification to PPFs, in addition to road surfaces and noise barriers, may be considered.

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

4.3.4 Maintenance of structural mitigation measures

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

This means that any barrier proposed for the Projects should not develop gaps or other openings or material failure. Any damage and vandalism to the barrier will need to be repaired, and asphalt surfaces should be maintained to be smooth and even, in order to achieve the same noise reducing qualities as following initial installation.

Maintenance of structural mitigation measures to the performance standards of NZS 6806 should be undertaken for the Projects in order to achieve the noise level reductions on which the noise level predictions are based.

4.4 Overview of Traffic Noise Effects

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

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

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

Table 4-2 Noise level change compared with general subjective perception

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

> 11 decibels

More than halving/doubling of loudness

5 Redhills Riverhead Assessment Package Overview

A brief summary of the Redhills Riverhead Assessment Package projects is provided in Table 5-1 below.

Table 5-1: Redhills Riverhead Assessment Package Project Summary

Corridor	NOR	Description	Requiring Authority
Don Buck Road FTN Upgrade	RE1	Upgrade of Don Buck Road corridor to a 30m wide four-lane cross-section providing bus priority lanes and separated active mode facilities on both sides of the corridor.	Auckland Transport
Fred Taylor Drive FTN Upgrade	RE2	Upgrade of Fred Taylor Drive corridor to a 30m wide four-lane cross-section providing bus priority lanes and separated active mode facilities on both sides of the corridor.	Auckland Transport
Coatesville-Riverhead Highway Upgrade	R1	Upgrading the southern section of the corridor to a 33m two-lane low speed rural arterial cross-section with active mode facilities on the western side; and Upgrading the northern section of the corridor to a 24m two-lane urban arterial cross-section with active mode facilities on both sides of the corridor.	Auckland Transport

6 Existing Ambient Noise Environment

The criteria in NZS 6806 to assess road-traffic noise are not dependent on the existing noise levels. Measurements of existing levels are therefore not required for the assessment against that standard. Nevertheless, an appreciation of the existing environment is required to judge the potential noise effects, regardless of compliance with any particular noise criteria. However, due to Covid-19 restrictions impacting typical traffic volumes it has not been possible to carry out noise measurements.

Based on the predicted existing noise levels, the rural environment in the Redhills Riverhead region, currently zoned as Future Urban Zone, will typically have low noise levels of 40 dB $L_{Aeq(24h)}$ to 50 dB $L_{Aeq(24h)}$. In areas near the busier sections of Don Buck existing noise levels are between 55 dB $L_{Aeq(24h)}$ and 65 dB $L_{Aeq(24h)}$.

7 NoR RE1: Don Buck Road FTN Upgrade

7.1 Project Corridor Features

Don Buck Road is an existing two-lane arterial extending from Fred Taylor Drive in the north to Swanson Road and Universal Drive in the south. The extent of the proposed upgrade is from Fred Taylor Drive in the north to Royal Road to the south

This section of Don Buck Road is proposed to be upgraded from a corridor width of 27-35m to a 30m wide four-lane local arterial with buses priority lanes and separated cycle lanes and footpaths on both sides of the corridor.

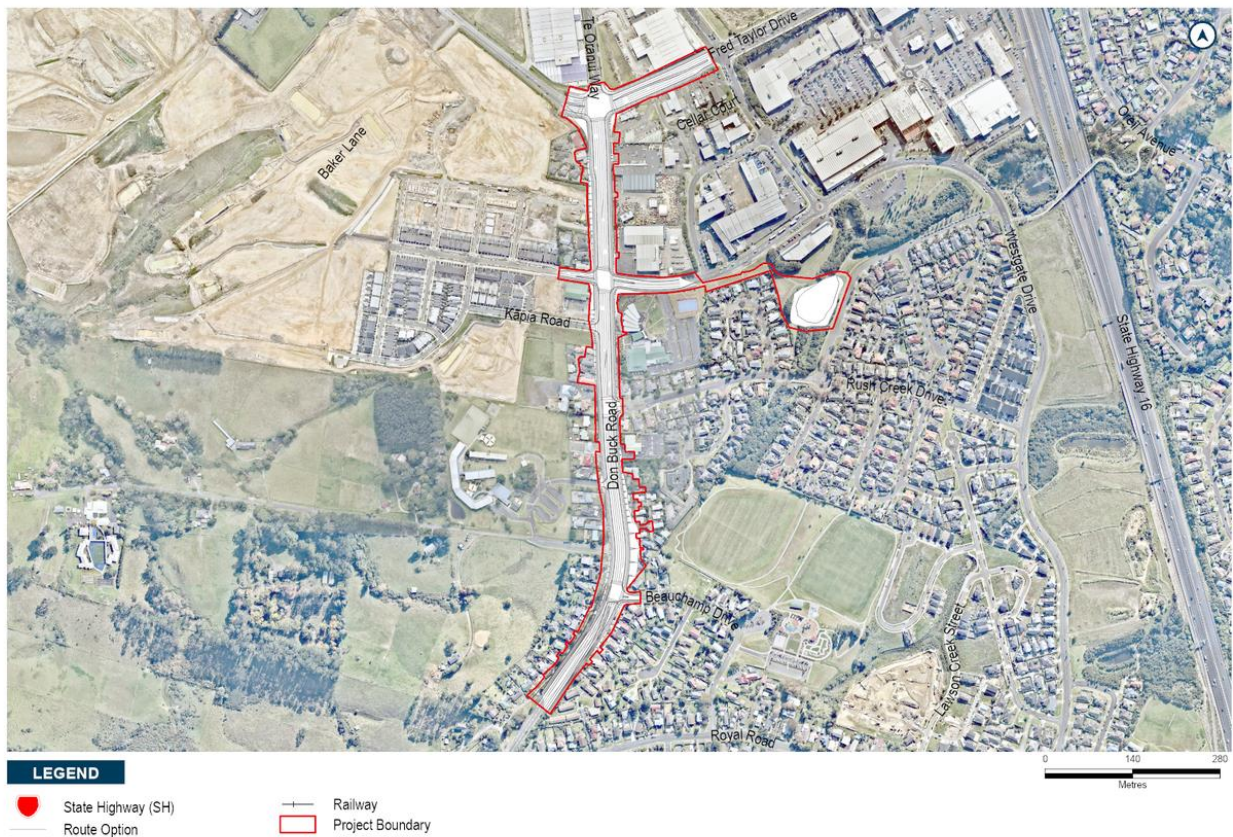


Figure 7-1 Overview of Don Buck Road

Key features of the proposed new corridor include the following:

- Widening of Don Buck Road to a 30m wide four-lane local arterial with buses priority lanes and separated cycle lanes and footpaths on both sides of the corridor
- The upgrade to the intersections with Fred Taylor Drive, Westgate Drive, Rush Creek Drive and Beauchamp Road.

