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# Noise and Vibration Management Plan Thornlie-Cockburn Link Transport Corridor Rail Operations

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# Noise and Vibration Management Plan

## Thornlie-Cockburn Link Transport Corridor Rail Operations

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## EXECUTIVE SUMMARY

The Thornlie-Cockburn Link consists of the construction of two passenger railway tracks between Thornlie Station and Cockburn Central Station, and realignment of an existing freight line rail.

This Noise and Vibration Management Plan documents commitments from the Public Transport Authority in regards to the management of airborne noise, ground-borne vibration and ground-borne noise arising from the operation of the new railway infrastructure.

The key commitments in this regard are:

- a. From detailed design and community consultation outcomes, review noise and vibration mitigation measures to be conducted.

Subject to detailed survey, safety and integration requirements, a series of noise walls between 2.4 and 4.0 m height limit will be constructed. Final heights of noise walls will be determined following community consultation, as well as detailed design considerations. Internal surfaces of noise barriers in some selected locations are proposed to have engineered sound absorptive finishes to improve performance instead of increased heights (and therefore visual impact). Such sound absorptive finishes should have a minimum weighted performance co-efficient of  $\alpha_w$  0.70 (Class C or better) when installed and rated to AS ISO 11654.

- b. Subject to geotechnical and railway requirements, an extent of resilient anti-vibration ballast matting will be constructed under both passenger and freight tracks.

Additional management measures defined in this Plan include a complaint handling procedure, noise and vibration monitoring and corrective actions where project criteria are not achieved.

## Table of Contents

1	INTRODUCTION	5
1.1	Overview	5
1.2	Acoustic terminology	5
2	PROJECT DESCRIPTION	8
2.1	Site locality	8
2.2	Key acoustic considerations	8
2.3	Operational profile	1
3	NOISE AND VIBRATION CRITERIA	2
3.1	Regulatory framework	2
3.2	Airborne noise	3
3.3	Ground-borne vibration and secondary effects	4
4	ASSESSMENT METHODOLOGY	6
5	MITIGATION MEASURES	7
5.1	Recommended airborne noise controls	7
5.2	Vibration mitigation	8
5.3	Track maintenance	9
6	COMPLIANCE MONITORING	10
6.1	Baseline noise and vibration	10
6.2	Methodology	10
6.3	Post commissioning verification	11
7	COMPLAINT MANAGEMENT PROCEDURE	13
7.1	Administrative procedures	13
7.2	Investigation	13
7.3	Community engagement	13
8	REVIEW	14
9	REFERENCES	15

### APPENDICES

Appendix A	Assessment summary of rail noise and vibration with the TCL and recommended mitigation
Appendix B	Predicted airborne noise levels (prior to mitigation)
Appendix C	Predicted ground borne vibration and noise levels (prior to mitigation)
Appendix D	Recommended extent of noise and vibration controls (indicative)

# 1 INTRODUCTION

## 1.1 Overview

The Thornlie-Cockburn Link (TCL) project forms part of the State Government's METRONET program. The TCL will connect existing passenger railway services from Thornlie Station on the Armadale railway to Cockburn Central Station on the Rockingham (Mandurah) railway line.

This Noise and Vibration Management Plan (NVMP) applies to operations of the passenger rail main lines between Beckenham Station and Cockburn Central Station, in accordance with *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning* (SPP5.4).

A noise and vibration assessment of the TCL conducted by SLR<sup>1</sup> (herein referred as the 'Assessment Report') has been the basis for the preparation of this NVMP. Details from the assessment, methodology and results have been summarised in **Appendix A**.

This Plan details relevant operational noise and vibration criteria and the mitigation measures to be implemented to achieve these criteria, where reasonable and practicable to do so. This plan also includes monitoring and response actions should there be complaints or adverse comment to excessive noise and/or vibration.

The Plan has been structured as follows:

- **Section 2** provides a description of the new infrastructure and the operational noise and vibration aspects addressed by this Plan.
- **Section 3** details the assessment criteria and guidelines that have been adopted for the management of noise and vibration impacts.
- **Section 4** summarises the basis of the Assessment Report including the locations of noise and vibration sensitive receptors.
- **Section 5** identifies reasonable and practicable measures for mitigating airborne noise and vibration from train passbys.
- **Section 6** details the noise and vibration monitoring methodology.
- **Section 7** provides the complaint management procedure.
- **Section 8** provides the documentation referenced in the preparation of this Plan.

A summary of the Assessment Report and the predicted airborne noise, ground vibration and ground-borne noise is provided in **Appendix A**.

## 1.2 Acoustic terminology

Terms considered important to understanding the technical noise and vibration aspects relating to this Plan are defined below.

### 1.2.1 Airborne noise

The term 'noise' is defined as unwanted sound but is commonly used when discussing all sound within our environment. In this report the term 'noise' refers to all sound pressure levels irrespective of whether it would be defined as 'unwanted'.

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<sup>1</sup> Thornlie-Cockburn Link, Noise and Vibration Assessment, SLR Report No. 675.10409.00100-R01.

The most common form of noise experienced by people is termed 'airborne noise', indicating that it propagates between the source and receptor primarily through the air.

Noise levels are measured and assessed in terms of decibels (dB). When assessing impacts to people noise levels are filtered (weighted) to the normal human response to loudness perceived by the ear. This is referenced as the A-weighted scale and is denoted with a subscript A.

For railways, airborne noise emissions are caused by the rolling contact of the wheels on the rails, the train engines and discrete events such as braking noise, curve squeal or impact noise from rail discontinuities such as turnouts, crossovers, joints or rail defects which can increase the level of wheel-rail noise.

It is noteworthy that even under ideal conditions with "smooth" rail and wheels, noise would occur as a result of the elastic deformation at the rolling contact point and due to the finite residual roughness of typical wheel and rail running surfaces.

Other sources of airborne noise, such as idling engines or air-conditioning plant and air compressors, are generally insignificant when compared to the noise from the train passbys.

The primary noise metrics used to describe transport noise emissions in this Plan are:

$L_{Aeq}$  the 'energy average noise level' evaluated over a defined time period. The  $L_{Aeq}$  can be likened to a noise dose representing the cumulative effects of all the noise events occurring in the relevant time period. Sound levels are here expressed in dB re 20  $\mu$ Pa.

$L_{Amax}$  the maximum  $L_{Aeq}$  value measured during each train passby using a time interval of one second.

The subscript "A" in the above terms indicates that the noise levels are filtered to match normal human hearing characteristics (i.e. A-weighted).

### 1.2.2 Vibration

Railway vibration is generated by dynamic forces at the wheel-rail interface and will occur to some degree, even with smooth wheel and rail contact surfaces (due to the moving loads, finite roughness of the surfaces and elastic deformation). Significantly higher vibration levels can occur due to design and/or maintenance factors such as rail and wheel surface irregularities (e.g. rail corrugation, wheel out of roundness) and discontinuities (e.g. joints or defects).