7.2 Existing and Likely Future Environment

7.2.1 Planning context

The land adjacent to Don Buck Road is comprised of various business, residential and open space zoning. The following outlines the key elements of the planning context for the Don Buck Road FTN Upgrade:

- The eastern side of Don Buck Road above Westgate Drive is zoned under the AUP:OP as Business – Light Industry. To the south of Westgate Drive, the eastern side of Don Buck Road contains an Open Space – Community Zone (occupied by Massey Leisure Centre), with the remaining land zoned as Residential – Mixed Housing Zone.
- The western side of Don Buck Road is within the I610 Redhills Precinct and is predominantly zoned Residential – Mixed Housing Urban, with a portion of land in the northern section of the corridor zoned Residential – Terraced Housing and Apartment Buildings Zone (**THAB**). Land further to the west of Don Buck Road forms part of the Redhills Precinct.

Table 7-1 below provides a summary of the existing and likely future environment as it relates to the Don Buck Road FTN Upgrade.

Table 7-1: Don Buck Road FTN Upgrade Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment ¹	Likely Future Environment ²
Business	Business (Industrial)	Low	Business
Residential	Residential – Mixed Housing Urban Zone Residential – Terraced Housing and Apartment Zone	Low	Residential
Open Space	Open Space – Community Zone	Low	Open Space

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

7.2.2 Noise Environment

Don Buck Road is an existing busy road with commercial buildings and residential dwellings along the road corridor. The noise environment is dominated by road traffic noise from vehicles on Don Buck Road and industrial noise from businesses located in the Light Industrial Zone.

¹ Based on AUP:OP zoning/policy direction

² Based on AUP:OP zoning/policy direction

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

Predicted road traffic noise levels at all PPFs for the Existing, Do Nothing and Do Minimum scenarios are shown in Appendix 2. The cells are colour coded according to the NZS 6806 Category: Category A – green, Category B – orange, and Category C – red.

Grid noise maps showing indicative noise levels across the assessment area (100m radius from the alignment) are provided in Appendix 3. Specific noise level values should not be taken directly from the contours as they are interpolated from a grid resulting in some localised inaccuracies.

Based on the indicative designation boundary maps, the buildings in Table 7-2 will be removed to make room for the Project alignment and have not been considered in the assessment.

Table 7-2 Buildings within designation boundary

Buildings Within Designation Boundary	
453 Don Buck Road	2/520 Don Buck Road
455 Don Buck Road	3/520 Don Buck Road
457 Don Buck Road	4/520 Don Buck Road
469 Don Buck Road	5/520 Don Buck Road
471 Don Buck Road	6/520 Don Buck Road
473 Don Buck Road	7/520 Don Buck Road
479 Don Buck Road	552 Don Buck Road
1/485 Don Buck Road	562 Don Buck Road
11/148 Don Buck Road	
10/148 Don Buck Road	
14/148 Don Buck Road	
1/520 Don Buck Road	

7.3.1 Road Traffic Noise Model Results Analysis

The Project meets the definition of an Altered Road in accordance with NZS 6806 because the Do Minimum noise environment is predicted to be greater than or equal to 64 dB $L_{Aeq(24h)}$ at some PPFs and, if no specific noise mitigation is undertaken, the alterations are predicted to increase road-traffic noise at these PPFs by 3 dB $L_{Aeq(24h)}$ or more at the design year, when compared with the Do Nothing noise environment as per Section 3.1. A summary of the results of the NZS 6806 assessment is shown in Table 7-3.

Table 7-3 NZS 6806 Assessment Summary - Altered Roads - NoR RE1

Category	Criteria	Number of PPFs				
		Existing	Do Nothing	Do Minimum	Mitigation Option 1	Mitigation Option 2
Cat A	64 dB $L_{Aeq(24h)}$	127	126	95	116	121
Cat B	67 dB $L_{Aeq(24h)}$	5	6	11	16	11
Cat C	40 dB Internal $L_{Aeq(24h)}$	0	0	26	0	0
Total		132	132	132	132	132

Existing scenario predictions show that noise levels within the Project area are between 43 – 67 dB $L_{Aeq(24h)}$ with five PPFs in Category B and the remainder within Category A.

Under the Do Nothing scenario, predictions show similar noise levels to the Existing scenario. Noise levels range between 44 – 67 dB $L_{Aeq(24h)}$ with six PPFs in Category B and the remainder within Category A.

Under the Do Minimum scenario, predictions show a higher traffic noise level range of 50 – 72 dB $L_{Aeq(24h)}$ with 26 PPFs in Category C and 11 PPFs in Category B. The increase in traffic noise level is due to a louder road surface (chipseal) being used compared to the Existing and Do Nothing scenarios that have AC-14 as the road surface finish across all roads. In accordance with NZS 6806, mitigation options should be considered for the 37 PPFs that are predicted to receive noise levels within Category B and C. The Category B and Category C PPFs are presented in Table 7-4.

Table 7-4 Category B and C PPFs - NoR RE1

Category B PPFs	Category C PPFs
1/14 Royal Road	7/14 Royal Road
2 Royal Road	9/14 Royal Road
501 Don Buck Road	538 Don Buck Road
490 Don Buck Road	552A Don Buck Road
8/520 Don Buck Road	1 Rush Creek Drive
513 Royal Road	540 Don Buck Road
480 Don Buck Road	546 Don Buck Road
2/14 Don Buck Road	10/14 Royal Road
556 Don Buck Road	461 Don Buck Road
8/14 Royal Road	510 Don Buck Road
466 Don Buck Road	463 Don Buck Road
	2 Rush Creek Drive
	11/14 Royal Road
	492 Don Buck Road
	459 Don Buck Road
	508 Don Buck Road
	6/14 Royal Road
	12/14 Royal Road
	560 Don Buck Road

	504 Don Buck Road
	502 Don Buck Road
	500 Don Buck Road
	506 Don Buck Road
	494 Don Buck Road
	465 Don Buck Road
	496 Don Buck Road

Two mitigation options have been considered to reduce noise levels at PPFs. The options comprise of low noise road surface and localised barriers.

Mitigation option 1 is applying AC-14 to the Altered Roads, which would reinstate the current road surface, resulting in all but sixteen PPFs falling within Category A. The sixteen Category B PPFs are:

- 1 Rush Creek Drive
- 2 Rush Creek Drive
- 6/14 Royal Road
- 9/14 Royal Road
- 10/14 Royal Road
- 11/14 Royal Road
- 12/14 Royal Road
- 459 Don Buck Road
- 461 Don Buck Road
- 463 Don Buck Road
- 492 Don Buck Road
- 508 Don Buck Road
- 510 Don Buck Road
- 538 Don Buck Road
- 540 Don Buck Road
- 546 Don Buck Road

Mitigation option 2 involves applying AC-14 to the Altered Roads, which would reinstate the current road surface as per the first mitigation option, and installing two metre high noise barriers at the sixteen Category B PPFs. Predictions indicate that the noise barriers would only achieve the required reduction (5 dB noise reduction at a single PPF and 3 dB noise reduction at a cluster of PPFs) at 1 Rush Creek, 538, 540, 546 and 492 Don Buck Road. At all other locations the noise barrier performance was affected by the gaps required for driveways/entrances.

The second mitigation option is recommended for Altered Roads within NoR RE1 as it achieves the Category A criteria at the highest number of PPFs, i.e. low-noise road surface AC-14 installed along the entire project alignment, with localised noise barriers at 1 Rush Creek, 538, 540 546 and 492 Don Buck Road NoR RE1.