This vibration propagates via the sleepers or rail mounts into the ground or track support structure. It then propagates through the ground into buildings, and is then felt as perceptible vibration (or audible noise, see **Section 1.2.3**) by the occupants of buildings.

The thresholds of perceptible vibration are much lower than the levels of vibration likely to cause cosmetic damage to buildings and structures. In most cases where ground vibration levels are within levels to avoid impacts to human comfort (disturbance) structural impacts to buildings and structures will be prevented.

The primary metric used to describe ground-borne vibration from train passbys is as follows:

$L_{Vmax}$  the "Maximum Vibration Level" occurring during a train passby event. This is normally defined as the maximum root-mean-square (RMS) vibration level during the train passby averaged over a one second interval. The vibration level is here expressed in dB re  $10^{-9}$  m/s.

Use of the  $L_{Vmax}$  vibration level is advantageous as it allows the variation in individual train passby events to be examined. The  $L_{Vmax}$  metric can also be compared directly with human response curves to determine whether the train passby vibration levels are likely to be perceived by building occupants.

### 1.2.3 Ground-borne noise

Railway generated vibration entering a building causes the walls and floors to vibrate and radiate noise (commonly termed “ground-borne noise” or “regenerated noise” where audible), often with a low frequency ‘rumbling’ characteristic.

Although ground-borne noise may be produced it does not necessarily indicate that it is noticeable. In many cases, the noise may pass unnoticed due to the “masking” effect of concurrent airborne noise from trains and other nearby activities.

The metric applied in the prediction and assessment of ground-borne noise from transport projects is:

$L_{Amax}$  the A-weighted maximum noise level occurring during a pass-by noise event (measured using the ‘slow’ response setting on a sound level meter).

## 2 PROJECT DESCRIPTION

### 2.1 Site locality

**Figure 1** indicates the extent of the TCL passenger rail extension between Beckenham and Cockburn Central rail stations, via existing rail transport corridors. The upgrades that form the TCL development include:

- the 3km duplication of the existing single passenger track from Beckenham Junction to Thornlie Station.
- Construction of two new passenger tracks to Cockburn Central Station.
- Realignment of the existing freight lines to accommodate the new passenger lines within the existing rail corridor. This will result in the freight railway being moved approximately 10m north-west, away from the majority of residential areas and closer to industrial and public open space land uses.

The TCL transport infrastructure addressed by this Plan is located within the rail corridor for the Thornlie Line and existing freight Line, which crosses Beckenham, Thornlie, Canning Vale, Leeming, Jandakot, South Lake and Cockburn Central. The TCL includes the development of new stations at Nicholson Road and Ranford Road.

The existing and future tracks will be ballasted track on concrete sleepers and may require new turnouts to enable trains to access the duplicated tracks and the stow roads.

### 2.2 Key acoustic considerations

Key elements considered within this NVMP are comprised of the following:

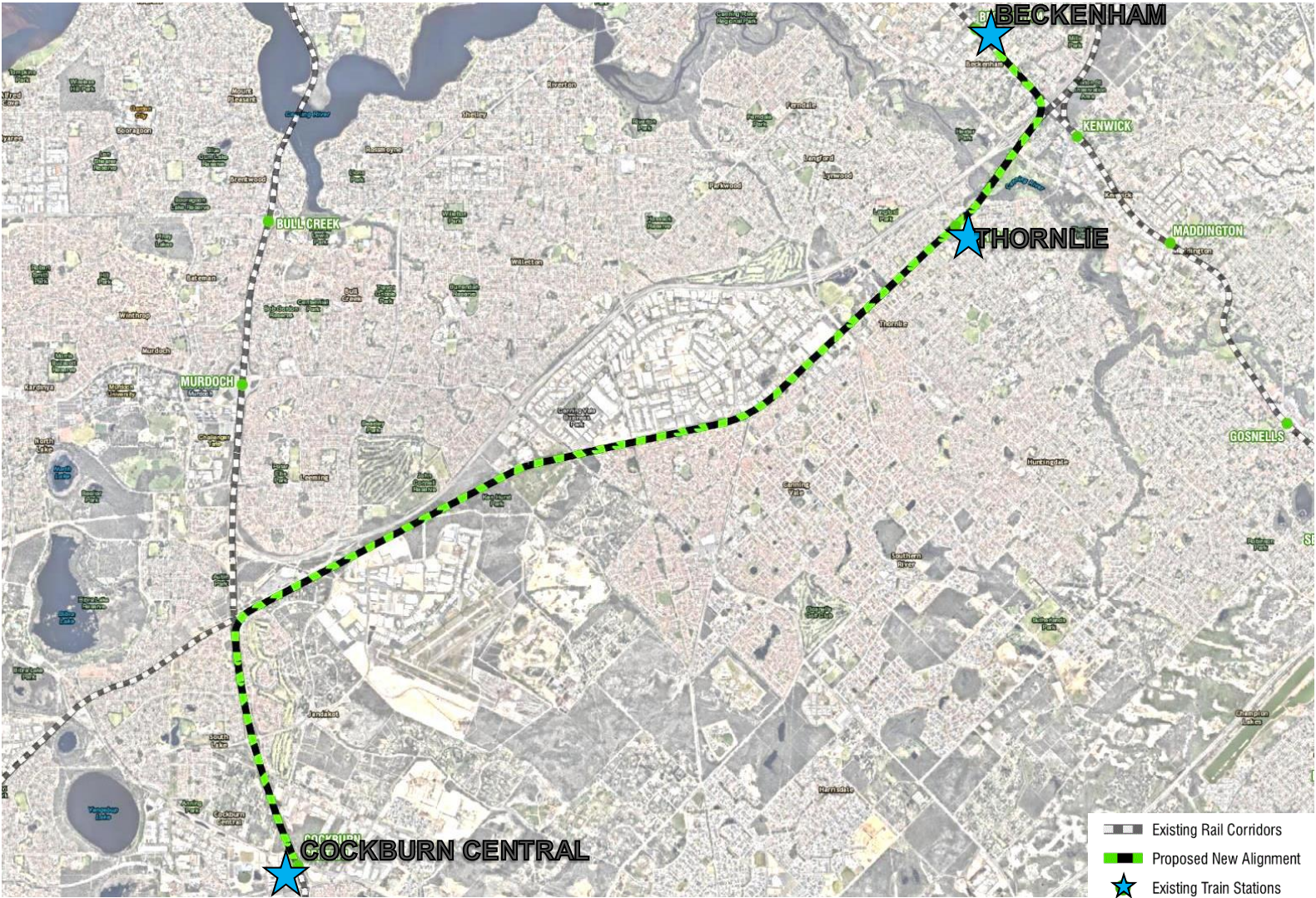
- **Airborne noise.** This refers to all noise generated within the railway corridor from the movement of trains that arrives at nearby properties via air pathways.
- **Ground-borne vibration (GBV).** Due to the close proximity to the residential properties along the existing freight rail corridor, potential vibration related comfort disturbance could be from both the proposed passenger rail traffic and the existing freight rail traffic. Historically there have been a number of complaints from residents in regards to vibration disturbance from the existing freight rail traffic. As a result, the PTA has carried out a number of investigations in response to the complaints.
- **Regenerated/ground-borne noise and low frequency noise.** Regenerated noise or ground-borne noise (GBN) and low frequency noise are now widely recognised noise problems, and are commonly perceived as vibration due to the low frequency characteristics. Although these elements are not clearly specified within the current state policy framework in Western Australia, there are well developed applicable criteria that have been used in some other states in Australia and some countries in the world. The Department of Water and Environmental Regulation (DWER) has undertaken significant investigations in these issues to address complaints about freight train disturbance near Canning Vale<sup>2</sup>.
- **Existing noise and vibration environment.** To assess the level of impact in relation to noise and vibration impacts as a result of the TCL, the existing environment has been characterised by undertaking site monitoring along the extension route and reviewing available data collected in previous surveys.

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<sup>2</sup> DER Report, Canning Vale Rail Noise and Vibration Monitoring, Stage I, Jun 2009, Report No. EN 01/09; Stage II, Dec 2011, Report No. EN 01/11.



Figure 1 Annotated aerial image indicating site context / locality



## 2.3 Operational profile

The train numbers modelled in the Assessment Report for existing and future rail traffic are detailed in **Table 1**.

**Table 1 Modelled Future Rail Volumes for Existing Freight and Proposed Passenger Lines**

Lines	Normal Service Volumes, Both Up and Down Directions			Modelled Speed Limit, km/h	Basis
	Total (24 hours)	Day (6.00 am – 10.00 pm)	Night (10.00 pm – 6.00 am)		
Existing Freight Lines (for model calibration)	24	18	6	70 UP 50 DN	Future scenario at year 2021
Future Freight Lines	24	18	6	80	
<i>Proposed TCL &gt;&gt;&gt;</i>	<i>128</i>	<i>112</i>	<i>16</i>	<i>80</i>	2017 timetables
Rockingham (Mandurah) Lines	128	112	16	100	
Armadale Lines (continuation)	144	126	18	80	

For rail operations, the modelled scenarios for concurrent rail operations included both the dual gauge and passenger main lines with rail traffic data for the relevant assessed scenarios as provided by the PTA as detailed in the table above. Stowed / parked trains were not considered.

Consideration of the estimated increase in noise levels due to rail traffic growth (estimated 20 years in the future) in accordance with SPP5.4 policy was captured within the modelled operational profile.

### 3 NOISE AND VIBRATION CRITERIA

#### 3.1 Regulatory framework

In terms of state environmental noise policy, trains are generally exempted under Regulation 3 of the current *Environmental Protection (Noise) Regulations 1997* to the *Environmental Protection Act 1986*.

In terms of state planning policy, *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning* (SPP5.4, the Policy) is applicable. Whilst SPP5.4 is currently under review, criteria have been set using the current versions of the Policy and its associated guidelines as gazetted in 2009 and 2014 respectively.

SPP5.4 denotes the objectives of the Policy are achieved where noise levels do not exceed the Noise Target and/or Noise Limits presented in Table 2.

**Table 2 SPP5.4 outdoor criteria**

Time of day	Noise Target	Noise Limit
Day (6.00 am to 10.00 pm)	L <sub>Aeq</sub> 55 dB	L <sub>Aeq</sub> 60 dB
Night-time (10.00 pm to 6.00 am)	L <sub>Aeq</sub> 50 dB	L <sub>Aeq</sub> 55 dB

The TCL involves realignment and duplication of rail within an existing rail corridor and is therefore considered to be a major rail redevelopment and not a new rail infrastructure project. Therefore, the criteria listed in the above table are not enforceable under the Policy. However, SPP5.4 states that practicable noise management and mitigation measures should be considered in accordance with the policy, having regard to:

- existing transport noise levels,
- the likely changes in noise emissions resulting from the proposal, and
- the nature and scale of the works and the potential for noise amelioration.

The Noise Targets specified in the Policy are here considered trigger levels which if exceeded, require consideration of mitigation measures.

Reducing railway noise emissions to meet these trigger levels is considered aspirational and may not be reasonable and practicable for the TCL, due to the following:

- It is unreasonable to significantly modify the existing freight line alignment and the surrounding land usage planning (predating SPP5.4) which removes options in regards to distance separation and vertical alignment;
- Freight train noise emissions are not licensed in Western Australia and likely outside the reasonable control of the proponent; and
- The trigger levels are not sensitive to existing freight traffic: in similar contexts such as the NSW RING, a 3 dB increase 'trigger' is often used (e.g. "Where the development increases existing levels by 3dB or more ...") to acknowledge limitations in achieving the original criteria.

Here, 'Practicable noise management' means that if the Noise Limit is exceeded, the treatments implemented are reasonable and practicable as per Section 5.8 of the Policy (emphasis added):

*It is recognised that in a number of instances it may not be reasonable and practicable to meet the Noise Target criteria. Where transport noise is above the target level, measures are expected to be implemented that best balance reasonable and practicable considerations, such as noise benefit, cost, feasibility, community preferences, amenity impacts, safety, security and conflict with other planning and transport policies. In these cases the community should also be consulted to assist in identifying best overall solutions.*

[...]

*It is further acknowledged that there may also be situations in which the Noise Limit cannot practicably be achieved, **especially in the case of major redevelopment of existing transport infrastructure**. Similarly, it may not be practicable to achieve acceptable indoor noise levels if the new development is located very close to the transport corridor. In these situations the primary focus should be on achieving the lowest level of noise, with other reasonable and practicable considerations being secondary to this objective.*

The Implementation Guidelines for SPP5.4 provide further advice on the considerations for determining what is reasonable and practicable. Specifically to transport noise, these include the noise reduction benefit provided by the mitigation and the number of people protected.

Although SPP5.4 has limited guidance on vibration and its secondary effects and does not set objective limits, reference is made to interstate and international guidance, and historical targets on recent major rail projects in Perth such as the Forrestfield Airport Link.

The subsections below outline the adopted assessment criteria for airborne rail noise, ground-borne noise and ground-borne vibration. Additional background discussion of the following is provided in the Assessment Report.