7.3.2 Assessment of Road Traffic Noise Effects

The effects associated with a change in noise level have been considered in addition to the NZS 6806 assessment. The Do Nothing scenario and Mitigation Option 2 scenario can be compared to determine the predicted noise level increase or decrease at PPFs as a result of the Project.

Figure 7-2 shows the predicted change in noise levels at PPFs when comparing the Do Nothing and Mitigation Option 2 scenarios.

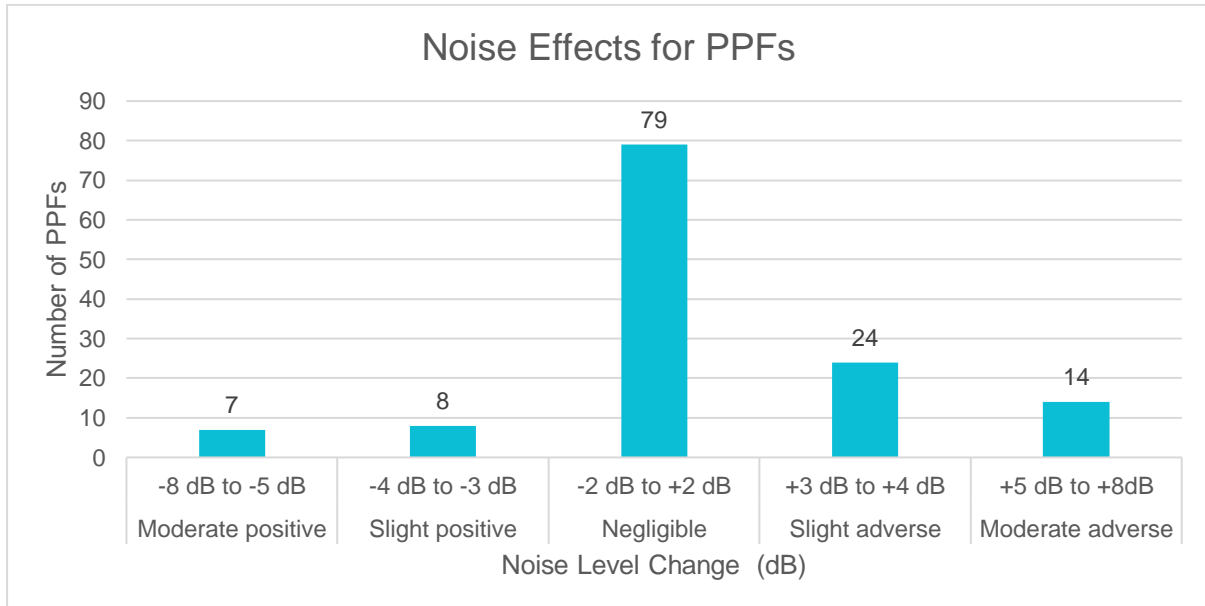


Figure 7-2 Change in Noise Level - Do Nothing Vs Mitigation Option 2 - NoR RE1

Predictions indicate that the vast majority of PPFs will experience a negligible change in noise levels due to the Project when comparing the Do Nothing and Mitigation Option 2 scenarios.

24 PPFs are predicted to experience a 3-4 dB increase in noise levels, resulting in slight adverse noise effects. 14 PPFs are predicted to experience at 5-8 dB increase in noise levels, resulting in moderate adverse noise effects. The increase in noise levels is due to the road alignment moving closer to some PPFs and/ or the removal of buildings that were providing shielding from road traffic noise.

15 PPFs are predicted to experience a 3 dB to 8 dB decrease in noise levels resulting in slight to moderate positive noise effects. This is due to the recommended noise barriers providing mitigation at some PPFs, along with the movement of the alignment away from some PPFs.

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

7.4 Conclusions

An assessment of traffic noise has been carried out for Altered Road for the Don Buck Road upgrade based on NZS 6806 and the predicted change in noise levels.

The recommended mitigation for the Altered Roads within NoR RE1 is the installation of AC-14, which would reinstate the current road surface, or an equivalent low noise road surface for the whole road

alignment and localised two metre high barriers at five PPFs. After implementation of the recommended mitigation option the majority of PPFs are predicted to receive noise levels within Category A with 11 in Category B.

A comparison of the predicted road traffic noise levels in the Do Nothing scenario (representative of the design year without the Project) and the Mitigation Option 2 scenario indicates that the vast majority of PPFs are predicted to experience a negligible change in noise level of +/- 2 dB which would be imperceptible.

24 PPFs are predicted to experience an increase in noise level of 3-4 dB, resulting in slight adverse noise effects. 14 PPFs are predicted to experience at 5-8 dB increase in noise levels, resulting in moderate adverse noise effects. However, 15 PPFs are predicted to experience a 3 dB to 8 dB decrease in noise levels resulting in slight to moderate positive noise effects.

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

8 NoR RE2: Fred Taylor Drive FTN Upgrade

Fred Taylor Drive is an existing two-lane arterial corridor which extends from the existing Brigham Creek Interchange in the north to SH16 in the south (via an intersection with Don Buck Road). This corridor runs through a mix of residential and industrial land uses and forms an important connection as the spine of the Redhills network.

It is proposed to upgrade the corridor between Hailes Road and Dunlop Road to accommodate a 30m wide four-lane FTN arterial with separated walking and cycling facilities.



Figure 8-1 Overview of Fred Taylor Drive Upgrade

Key features of the proposed upgrade include the following:

- The upgrade of the existing corridor to a 30m wide four-lane FTN arterial with separated walking and cycling. This widening is expected to remain in the existing designation 1433 to the extent possible.
- Localised widening outside the existing designation 1433 occurring at intersections.
- The upgrade of the intersections with Kakano Road and Northside Drive to signalised intersections.

8.1 Existing and Likely Future Environment

8.1.1 Planning context

The existing Fred Taylor Drive corridor runs through a mix of residential and industrial land uses.

The northern section of Fred Taylor Drive is within the Redhills North FUZ, with an area of land zoned under the AUP:OP as Open Space – Sport and Active Recreation Zone (Fred Taylor Park) adjacent the road corridor. The southern section of Fred Taylor Drive is zoned under the AUP:OP as THAB zone on the western side, and forms part of the I610 Redhills Precinct. The eastern side is zoned Business – Light Industry Zone and Business – Mixed Use Zone and forms part of the I615 Westgate Precinct.

Table 8-1 below provides a summary of the existing and likely future environment as it relates to the Fred Taylor Drive FTN Upgrade.

Table 8-1: Fred Taylor Drive FTN Upgrade Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment ³	Likely Future Environment ⁴
Business	Business (Light Industrial)	Low	Business
	Business (Mixed Use)	Low	
Residential	Residential – Terraced Housing and Apartment Zone	Low	Residential
Open Space	Open Space – Sport and Active Recreation	Low	Open Space
Undeveloped greenfield areas	Future Urban	High	Urban

8.1.2 Noise Environment

Fred Taylor Drive is located within a predominantly rural area with some PPFs and commercial receivers located close to the road corridor. The noise environment is dominated by road traffic noise from vehicles on Fred Taylor Drive and the surrounding road network.

³ Based on AUP:OP zoning/policy direction

⁴ Based on AUP:OP zoning/policy direction

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

Predicted road traffic noise levels at all PPFs for the Existing, Do Nothing and Do Minimum are shown in Appendix 2. The cells are colour coded according to the NZS 6806 Category: Category A – green, Category B – orange, and Category C – red.

Grid noise maps showing indicative noise levels across the assessment area (100m radius from the alignment) are provided in Appendix 3. Specific noise level values should not be taken directly from the contours as they are interpolated from a grid resulting in some localised inaccuracies.

8.2.1 Road Traffic Noise Model Results Analysis

The Project meets the definition of an Altered Road in accordance with NZS 6806 because the Do Minimum noise environment is predicted to be greater than or equal to 64 dB $L_{Aeq(24h)}$ at some PPFs and, if no specific noise mitigation is undertaken, the alterations are predicted to increase road-traffic noise at these PPFs by 3 dB $L_{Aeq(24h)}$ or more at the design year, when compared with the Do Nothing noise environment as per Section 3.1. A summary of the results of the assessment is presented in Table 8-2.

Table 8-2 NZS 6806 Assessment Summary - Altered Roads - NoR RE2

Category	Criteria	Number of PPFs			
		Existing	Do Nothing	Do Minimum	Mitigation
Cat A	64 dB $L_{Aeq(24h)}$	70	63	58	73
Cat B	67 dB $L_{Aeq(24h)}$	3	10	14	0
Cat C	40 dB Internal $L_{Aeq(24h)}$	0	0	1	0
Total		73	73	73	73

Existing scenario predictions show the noise level within the Project area is between 40 – 65 dB $L_{Aeq(24h)}$ with three PPFs in Category B and the remainder in Category A.

Under the Do Nothing scenario, predictions show a higher traffic noise level range of between 41 – 66 dB $L_{Aeq(24h)}$ with ten PPFs in Category B due to an increase in traffic volumes.

The Do Minimum scenario shows a higher traffic noise level range compared to the Do Nothing scenario of 40 – 69 dB $L_{Aeq(24h)}$ with 14 PPFs in Category B and one PPF in Category C. The increase in traffic noise level is due to a louder road surface (chipseal) being used compared to the Do Nothing scenario that has a low noise road surface finish across all roads. In accordance with NZS 6806, mitigation options must be considered for the PPFs that are predicted to receive noise levels within Categories B and C.

For the Do Minimum Scenario, the 14 PPFs in Category B and one PPF in Category C are presented in Table 8-3.

Table 8-3 Category B and C PPFs - NoR RE2

Category B Addresses	Category C Addresses
122 Fred Taylor Drive	89 Fred Taylor Dr
127 Fred Taylor Drive	
1A Matakoho Road	
1B Matakoho Road	
1C Matakoho Road	
1D Matakoho Road	
166 Fred Taylor Drive	
73-2 Fred Taylor Drive	
61 Fred Taylor Dive	
100 Fred Taylor Drive	
129 Fred Taylor Drive	
144 Fred Taylor Drive	
75 Fred Taylor Drive	
75B Fred Taylor Drive	

A mitigation option of installing AC-14 along the whole road alignment, which would reinstate the current low noise road surface, has been considered which results in all PPFs being in Category A. This is the recommended mitigation option for NoR RE2.

8.2.2 Assessment of Road Traffic Noise Effects

In addition to assessing effects due to absolute noise levels, the effect of road noise changes has also been addressed. The Do Nothing scenario (Project design year traffic flow without Project) and Mitigated scenario (project design year traffic flow with Project and mitigation applied) can be compared to determine the predicted noise level increase or decrease as a result of the Project.

Figure 8-2 shows the noise level change in the Design year for all the PPFs.

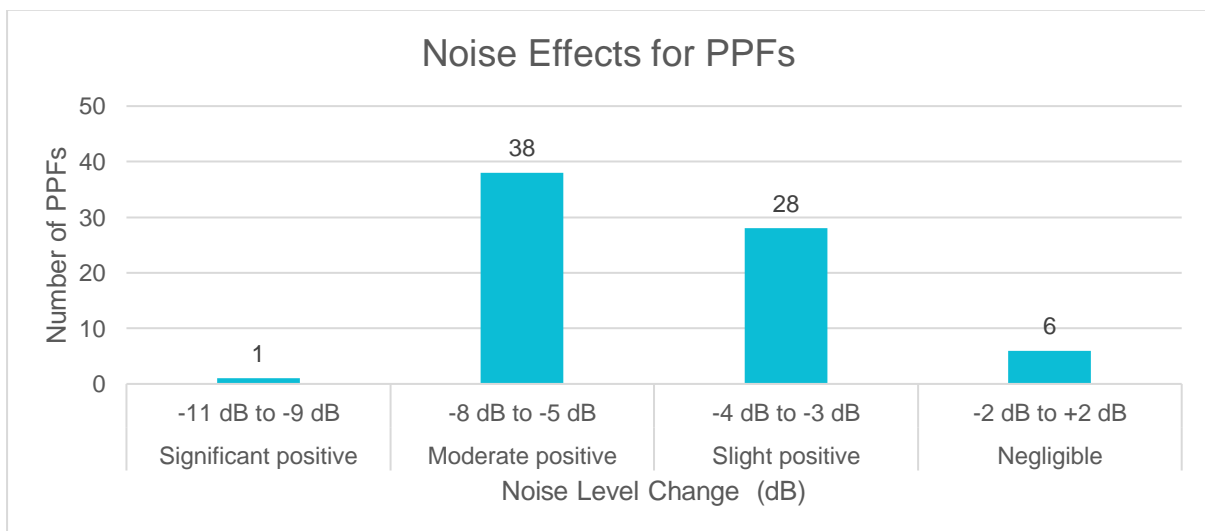


Figure 8-2 Change in Noise Level - Do Nothing Vs Mitigated - NoR RE2

Predictions indicate that noise levels will decrease at almost all PPFs when comparing the Do Nothing and Mitigated scenarios. This is primarily due to the application of AC-14 low noise road surface, along with a reduction in traffic volumes along Don Buck Rd and a planned decrease in speed limit upon implementation of the project.

Six PPFs are predicted to experience a change in road traffic noise levels of +/- 2 dB compared to the Do Nothing scenario, which would be imperceptible. 28 PPFs are predicted to experience a reduction in noise levels of 3-4 dB, resulting in slight positive noise effects. 38 PPFs are predicted to experience a reduction in noise levels of 5-8 dB, resulting in moderate positive noise effects. The PPF at 77 Fred Taylor Dr is predicted to experience a 9 dB decrease in noise levels, resulting in significant positive noise effects.

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

8.3 Conclusions

An assessment of traffic noise has been carried out for Altered Roads for the Fred Taylor Drive Upgrade based on NZS 6806 and the predicted change in noise levels.