### 3.2 Airborne noise

**Table 3** below outlines the project criteria in regards to airborne noise.

**Table 3 Project rail operations noise criteria**

Parameter	Criterion <sup>3</sup>	Value	Basis
Rail Operations – Noise Generally	Noise levels from rail operations will be managed as low as is reasonably practicable.	demonstrated	SPP5.4
Rail Operations – Airborne Noise Trigger Level	Noise mitigation must be considered where the noise level is at or above the prescribed Rail Operations – Airborne Noise Trigger Level at an external distance of 1 metre from a suitably representative building facade with a noise sensitive use located on noise sensitive premises and 1.5m above ground, with L <sub>Amax</sub> applicable to the 95 <sup>th</sup> percentile train passby event.	L <sub>Aeq,day</sub> 55 dB L <sub>Aeq,night</sub> 50 dB L <sub>Amax</sub> 75 dB	SPP5.4, (L <sub>Amax</sub> - Industry best practice)
Rail Operations – Airborne Noise Design Level	Noise mitigation must be provided where the combined noise level resulting from the proposal and existing rail operations is both <ul style="list-style-type: none"> <li>- above the Rail Operations – Airborne Noise Trigger Level by more than 5 dB, and</li> <li>- above the L<sub>Aeq,day</sub> or L<sub>Aeq,night</sub> noise level that would result from operation of existing rail infrastructure prior to the proposal.</li> </ul> at an external distance of 1 metre from a suitably representative building facade with a noise sensitive use located on noise sensitive premises and 1.5m above ground, with L <sub>Amax</sub> applicable to the 95 <sup>th</sup> percentile train passby event.	demonstrated	<b>Table 2</b>

In this table, there are several key noise measures, being:

- the Rail Operations – Airborne Noise Trigger Level (“Trigger Level”), for which noise mitigation must be considered; and

<sup>3</sup> Airborne noise criteria are referenced to 20 microPascals (dB re 20µPa). Vibration criteria are referenced to 1nm/s (dB re 1nm/s), use the subscript ‘v’ and are assessed on the basis of 1 second root mean square (RMS) values.

- the Rail Operations – Airborne Noise Design Level (“Design Level”), which is here set as the higher of
  - that modelled as existing; and
  - the Trigger Level plus a 5 dB margin.

Cumulative levels as a result of the TCL are proposed be designed to the Design Level.

In this NVMP, reference is also made to a ‘Default Design Level’ which is similar to the Design Level which is 5dB above the trigger level, but does not take into account existing levels. Given Table 3 above, it represents a position where further noise mitigation may not be required. For  $L_{Aeq,day}$  and  $L_{Aeq,night}$  values, the Default Design Level aligns to the ‘Noise Limits’ described in SPP5.4 which are here considered non-mandatory. An additional objective in the consideration of mitigation measures is for final noise and vibration levels resulting from the TCL not to exceed the relevant levels modelled for the existing scenario.

The desired outcome is a mitigation solution that achieves the lowest reasonable and practicable level of noise without unacceptable or significant consequences to the considerations described in Section 5.8 of SPP5.4 (reproduced above).

### 3.3 Ground-borne vibration and secondary effects

Table 4 presents vibration trigger levels that are intended to apply to existing buildings and any future buildings that have Development Approval at the time of the TCL procurement contract, including future residential buildings, hotels and overnight accommodations along or adjacent to the route.

Where these levels are exceeded, the project will consider the use of reasonable and practicable controls.

In WA, assessment of vibration impacts on human comfort has historically been carried out based on Australian Standard AS 2670.2-1990. Previous technical studies of the area and typical complaints around ground borne (‘regenerated’) noise (GBN) indicate it is also a risk factor, and a trigger level is proposed to consider further mitigation in each instance.

**Table 4 Project rail operations vibration trigger levels**

Parameter	Criterion <sup>4</sup>	Value	Basis
Rail Operations – Design Level	Vibration levels from rail operations will be managed as low as is reasonably practicable.	demonstrated	Industry best practice
Rail Operations Building Vibration Trigger Level	Mitigation of vibration via ground or structural pathways must be considered where the vector sum Rail Operations Building Vibration Trigger Level is exceeded as applicable to the 95 <sup>th</sup> percentile train passby event measured at a reasonably representative location of the building occupancy, with appropriate use of frequency weightings from ISO 2631.1:1997 <sup>5</sup> as amended or AS ISO 2631.2:2014 <sup>6</sup> .		AS2670.2:1990 ISO2631, Perth City Link CBD ASHRAE <sup>7</sup>

<sup>4</sup> Airborne noise criteria are referenced to 20 microPascals (dB re 20µPa). Vibration criteria are referenced to 1nm/s (dB re 1nm/s), use the subscript ‘v’ and are assessed on the basis of 1 second root mean square (RMS) values.

<sup>5</sup> ISO 2631-1:1997 Mechanical vibration and shock - Evaluation of human exposure to whole-body vibration - Part 1: General requirements.

<sup>6</sup> AS ISO 2631.2:2014 Mechanical vibration and shock - Evaluation of human exposure to whole-body vibration - Vibration in buildings (1 Hz to 80 Hz).

<sup>7</sup> American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc (ASHRAE), 2011 ASHRAE Handbook - Heating, Ventilating, and Air-Conditioning APPLICATIONS - SI Edition, Atlanta GA <http://www.ashrae.org>

Parameter	Criterion <sup>4</sup>	Value	Basis
	Medical clinical treatment, surgery or recovery areas, or facilities operating precision equipment	Curve 1 (L <sub>v,RMS,1s</sub> 100dB)	guidelines
	Residential and hotel accommodation	Curve 2 (L <sub>v,RMS,1s</sub> 106dB)	
	Commercial premises, Public buildings, Churches and community centres and the like	Curve 4 (L <sub>v,RMS,1s</sub> 112dB)	
	Light and general industrial buildings	Curve 8 (L <sub>v,RMS,1s</sub> 118dB)	
Rail Operations Regenerated Noise/GBN Trigger Level	Mitigation of vibration via ground or structural pathways must be considered where the Rail Operations Regenerated Noise Trigger Level is exceeded as applicable to the 95 <sup>th</sup> percentile train passby event and measured at centre of reasonably representative interior space(s) of each building usage.		NSWRING DWER comments received
	Residential and hotel accommodation, 10pm to 6am	L <sub>ASmax</sub> 40dB	
	Residential and hotel accommodation, 6am to 10pm		
	Commercial buildings, Public buildings, Churches and community centres and the like	L <sub>ASmax</sub> 45dB	
	Retail and point of sale areas, Occupiable light and general industrial buildings	L <sub>ASmax</sub> 50dB	

## 4 ASSESSMENT METHODOLOGY

All residential properties and land uses adjacent to the rail corridor have been identified as potential noise-sensitive receptors; these were identified on the basis of aerial imagery surveys and supplied cadastral data from Landgate.

- Airborne noise receivers for all residential dwellings are represented by a point 1.5 m above ground level and 1 m away from their mostly exposed habitable façades, in accordance with SPP5.4.
- Vibration receivers are represented by the closest ground level point on the building exterior to the rail alignments.