The recommended mitigation for the Altered Roads within NoR RE2 is the installation of AC-14, which would reinstate the current low noise road surface or an equivalent low noise road surface along the whole road alignment. After implementation of the recommended mitigation option, noise levels are predicted to decrease at the vast majority of PPFs resulting in slight to moderate positive noise effects. 6 PPFs are predicted to experience an imperceptible change in noise levels, and the PPF at 77 Fred Taylor Drive is predicted to experience a reduction in noise levels resulting in significant positive noise effects.

All PPFs are predicted to receive noise levels within Category A after implementation of the recommended mitigation option.

9 NoR R1: Coatesville-Riverhead Highway Upgrade

9.1 Project Corridor Features

The Coatesville-Riverhead Highway is an existing arterial extending from SH16 in the south to its intersection with Dairy Flat Highway in the north east, with the extents of the proposed upgrade from SH16 in the south to its intersection with Riverhead Road in the north. The southern section of the alignment from SH16 to Short Road runs through rural land uses which are expected to remain.



Figure 9-1 Overview of Coatesville-Riverhead Highway Upgrade

Key features of the proposed new corridor include the following:

- Upgrading the southern section of the corridor to a 33m two-lane low speed rural arterial with active mode space on the western side and upgrading the northern section of the alignment to a 24m two-lane urban arterial with walking and cycling facilities on both sides of the corridor
- The upgrade of the Coatesville-Riverhead Highway / Old Railway Road unsignalised intersection to a roundabout.
- The upgrade of the existing Coatesville-Riverhead Highway / Riverhead Road roundabout intersection.

9.2 Existing and Likely Future Environment

9.2.1 Planning context

The southern section of Coatesville-Riverhead Highway from SH16 to Short Road runs through rural land uses predominantly zoned under the AUP:OP as Rural – Mixed Rural Zone on both sides of the existing corridor. The northern section (close to and within the Riverhead township) runs through land zoned as Residential – Single House Zone and to the east and future urban zoned land on the west.

Table 9-1 below provides a summary of the existing and likely future environment as it relates to the Coatesville-Riverhead Highway Upgrade.

Table 9-1: Coatesville-Riverhead Highway Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment ⁵	Likely Future Environment ⁶
Rural	Rural	Low	Rural
Residential	Residential	Low	Residential
Future Urban Zone / Undeveloped greenfield areas	Future Urban	High	Urban

9.2.2 Noise Environment

The Coatesville-Riverhead Highway currently runs through a rural area with few dwellings near the road. The noise environment is dominated by road traffic noise from vehicles using the Coatesville-Riverhead Highway and the surrounding road network.

Development is highly likely to occur in the Future Urban Zone. An increase in ambient noise levels is expected as the area urbanises.

⁵ Based on AUP:OP zoning/policy direction

⁶ Based on AUP:OP zoning/policy direction

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

Predicted road traffic noise levels at all PPFs for the Existing, Do Nothing and Do Minimum are shown in Appendix 2. The cells are colour coded according to the NZS 6806 Category: Category A – green, Category B – orange, and Category C – red.

Grid noise maps showing indicative levels across the assessment area (100m radius from the alignment) are provided in Appendix 3. Specific noise level values should not be taken directly from the contours as they are interpolated from a grid resulting in some localised inaccuracies.

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

- 5 Moontide Road
- 1302 Coatesville-Riverhead Highway
- 1308 Coatesville-Riverhead Highway
- 1385 B3 Coatesville-Riverhead Highway

9.3.1 Road Traffic Noise Model Result Analysis

The Coatesville-Riverhead Road Upgrade meets the definition of an Altered road in accordance with NZS 6806 because the Do Minimum noise environment is predicted to be greater than or equal to 64 dB $L_{Aeq(24h)}$ at some PPFs and, if no specific noise mitigation is undertaken, the alterations are predicted to increase road-traffic noise at these PPFs by 3 dB $L_{Aeq(24h)}$ or more at the design year, when compared with the Do Nothing noise environment as per Section 3.1. A summary of the results of the assessment is presented in Table 9-2.

Table 9-2 NZS 6806 Assessment Summary - Altered Roads NoR R1

Category	Criteria	Number of PPFs			
		Existing	Do Nothing	Do Minimum	Mitigation
Cat A	64 dB $L_{Aeq(24h)}$	90	91	85	92
Cat B	67 dB $L_{Aeq(24h)}$	2	1	6	0
Cat C	40 dB Internal $L_{Aeq(24h)}$	0	0	1	0
Total		92	92	92	92

Existing scenario predictions indicate that the noise level within the Project area is between 43 – 66 dB $L_{Aeq(24h)}$ with two PPFs in Category B and the remaining in Category A.

Under the Do Nothing scenario, predictions show a slightly higher traffic noise level range between 45 – 67 dB $L_{Aeq(24h)}$, with one PPF in Category B and the remaining in Category A.

Under the Do Minimum scenario predictions indicate a higher traffic noise level range between 46 – 69 dB $L_{Aeq(24h)}$, with one PPF in Category C, six PPFs in Category B and the remaining PPFs in Category A. The increase in traffic noise level is due to a louder road surface (chipseal) being used compared to the Do Nothing scenario that has AC-14 as the road surface finish across most roads.

For the Do Minimum scenario, the six PPFs in Category B and one PPF in Category C are presented in Table 9-3.

Table 9-3 Category B and C PPFs - NoR R1

Category B Addresses	Category C Addresses
1293 Coatesville-Riverhead Highway	1090 Coatesville-Riverhead Highway
1323 Coatesville-Riverhead Highway	
1351 Coatesville-Riverhead Highway	
1363 Coatesville-Riverhead Highway	
1397 Coatesville-Riverhead Highway	
1404 Coatesville-Riverhead Highway	

A mitigation option of installing AC-14 along the whole road alignment has been considered which results in all PPFs falling within Category A. This is the mitigation option recommended for NoR R1.

9.3.2 Assessment of Road Traffic Noise Effects

The effects associated with a change in noise level have been considered in addition to the NZS 6806 assessment. The Do Nothing scenario and Mitigated scenario can be compared to determine the predicted noise level increase or decrease at PPFs. Figure 9-2 shows the predicted change in noise level at PPFs when comparing the Do Nothing and Mitigation scenarios.