Specifically, a total of 707 sensitive receptors have been identified including the first row (nearest) residential, commercial and industrial dwellings immediately adjacent to the rail corridor. Where the noise and vibration levels achieve the design criteria at the first row receptors, the criteria will generally also be achieved at all receptors at a greater distance from the rail corridor where received noise and vibration levels would be lower.

Furthermore, the noise criteria in **Section 3** would also manage amenity impacts at the non-residential (commercial) land-uses adjacent to the rail corridor.

Refer to the Assessment Report for further detail on the methodology and assumptions used to inform this plan.

## 5 MITIGATION MEASURES

Based on the assessment of airborne noise levels as summarised in **Appendix A**, the following mitigation measures are proposed to be implemented to achieve the assessment criteria as far as is practicable to do so (noting the final extent of each control is subject to factors such as visual impact, community consultation and detailed engineering design).

### 5.1 Recommended airborne noise controls

Based on community workshops undertaken in December 2017 to identify key concerns and subject to acknowledged limitations and other considerations such as visual amenity, constructability, and reasonable cost, the project commits to the following noise mitigation measures:

- a combination of noise walls, generally of the order of at least 2.4 m height, as per **Section 5.1.1**.

The final extent of noise walls will be developed during the detailed design and procurement process.

#### 5.1.1 Rail noise barriers

##### 5.1.1.1 Locations and dimensions

To screen noise from the operation of trains on the existing and new lines; the following rail noise barriers will be required<sup>8</sup> with locations and extents as shown in **Table 5**, which is a concept-level schedule of noise walls proposed to achieve the project Design Level, with locations and heights developed using the methodology in the Assessment Report. Final heights and extent of these proposed noise walls are subject to detailed survey, design and community consultation.

**Table 5 Noise wall extent**

#	Location	Length, m	Recommended Design Level height, m (Note <sup>1</sup> )	Comments
1	Adjacent to western Portal at Kwinana Freeway	475	4.0	A long section of the existing property fences adjacent to the western portal needs to be upgraded.
2	Adjacent to Lakes Way and Clements Place	1,070	4.0	New barrier likely required for control of noise levels at properties along Lakes Way and Clements Place.
3	Fairfield Garden to Hughes Street	2,450	4.0	Preferred as an item within the rail reserve than as upgrades to all existing boundary walls.
4	Nyandi Court to Elliot Place	865	4.0	-
5	Elliot Place to Kidman Court	980	4.0	The existing property fences between Elliot Place and Kidman Court need to be upgraded to an absorptive noise barrier with increased height.
6	Cameron Street to Lyrebird Way	1,240	4.0	Absorptive noise barrier needed
7	O'Dell Street	480	4.0	Absorptive noise barrier needed

<sup>8</sup> All heights here defined relative residual ground level based on the information detailed in the assessment report.



#	Location	Length, m	Recommended Design Level height, m (Note <sup>1</sup> )	Comments
8	Southdown Place	330	4.0	Absorptive noise barrier needed
9	Adjacent to eastern Portal at Burham Road	250	4.0	-
10	Corriedale Place	80	2.4	Existing walls may be retained, subject to detailed design and surveys.
11	Albany Hwy to Sevenoaks	420	2.4	
12	Railway Pde	863	2.4	
Total >>>		9,503	-	-

Note 1 Considered compliant with Design Level outlined in **Table 3** on the basis of the Assessment Report.

Predicted noise levels with these noise barriers are presented in **Appendix B**. The indicative extent and locations of these walls are illustrated in **Appendix D**. In this table, the heights are recommended for compliance with the Design Level in **Table 3** on the basis of the Assessment Report; however this is subject to further design refinement and approval.

### 5.1.1.2 Construction

Subject to detailed design considerations, each noise barrier is proposed to be constructed so that:

- Each barrier is to have a weighted sound reduction index ( $R_w$ ) of not less than 20 dB as defined by ISO 717.1. This assumes the barrier performance is at least 10 dB greater than that due to diffraction around its edges.
- Where noted in **Table 5**, the internal facing of the noise barriers are to be of absorptive type with a minimum weighted performance co-efficient of  $\alpha_w$  0.70 (Class C) when installed and rated to AS ISO 11654.
- The barriers will form a continuous solid façade with no gaps or openings. Any gaps are to be closed with an acoustic seal. The panels of the noise barriers are to be securely fixed and designed to minimise rattle and whistle under heavy wind gusts.
- They are built within the rail reserve and at a fixed offset distance from the closest rail track to allow passage of service and maintenance vehicles.

### 5.1.2 Rail web dampers

Rail web dampers were considered in the Assessment Report. However, noise walls are anticipated to provide the most significant reduction in airborne noise from both the passenger and freight railways, of the order of 5 to 10dB.

Given that rail web dampers are likely to achieve a noise reduction of about 4 to 5 dB from the passenger rail only, it is proposed that rail web dampers be considered as a post operational option where practicable and monitoring indicates that the project noise criteria have not been met.

## 5.2 Vibration mitigation

Based on the results presented in **Appendix C** (prior to mitigation), resilient ballast matting will be installed under selected portions of the passenger and freight lines to reduce vibration emissions. The ballast matting will also reduce the propagation of any ground-borne noise experienced within buildings.

Subject to detailed design, resilient ballast matting will be considered for any track that is proposed to be re-laid or constructed within the following distances of any existing or proposed residential development:

- Freight rail, 90 metres.

- Passenger rail, 45 metres.

The attached drawings in **Appendix D** present an indicative extent of mitigation subject to detail development and refinement.

### **5.3 Track maintenance**

PTA/ARC will undertake rail maintenance to reasonably maintain the operational performance of the relevant railway infrastructure and reduce wear to trains. This will involve regular inspection of the rail condition and rail rectification / grinding to remove excessive roughness or corrugation which may develop over time.

## 6 COMPLIANCE MONITORING

Monitoring of future noise and vibration levels is proposed as per the following subsections to verify potential impacts and determine compliance with the criteria in **Section 3**.

### 6.1 Baseline noise and vibration

Noise and vibration measurements were conducted in 2017 as part of the Assessment Report. Six noise loggers and six vibration loggers were used at three monitoring sites along the rail corridor. The results of this initial survey were used to calibrate the 'Existing' assessment scenario. Therefore, the results of the 'Existing' modelling scenario in the assessment may serve as indicating the baseline for future comparison in lieu of field data obtained elsewhere.

### 6.2 Methodology

The following monitoring methodologies provide a recommended approach to the monitoring of airborne noise and ground vibration from future train operations. The methodology may need to be adjusted subject to the specific requirements of each monitoring event.

In accordance with SPP5.4, all monitoring will be conducted by a suitably qualified and experienced acoustic engineer or consultant.

The monitoring of airborne noise will be undertaken in accordance with the following Standards and guidelines where relevant:

- SPP5.4 guidelines.
- Sound levels meters and noise loggers shall be Class 1 certification as defined in Australian Standard AS IEC-61672.1-2004:
- Sound level meters or noise loggers must be calibrated before and after measurement periods using a calibrator, suitable for a Class 1 instrument, which complies to AS IEC-60942-2004.
- For monitoring ground vibration refer to Australian Standards; AS 2670, AS 2775 and International Standard ISO 14837-1.
- Monitoring guidelines for ground-borne noise from railways is contained in ISO 14837-1.

#### 6.2.1 Airborne noise monitoring

Where feasible, the monitoring locations will be:

- Where the microphone is set at a height of 1.2 to 1.5 m above ground level.
- At 1 m from the most affected building façade adjacent to the rail corridor. Otherwise, the nearest accessible location to the building façade shall be utilised as the monitoring location to best determine the received noise level at the buildings.
- At reasonably representative positions of the receiver with any appropriate adjustments.
- Free from interference from extraneous sources such as road traffic or air-conditioning units.

The monitoring of airborne noise levels will require:

- Noise loggers shall be deployed at all locations to continuously monitor noise levels for one week period during standard operations.
- Noise levels to be monitored with the sound level meter and/or noise logger(s) on the 'Slow' response setting.
- Monitoring with sound level meter(s) will include measurement of one-third octave band noise levels to assist the analysis of noise characteristics.

- The LAeq, LAm<sub>ax</sub>, LA1, LA10 and LA90 noise metrics are to be monitored at each location.
- When monitoring train passby events it is recommended that the 1-second sound pressure levels or 1-second LAeq levels are monitored to clearly isolate the contribution from each passby event.
- The monitored noise levels are to be reported in tabular format clearly identifying the time, date and location of each measurement.
- To assist the identification of rail passby events from the ambient noise environment, audio recordings may accompany the long-term noise monitoring subject to approval from residents.

### 6.2.2 Ground vibration monitoring

Due to the complex interactions with the local ground conditions and structures, it is preferential to monitor ground vibration levels at the receptor rather than an intervening location between the receptor and the rail corridor.

Vibration levels are to be monitored at the most affected façade(s) / room(s) of the buildings or reasonably representative equivalent position(s) with suitable adjustments.

## 6.3 Post commissioning verification

### 6.3.1 Airborne noise

- Within three months and again at 18 months of the commissioning of the TCL noise and vibration levels will be monitored to verify the project has achieved the Design Levels.
- Monitoring will be undertaken over a minimum period of seven days at each monitoring location.

At least ten (10) monitoring locations will be established at locations representative of the communities in Beckenham, Kenwick, Thornlie, Canning Vale and Jandakot. Subject to accessibility, monitoring is proposed to be undertaken at the following selected residential properties identified within the Assessment Report or their vicinity, in accordance with the methodology outlined in **Section 6.2.1**.

1. 404 to 484 Railway Pde, Beckenham.
2. 7 to 23 Burham Rd, Kenwick.
3. One property at 20 Southdown Pl, Thornlie
4. 23 Elliot Pl, Thornlie
5. Between 1 and 47 Nyandi Ct, Thornlie.
6. 35 Hughes St, Canning Vale
7. 18 Browallia Cl, Canning Vale
8. 17 and 38 Park Ln, Canning Vale.
9. 99 Glen Iris Dr, Jandakot
10. 13 Lakes Way, Jandakot

Additional (or fewer) locations may be used depending on feedback from residents once operations have commenced.

### 6.3.2 Ground vibration

Ground vibration levels will be monitored at the same locations as the noise monitoring.

Vibration levels will be monitored in accordance with the methodology in **Section 6.2.2**, following the principles outlined in Section 7 of ISO 14837.1:2005, preferably on the nearest external foundation or lower external wall of a vibration sensitive building, or at a reasonably equivalent interim point of observation with appropriate adjustments.

### 6.3.3 Corrective action

Where the above monitoring determines that the criteria in **Section 3** are not achieved at commissioning, the steps to review and implement further reasonable and practicable mitigation will include:

- Identifying the locations where the criteria may be exceeded and to what degree.
- Confirming the noise reduction performance of the mitigation implemented.
- Quantifying the change in noise and/or vibration levels upon commissioning of the project.
- Determining the number of residents affected and severity profile.
- Identifying the key noise sources contributing to the exceedances.
- Undertaking a review of reasonable and practicable mitigation measures available to further reduce and control noise and/or vibration levels.
- Where reasonable and practicable to do so, implementing additional mitigation.

## **7 COMPLAINT MANAGEMENT PROCEDURE**

Detailed below are the measures to be implemented in the event a complaint or adverse comment to airborne noise, ground vibration or ground-borne noise is received directly or indirectly by PTA.

### **7.1 Administrative procedures**

Requests for information and complaints will be directed to the PTA's Infoline telephone number 13 62 13 or via the comments section on PTA's website [www.pta.wa.gov.au](http://www.pta.wa.gov.au) (<http://www.pta.wa.gov.au/about-us/complaints-and-comments>). All calls and emails will be logged and a response provided within 5 days of receipt.

### **7.2 Investigation**

The PTA will investigate all noise and/or vibration complaints received by:

- Investigating the operations at the time of the complaint.
- Substantiated or widespread complaints will be investigated as follows:
  - An appropriate number of short-term measurements will be undertaken to accurately determine the cause of substantiated complaint/incidents and to determine how to rectify the situation.
  - Review any unattended (logged) noise levels relevant to the complaint or incident.
  - Where appropriate, reviewing any immediate measures that could be implemented to address the nature of the complaint.
- File an incident report.
- Where appropriate, supply a response in writing within 10 working days of the complaint.

### **7.3 Community engagement**

The PTA has initiated an extensive community engagement program, including the provision of information on likely noise and vibration impacts from the project via the METRONET website [www.metronet.wa.gov.au](http://www.metronet.wa.gov.au)

As required, information will be routinely updated to inform the community as the project commences construction and as the railway is commissioned. The PTA has also committed to consulting with residents regarding the heights, extents and aesthetics of the noise walls, once final railway design is complete.

Copies of monitoring reports, data or outcomes of complaint investigations may be made available to residents upon specific request where appropriate.

## **8 REVIEW**

This Plan will be reviewed following finalisation of the TCL railway design. The final design will be used to verify the noise and vibration modelling within the Assessment Report and confirm the extents of noise walls and ballast matting to be installed. This Plan will also be reviewed following post operations noise and vibration monitoring.

## 9 REFERENCES

British Standard BS6472-2008: *Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)*.

British Standard BS7385-1993: *Evaluation and Measurement for Vibrations in Buildings – Part 2 Guide to Damage Levels from Ground-Borne Vibration*.

British Standards, 2009. *BS5228.2.2009 Code of practice for noise and vibration control on construction and open sites Part 2: Vibration*.

Federal Transit Administration (FTA) (2006). *Transit Noise and Vibration Impact Assessment*. Washington DC: Department of Transport, USA.