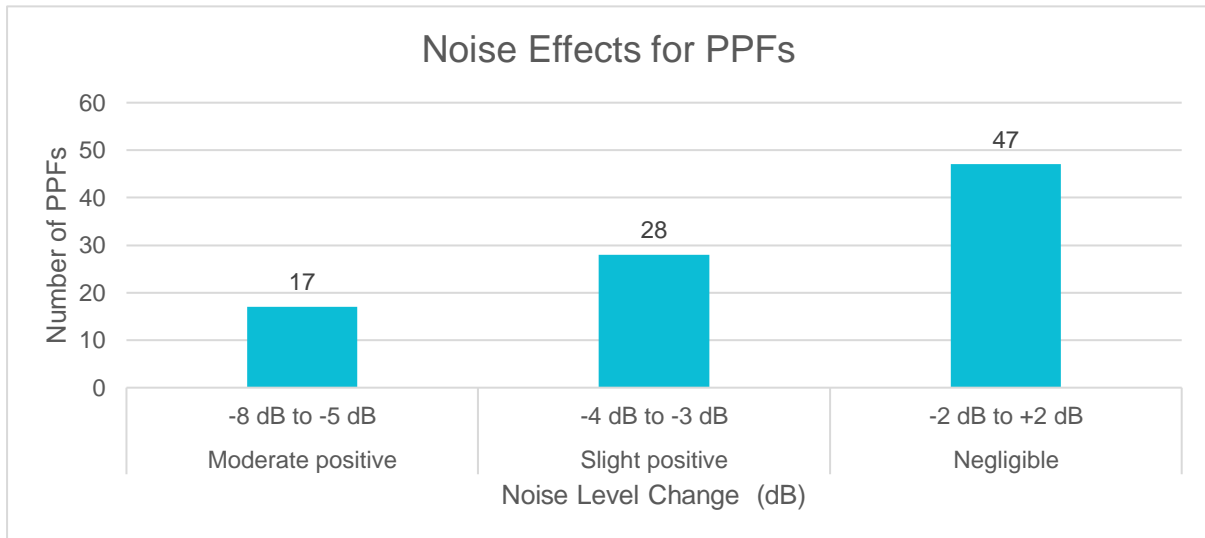


Figure 9-2 Change in Noise Level - Do Nothing Vs Mitigated - NoR R1

Predictions indicate that noise levels will change by a negligible margin or decrease at all PPFs when comparing the Do Nothing and Mitigation scenarios. This is due to the application of the AC-14 low-noise road surface, along with a reduction in traffic volumes along the Coatesville-Riverhead Highway upon implementation of the project.

47 PPFs are predicted to experience a change in noise level of +/- 2 dB, which would be imperceptible. 28 PPFs are predicted to experience a reduction in noise levels of 3-4 dB, resulting in slight positive noise effects. 17 PPFs are predicted to experience a reduction in noise levels of 5-8 dB, resulting in moderate positive noise effects.

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

9.4 Conclusions

An assessment of traffic noise has been carried out for Altered Roads for the Coatesville-Riverhead Highway Upgrade based on NZS 6806 and the predicted change in noise levels.

The recommended mitigation for the Altered Roads within NoR R1 is the installation of AC-14 or an equivalent low noise road surface for the whole road alignment. After implementation of the recommended mitigation option, noise levels are predicted to decrease at 45 PPFs, resulting in slight to moderate positive noise effects. Changes in noise level are predicted to be imperceptible at all other PPFs.

All PPFs are predicted to receive noise levels within Category A after implementation of the recommended mitigation option.

10 Conclusion

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

All existing PPFs within 100m of each alignment have been considered within the assessment (in accordance with the definition of urban areas as per Statistics New Zealand 2004). Buildings that are within the NoR areas have been removed from the Do Minimum scenario as they will not remain following the Project implementation.

For NoR RE1, noise levels are predicted to remain unchanged at the vast majority (79 of 132) of PPFs after implementation of the recommended mitigation option of low-noise road surface and two metre high barriers at five PPFs. Eleven PPFs will be in Category B with the remaining PPFs in Category A. Changes in noise level at PPFs are due to the movement of the road alignment and the removal of buildings that were providing shielding from road traffic noise.

For NoR RE2 and NoR R1, noise levels are predicted to change by a negligible margin or decrease at all PPFs after implementation of the recommended mitigation option of a low-noise road surface. This will result in no noise effects where noise levels will change by a negligible margin, or positive noise effects where noise levels are predicted to decrease. All PPFs are predicted to receive noise levels within Category A after implementation of the recommended mitigation option.

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

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

Nevertheless, the predictions show that most PPFs (with the exception of eleven Category B PPFs in NoR RE1) will receive levels within the Category A criteria, which is the most stringent Category and represents the lowest design noise levels. Therefore, resulting noise levels will be reasonable in a residential context at the majority of PPFs assessed.

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

1 Appendix 1: Assumptions

Package	Project(s)	Existing	Do Nothing	Do Minimum
Whenuapai Arterials	Trig Road upgrade (NoR W1)	x	x	√
	Māmari Road upgrade (NoR W2)	x	x	√
	Brigham Creek Road upgrade (NoR W3)	x	x	√
	Spedding Road upgrade (NoR W4)	x	x	√
	Hobsonville Road upgrade (NoR W5)	x	x	√
Redhills Arterials	Fred Taylor Drive FTN upgrade	x	√	√
	Northside Drive East extension	x	√	√
	Don Buck Road FTN upgrade	x	√	√
	Royal Road FTN upgrade	x	√	√
Riverhead Arterials	Coatesville – Riverhead Highway upgrade	x	√	√
	Riverhead Road upgrade	x	√	√
Strategic Projects	Rapid Transit Corridor (RTC)	x	√	√
	Alternative State Highway (ASH)	x	√	√
	Brigham Creek Interchange	x	√	√
	Regional Active Mode Corridor (RAMC)	x	√	√
	SH16 Main Road upgrade	x	√	√
	Access Road upgrade	x	√	√

Package	Project(s)	Existing	Do Nothing	Do Minimum
	Station Road upgrade	x	√	√
Growth	Land Use Assumptions	up to 2015	up to 2048+	up to 2048+
		Key		
			√	Included
			x	Excluded
			*	Minimal Network Change

2 Appendix 2: Predicted Traffic Noise Levels

KEY

Cat A	Cat B	Cat C
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NoR RE1

NoR RE1 - Altered Roads					
Address	Existing, dB LAeq(24hr)	Do Nothing, dB LAeq(24hr)	Do Minimum, LAeq(24hr)	Mitigation Option 1, LAeq(24hr)	Mitigation Option 2, LAeq(24hr)
9/14 Royal Road	64	64	71	67	67
538 Don Buck Road	60	63	72	67	62
1 Rush Creek Drive	67	67	71	66	59
540 Don Buck Road	61	64	71	66	61
546 Don Buck Road	61	64	71	66	63
10/14 Royal Road	62	62	70	66	66
461 Don Buck Road	62	63	71	65	65
510 Don Buck Road	62	63	70	65	65
463 Don Buck Road	62	62	71	65	65
11/14 Royal Road	61	61	70	65	65
6/14 Royal Road	62	61	70	65	65
492 Don Buck Road	66	67	70	65	59
2 Rush Creek Drive	65	65	70	65	65
459 Don Buck Road	62	63	70	65	65
508 Don Buck Road	63	63	70	65	65
12/14 Royal Road	61	62	69	65	65
504 Don Buck Road	63	63	69	64	64
560 Don Buck Road	60	63	69	64	64
502 Don Buck Road	63	63	69	64	64
506 Don Buck Road	62	63	69	64	64
500 Don Buck Road	63	63	69	64	64
494 Don Buck Road	64	64	69	64	64
465 Don Buck Road	60	60	68	63	63
552A Don Buck Road	57	60	68	63	63
7/14 Royal Road	58	57	68	63	63
496 Don Buck Road	62	62	68	63	63
501 Don Buck Road	65	66	67	62	62
1/14 Royal Road	61	60	67	62	62
490 Don Buck Road	64	65	67	62	62
2/14 Royal Road	58	57	66	61	61
8/520 Don Buck Road	59	59	66	61	61
480 Don Buck Road	66	66	65	61	61