German Standard DIN 4150, Part 3-1986: *Structural Vibration in Buildings: Effects on Structures*

International Standards, 2005. *ISO14837-1 Mechanical vibration – Ground-borne noise and vibration arising from rail systems – Part 1: General guidance*.

New South Wales (NSW) Department of Environment and Climate Change & Water (DECCW): *Assessing Vibration: A Technical Guideline, 2006*.

NSW Government, 2013, *Rail Infrastructure Noise Guideline*.

Queensland Government, 2014. Department of Transport and Main Roads, *Code of Practice Volume 2 - Construction Noise and Vibration*, September 2014.

Queensland Government, 2013. Department of Transport and Main Roads *Policy for Development on Land Affected by Environmental Emissions from Transport and Transport Infrastructure Version 2*, May 2013.

Australian Standards 1990. *AS2670.2-1990 Evaluation of Human Exposure to Whole-Body Vibration. Part 2: Continuous and Shock-induced Vibration in Buildings (1 Hz to 80 Hz)*.

Standards Australia, 2001. *Australian Standard AS 2670.1-2001: Evaluation of human exposure to whole-body vibration Part 1: General requirements*.

Standards Australia, 2004. *Australian Standard AS IEC-61672.1-2004: Electroacoustics – Sound level meters Part 1: Specifications*

Standards Australia, 2004. *Australian Standard AS IEC-60942.1-2004: Electroacoustics – Sound calibrators*

Standards Australia, 2004. *Australian Standard AS 2775-2004: Mechanical vibration and shock – Mechanical mounting of accelerometers*.

Standards Australia, 2004. *AS/NZS ISO 717.1 Acoustics – rating of sound insulation in buildings and of building elements. Part 1: airborne sound insulation*.

Standards Australia, 2002. *Australian Standard AS ISO 11654 Acoustics – Rating of sound absorption – Material and systems*.



APPENDIX A – SUMMARY OF THE RAIL NOISE AND VIBRATION ASSESSMENT

**APPENDIX A – SUMMARY OF THE RAIL NOISE AND  
VIBRATION ASSESSMENT**

## APPENDIX A – SUMMARY OF THE RAIL NOISE AND VIBRATION ASSESSMENT

**Operational noise assessment****Methodology**

A noise and vibration assessment report was prepared for the proposed Thornlie-Cockburn Link (TCL) by SLR in January 2018<sup>1</sup>, which sets the basis for the Noise and Vibration Management Plan. A summary of the assessment is presented below.

This assessment included comparison of various scenarios with existing and future operational conditions, with or without mitigation measures. This summary presents assessment the results with mitigations in place.

The following approach was undertaken in order to identify the existing railway noise and vibration levels, the likely changes in noise emissions resulting from the TCL and the benefits achieved through the implementation of reasonable and practicable mitigation measures.

- For the freight railway, source noise and vibration measurements of the existing freight movements were obtained.
- For the existing and proposed passenger railway, historical measurements of Perth passenger trains by SLR were used to establish noise and vibration emission levels.
- Noise and vibration levels at each receiver were predicted for the following scenarios:
  - **‘Existing’** – Existing infrastructure. This refers to operation of existing freight and passenger railway infrastructure<sup>2</sup> in 2021 if the TCL was not constructed. On the basis of the agreed criteria, it hereby serves as a comparative benchmark or baseline.
  - **‘TCL only’** –TCL passenger line only, once operational (in 2021). This scenario excludes noise from the freight line.
  - **‘Combined TCL and Existing’** – The cumulative emissions from simultaneous operation of both TCL and existing infrastructure (in 2021). This includes the relocation of existing rail infrastructure to accommodate the TCL within the existing reserve.
- A specialist model of railway source noise emissions was used to assess the effectiveness of rail web dampers at various speeds for both the freight and passenger lines. Note that this model uses fixed signal speed limits and does not include for slowing of trains around new stations, as such traffic information is not yet determined.
- A series of mitigation treatments were designed such that, as far as is reasonably practicable, final noise and vibration levels resulting from the proposal meet the Design Level.

Detailed modelling prediction methodologies, relevant inputs and assumptions for both noise and vibration are outlined in the SLR assessment report.

**Operational Profile**

The assessment considered day and night time operational scenarios as follows.

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<sup>1</sup> Thornlie-Cockburn Link, Noise and Vibration Assessment, SLR Report No. 675.10409.00100--R01, V 4.3, dated January 23, 2018.

<sup>2</sup> Specifically the #6 Midland Line Up and Down (06MLU and 06MLD) in addition to passenger railway infrastructure (Thornlie, Armadale and Rockingham lines)

## APPENDIX A – SUMMARY OF THE RAIL NOISE AND VIBRATION ASSESSMENT

**Table 1 Modelled Future Rail Volumes for Existing Freight and Proposed Passenger Lines**

Lines	Normal Service Volumes, Both Up and Down Directions			Modelled Speed Limit, km/h	Basis
	Total (24 hours)	Day (6.00 am – 10.00 pm)	Night (10.00 pm – 6.00 am)		
Existing Freight Lines (for model calibration)	24	18	6	70 km/h UP 50 km/h DN	Future scenario at year 2021
Future Freight Lines	24	18	6	80	
<i>Proposed TCL</i>	<i>128</i>	<i>112</i>	<i>16</i>	<i>80</i>	Existing timetables
Rockingham (Mandurah) Lines (Note <sup>1</sup> )	128	112	16	100	
Armadale Lines (continuation)	144	126	18	80	

Note 1 Corrections for Series B trains here applied on the basis of unsprung mass and length only.

For rail operations, the modelled scenarios for concurrent rail operations include both the dual gauge and passenger main lines with rail traffic data for the relevant assessed scenarios as provided by the PTA as detailed in the table above. Stowed / parked trains were not modelled.

### Design assumptions

The study relied on the following assumptions:

- Influence of any new passenger stations on results, e.g. changes in speed profile or effects of building reflections / shielding were conservatively not modelled.
- Noise from existing rail infrastructure does not significantly increase or decrease (due to speed, above track controls etc.) from that measured and modelled in the period prior to operation of the TCL.
- Turnouts / joints / diamond crossings not modelled (locations not advised). No adjustments were included for track which is jointed or presents gaps. The assessment relies on the track to be continuously welded and ground smooth to the same specification as existing (or better).
- Any solid continuous noise walls located on the rail reserve boundary are assumed to have a minimum height requirement of 2.4 m in line with typical security considerations.
- The distribution in individual train noise and vibration emissions (say due to length, speed and condition) was considered the same throughout each day.
- Freight rail trackform is consistent across alignment as high stiffness / uninsulated (no specific vibration mitigation controls) with dynamic stiffness above 800 MN/m, AS50kg rail on concrete monobloc sleepers.
- Removing / modifying the existing ballasted track structure was not considered to be reasonably practicable to mitigate noise and vibration issues.
- The methodology used in GBN calculations used a theoretical adjustment of -27 dB in line with established guidelines; however, an adjustment of -32 dB is likely to be more appropriate in the experience of the author subject to further study of local conditions.
- Reasonable similarity in ground propagation effects between the locations used for baseline measurements and those near receiver positions.
- The analysis is based on vibration measured in the vertical direction only with adjustments for transverse / longitudinal vibration components (which are considered to be of minimal consequence at extended distances as captured in the design uncertainty).
- Building amplification effects. In practice they may vary (specific details of each building are not known, influence is already captured in the design uncertainty).