513 Don Buck Road	62	62	66	61	61
8/14 Royal Road	55	54	65	60	60
556 Don Buck Road	51	54	65	60	60
13/14 Royal Road	55	56	64	59	59
466 Don Buck Road	60	60	65	59	59
2 Royal Road	59	60	66	59	59
12/520 Don Buck Road	52	52	64	59	59
486 Don Buck Road	64	64	64	59	59
464 Don Buck Road	58	58	64	59	59
478 Don Buck Road	63	63	63	59	59
558 Don Buck Road	52	55	63	58	58
3/14 Royal Road	54	53	63	58	58
11/520 Don Buck Road	50	50	63	58	58
554 Don Buck Road	53	56	63	58	58
28 Beauchamp Drive	55	55	63	58	58
14/14 Royal Road	51	52	62	58	58
4 Rush Creek Drive	57	57	62	57	57
3 Rush Creek Drive	57	58	62	57	57
4 Royal Road	57	57	63	57	57
462 Don Buck Road	56	56	63	57	57
10/520 Don Buck Road	51	52	62	57	57
488 Don Buck Road	61	62	62	57	57
451 Don Buck Road	52	52	62	57	57
31 Beauchamp Drive	56	56	62	57	57
476 Don Buck Road	60	60	61	57	57
9/520 Don Buck Road	56	56	62	57	57
482 Don Buck Road	60	60	61	57	57
9/485 Don Buck Road	54	54	62	57	57
484 Don Buck Road	61	62	61	56	56
554A Don Buck Road	53	56	61	56	56
12/485 Don Buck Road	51	52	60	55	55
542 Don Buck Road	48	50	60	55	55
13/485 Don Buck Road	50	50	60	55	55
470 Don Buck Road	59	60	61	55	55
544 Don Buck Road	51	54	60	55	55
17/14 Royal Road	50	50	60	55	55
460 Don Buck Road	54	53	60	55	55
5 Rush Creek Drive	53	54	59	54	54
496 2 Don Buck Road	53	54	59	54	54
472 Don Buck Road	57	57	59	54	54
475 Don Buck Road	49	49	59	54	54
26 Beauchamp Drive	51	52	59	54	54
29 Beauchamp Drive	49	49	59	54	54
2/485 Don Buck Road	48	49	58	53	53

4/14 Royal Road	51	50	58	53	53
16/14 Royal Road	49	50	58	53	53
477 Don Buck Road	48	48	57	53	53
474 Don Buck Road	56	56	57	52	52
492A Don Buck Road	53	53	57	52	52
6 Rush Creek Drive	50	51	57	52	52
5/14 Royal Road	50	50	57	52	52
468 Don Buck Road	53	53	57	51	51
7 Rush Creek Drive	50	50	56	51	51
3B Reverie Place	48	49	56	51	51
24 Beauchamp Drive	48	48	56	51	51
25 Beauchamp Drive	46	46	55	50	50
15/14 Royal Road	48	49	55	50	50
10 Royal Road	49	49	55	50	50
28 Beauchamp Drive	47	48	55	50	50
6 Royal Road	49	49	55	50	50
8 Royal Road	49	49	55	50	50
31 Regents Park Place	48	48	55	50	50
13 Reverie Place	45	46	55	50	50
11 Reverie Place	45	46	54	49	49
24 Reverie Place	47	48	54	49	49
8 Rush Creek Drive	48	48	54	49	49
26 Reverie Place	47	47	54	49	49
8/485 Don Buck Road	49	49	54	49	49
19/14 Royal Road	47	47	54	49	49
5/485 Don Buck Road	46	47	54	49	49
9 Rush Creek Drive	48	48	54	49	49
41 Regents Park Place	46	47	53	48	48
43 Regents Park Place	46	47	53	48	48
27 Beauchamp Drive	45	45	53	48	48
3/485 Don Buck Road	45	46	53	48	48
7/485 Don Buck Road	47	47	53	48	48
6/485 Don Buck Road	46	46	53	48	48
20A Princes Street	46	47	53	48	48
22 Beauchamp Drive	45	46	53	48	48
33 Regents Park Place	46	47	53	48	48
12 Royal Road	46	47	53	48	48
4/485 Don Buck Road	45	45	53	48	48
15 Reverie Place	44	44	52	47	47
23 Beauchamp Drive	45	45	52	47	47
476A Don Buck Road	48	48	52	47	47
29 Regents Park Place	45	46	52	47	47
42 Regents Park Place	45	46	52	47	47
10 Rush Creek Drive	46	46	52	47	47

39 Regents Park Place	45	46	51	46	46
37 Regents Park Place	45	46	51	46	46
16 Royal Road	45	45	51	46	46
18 Royal Road	44	45	51	46	46
35 Regents Park Place	45	46	51	46	46
7 Reverie Place	44	45	51	46	46
22 Reverie Place	43	44	51	46	46
3A Reverie Place	45	45	51	46	46
27 Regents Park Place	44	45	51	46	46
9 Reverie Place	44	45	50	46	46
5 Reverie Place	44	44	50	45	45
20 Royal Road	43	44	50	45	45

NoR RE2

NoR RE2 - Altered Roads				
Address	Existing, dB LAeq(24hr)	Do Nothing, dB LAeq(24hr)	Do Minimum, dB LAeq(24hr)	Mitigation, dB LAeq(24hr)
89 Fred Taylor Drive	63	66	69	64
122 Fred Taylor Drive	61	64	67	62
1A Matakoho Road	65	66	67	62
127 Fred Taylor Drive	62	65	67	62
1B Matakoho Road	65	66	67	62
1C Matakoho Road	65	66	67	62
1D Matakoho Road	64	66	66	61
73 2 Fred Taylor Drive	61	65	66	61
166 Fred Taylor Drive	61	64	66	61
61 Fred Taylor Drive	62	64	66	61
100 Fred Taylor Drive	61	64	66	61
144 Fred Taylor Drive	59	62	65	61
129 Fred Taylor Drive	61	63	65	61
75 Fred Taylor Drive	63	66	65	60
75B Fred Taylor Drive	62	66	65	60
164 Fred Taylor Drive	61	63	64	60
96 Fred Taylor Drive	56	59	63	59
130 Fred Taylor Drive	58	61	63	59
116 Fred Taylor Drive	58	61	63	58
114 Fred Taylor Drive	58	61	63	58
83 2 Fred Taylor Drive	61	65	62	58
112 Fred Taylor Drive	57	61	62	58
83 Fred Taylor Drive	60	64	62	58
94 Fred Taylor Drive	60	63	62	58
109 Fred Taylor Drive	58	60	62	57
110 Fred Taylor Drive	56	60	61	57

10 Heri Lane	59	61	60	56
8 Heri Lane	59	60	60	56
12 Heri Lane	59	61	60	56
14 Heri Lane	59	60	60	56
102 Fred Taylor Drive	56	59	60	56
88 Fred Taylor Drive	58	60	60	55
6 Heri Lane	59	60	60	55
98 Fred Taylor Drive	56	58	60	55
2 Heri Lane	59	60	60	55
4 Heri Lane	59	60	60	55
77 Fred Taylor Drive	60	64	60	55
77 Fred Taylor Drive	57	59	59	54
3A Matakoho Road	58	59	58	54
3B Matakoho Road	57	58	58	53
118 Fred Taylor Drive	52	56	57	53
5 Matakoho Road	56	57	57	52
111 Fred Taylor Drive	52	55	56	52
121 Fred Taylor Drive	52	54	56	51
1 Dunlop Road	53	54	56	51
78 Fred Taylor Drive	54	55	56	51
122 2 Fred Taylor Drive	51	54	56	51
122 3 Fred Taylor Drive	48	51	55	50
7 Matakoho Road	55	56	55	50
106 Fred Taylor Drive	50	53	54	50
123 Fred Taylor Drive	50	52	54	49
108 Fred Taylor Drive	49	52	54	49
13 Heri Lane	53	54	53	49
105 Fred Taylor Drive	49	51	53	48
9 Matakoho Road	52	53	52	47
15 Heri Lane	51	52	51	47
11 Matakoho Road	50	51	50	46
13 Matakoho Road	49	51	50	45
15 Matakoho Road	48	50	50	45
17 Matakoho Road	48	50	50	45
11 Heri Lane	48	49	48	44
1 Heri Lane	47	48	47	43
9 Heri Lane	46	47	47	42
7 Heri Lane	43	45	45	40
63 Tahetoka Street	43	44	44	40
3 Heri Lane	43	44	44	40
5 Heri Lane	43	45	44	39
75 Tahetoka Street	41	42	41	36
71 Tahetoka Street	41	42	41	36
69 Tahetoka Street	40	42	41	36

73 Tahetoka Street	40	42	40	36
65 Tahetoka Street	40	41	40	36
67 Tahetoka Street	40	41	40	36

NoR R1

NoR R1 - Altered Roads				
Address	Existing, dB LAeq(24hr)	Do Nothing, dB LAeq(24hr)	Do Minimum, dB LAeq(24hr)	Mitigated dB, LAeq(24hr)
1090 Coatesville-Riverhead Highway	65	64	69	64
315 State Highway 16	66	67	64	64
1404 Coatesville-Riverhead Highway	63	64	67	63
1293 Coatesville-Riverhead Highway	62	63	66	61
1397 Coatesville-Riverhead Highway	60	61	66	61
1363 Coatesville-Riverhead Highway	61	62	65	61
1323 Coatesville-Riverhead Highway	59	61	65	60
1351 Coatesville-Riverhead Highway	60	61	65	60
1404 Coatesville-Riverhead Highway	63	63	60	60
2 Princes Street	60	60	63	60
1351 2 Coatesville-Riverhead Highway	59	61	64	60
1197 Coatesville-Riverhead Highway	59	62	63	59
1175 Coatesville-Riverhead Highway	62	64	63	59
1 Riverhead Point Drive	62	64	63	59
2 Pitoitoti Drive	61	64	63	59
1156 Coatesville-Riverhead Highway	60	62	62	58
1411 Coatesville-Riverhead Highway	60	60	58	58
15 Grove Way	60	63	62	58
1356 Coatesville-Riverhead Highway	56	57	62	58
5 Grove Way	60	62	62	58
1088 Coatesville-Riverhead Highway	58	57	62	58

1187 Coatesville-Riverhead Highway	60	63	62	58
1320 Coatesville-Riverhead Highway	57	58	62	58
1200 Coatesville-Riverhead Highway	56	59	62	58
1295 Coatesville-Riverhead Highway	58	60	62	57
19 Grove Way	59	62	61	57
1093 Coatesville-Riverhead Highway	60	60	61	57
1158 Coatesville-Riverhead Highway	59	61	61	57
1229 Coatesville-Riverhead Highway	56	60	60	57
1352 Coatesville-Riverhead Highway	57	58	61	57
21 Grove Way	59	61	61	57
7 Grove Way	59	62	61	57
1296 Coatesville-Riverhead Highway	57	58	61	56
1368 Coatesville-Riverhead Highway	57	58	60	56
9 Grove Way	59	61	60	56
11 Grove Way	58	61	60	56
1186 Coatesville-Riverhead Highway	56	59	60	56
1095 Coatesville-Riverhead Highway	60	59	60	56
1210 Coatesville-Riverhead Highway	55	59	59	56
1140 Coatesville-Riverhead Highway	54	56	59	55
1308 B3 Coatesville-Riverhead Highway	53	55	60	55
1328 Coatesville-Riverhead Highway	55	56	60	55
8 Jelas Drive	56	57	59	55
1308 B2 Coatesville-Riverhead Highway	52	54	59	54
1156 B2 Coatesville-Riverhead Highway	54	56	56	54
1230 Coatesville-Riverhead Highway	54	58	58	54
4 Princes Street	53	53	57	54
1385 B2 Coatesville-Riverhead Highway	53	54	58	53
1288 Coatesville-Riverhead Highway	53	55	58	53

1335 Coatesville-Riverhead Highway	54	55	58	53
1229 2 Coatesville-Riverhead Highway	54	58	57	53
6 Princes Street	52	52	56	53
1 Pitoitoi Drive	54	57	56	52
1409 Coatesville-Riverhead Highway	53	53	53	52
1335 2 Coatesville-Riverhead Highway	53	54	57	52
14 Leebank Crescent	52	55	54	52
8 2 Riverland Road	51	52	54	52
3 Riverhead Point Drive	54	56	55	52
1293 2 Coatesville-Riverhead Highway	50	51	54	52
7 Short Road	51	53	53	51
18 Leebank Crescent	53	56	55	51
8 Princes Street	50	49	54	51
5 Riverhead Point Drive	52	55	54	51
1385 Coatesville-Riverhead Highway	50	51	55	50
1092 Coatesville-Riverhead Highway	51	51	54	50
1194 Coatesville-Riverhead Highway	49	52	54	50
10 Princes Street	49	49	53	50
16 Leebank Crescent	50	53	52	50
3A Riverhead Point Drive	52	54	53	49
1170 Coatesville-Riverhead Highway	51	53	53	49
12 Short Road	47	50	50	49
182 Old Railway Road	51	53	54	49
3 Kaipara Portage Road	49	50	52	49
1158 B2 Coatesville-Riverhead Highway	50	53	52	49
5 Kaipara Portage Road	48	49	52	48
1156 B3 Coatesville-Riverhead Highway	48	51	51	48
12 Jelas Drive	46	48	52	48
11 Leebank Crescent	50	52	51	48
3 Pitoitoi Drive	49	51	52	48
1229 3 Coatesville-Riverhead Highway	49	52	52	48
9 Leebank Crescent	49	51	50	47
12 Leebank Crescent	43	46	46	46
7 Kaipara Portage Road	45	46	49	46
20 Jelas Drive	46	49	49	45

26 Jelas Drive	47	49	49	45
30 Jelas Drive	45	47	46	44
28 Jelas Drive	45	48	48	44
24 Jelas Drive	45	48	48	44
16 Jelas Drive	45	47	47	43
14 Jelas Drive	45	47	47	43
22 Jelas Drive	45	47	47	43
13 Jelas Drive	43	45	46	42