**APPENDIX A – SUMMARY OF THE RAIL NOISE AND VIBRATION ASSESSMENT****Results with noise mitigation**

The following subsections present results forecasted. In summary,

- noise emissions from the TCL only can be reduced in line with the Design Level through the use of rail web dampers and noise walls of the order of 2.4 m in height.
- noise walls of the order of 4.0 metres height and the use of rail web dampers in specific locations would be required to reduce noise emissions from the combined TCL and existing infrastructure to levels which are reasonably consistent with existing infrastructure only (i.e. the Design Levels).

**Overall results**

The below table summarises overall statistical results of various proposed controls:

- 'Existing' – the benchmark / baseline for evaluating whether the proposed treatments can offset the increase in noise levels from the proposal.
- 'Combined TCL and existing', with rail web dampers fitted to passenger lines only.
- 'Combined TCL and existing', with noise walls up to 4.0 m height only.
- 'Combined TCL and existing', with both noise walls up to 4.0 m height and rail web dampers fitted to passenger lines only.

The table shows that the combination of rail web dampers and noise walls of up to 4.0 m height can broadly reduce noise levels from the combined TCL and existing scenario to levels similar to or less than existing. Noting the design uncertainty determined in the assessment, it is important to note that individual results are expected to vary from that forecast depending on local factors.

APPENDIX A – SUMMARY OF THE RAIL NOISE AND VIBRATION ASSESSMENT

**Table 2 Forecast railway noise levels per scenario, with mitigation (n= 707 receivers).**

Time period	Parameter	Existing <i>Benchmark</i>	Combined TCL and existing, without mitigation	Combined TCL and existing, up to 4.0 m noise walls	Combined TCL and existing, 4.0 m walls, rail web dampers on passenger lines	Comments	
<b>Day</b> $L_{Aeq,day}$	Mean	59	60	56	55	3 to 8 dB improvement over existing $L_{Aeq,day}$ noise levels with noise walls up to 4.0 m.	
	95% are below ...	67	68	61	60		
	Highest	73	72	65	64	$L_{Aeq,day}$ noise levels at almost all residences can comply with the Default Design Level with noise walls up to 4.0 m only. Decrease in highest level is due to the changes in freight rail alignment.	
	Trigger level of $L_{Aeq,day}$ 55 dB	75%	75%	62%	58%		
	Default Design Level of $L_{Aeq,day}$ 60 dB	Percentage above investigative trigger level (Note <sup>1</sup> )	75%	75%	62%		58%
		Percentage above Default Design Level (Note <sup>1</sup> )	52%	53%	5%		2%
		Minimum number of residences more than Default Design Level (Notes <sup>1,2</sup> )	354	362	35		14
	Number of residences forecast above Design Level (Note <sup>1</sup> )	-	83	15	0		
<b>Night</b> $L_{Aeq,night}$	Mean	54	55	51	50	3 to 8 dB improvement over existing $L_{Aeq,night}$ noise levels with noise walls up to 4.0 m.	
	95% are below ...	62	63	56	55		
	Highest	68	67	60	60	$L_{Aeq,day}$ noise levels at almost all residences can comply with the Default Design Level with noise walls up to 4.0 m only. Decrease in highest level is due to the changes in freight rail alignment.	
	Trigger level of $L_{Aeq,night}$ 50 dB	75%	75%	63%	58%		
	Default Design Level of $L_{Aeq,night}$ 55 dB	Percentage above investigative trigger level (Note <sup>1</sup> )	75%	75%	63%		58%
		Percentage above Default Design Level (Note <sup>1</sup> )	53%	54%	6%		3%
		Minimum number of residences more than Default Design Level (Notes <sup>1,2</sup> )	366	371	44		19
	Number of residences forecast above Design Level (Note <sup>1</sup> )	-	89	19	0		

## APPENDIX A – SUMMARY OF THE RAIL NOISE AND VIBRATION ASSESSMENT

Time period	Parameter	Existing <i>Benchmark</i>	Combined TCL and existing, without mitigation	Combined TCL and existing, up to 4.0 m noise walls	Combined TCL and existing, 4.0 m walls, rail web dampers on passenger lines	Comments
<b>Max. level</b>	Mean	85	85	<b>81</b>	<b>81</b>	4 to 9 dB improvement over existing with noise walls up to 4.0 m.
L <sub>Amax</sub>	95% are below ...	96	96	<b>88</b>	<b>88</b>	
Trigger level of L <sub>Amax</sub> 75 dB	Highest	102	<b>101</b>	<b>93</b>	<b>93</b>	Rail web dampers (fitted to passenger railway) aren't effective against high L <sub>Amax</sub> levels associated with the freight railway (some levels are forecast to increase as freight line moves northward closer to some residences). Decrease in highest level is due to the changes in freight rail alignment.
Default Design Level of L <sub>Amax</sub> 80 dB	Percentage above investigative trigger level (Note <sup>1</sup> )	79%	<b>80%</b>	<b>78%</b>	<b>78%</b>	
	Percentage above Default Design Level (Note <sup>1</sup> )	74%	74%	<b>66%</b>	<b>66%</b>	
	Minimum number of residences more than Default Design Level (Notes <sup>1,2</sup> )	508	<b>511</b>	<b>451</b>	<b>451</b>	

Note 1 The 'trigger' and 'design' levels are defined further in the assessment report. The 'Default Design Level' is non-mandatory, set as 5dB above the trigger level prior to the consideration of existing levels.

Note 2 The term 'minimum' is used as there may be similar noise levels at properties further away from the rail reserve and therefore not included in this table.

Note 3 **Green** indicates improvement from the 'Existing' benchmark scenario or compliance with Default Design Level. **Orange** indicates degradation from the 'Existing' benchmark scenario.

APPENDIX A – SUMMARY OF THE RAIL NOISE AND VIBRATION ASSESSMENT

Operational ground borne noise (GBN) and ground borne vibration (GBV)

Ground borne vibration assessment

The assessment of potential ground-borne vibration levels has referenced ground vibration levels measured at various locations in Perth and in proximity of the TCL rail corridor. A summary of previous ground vibration measurements for rail projects in Perth is outlined in the following figures. Both figures use the same vertical scale for comparison.

Figure 1 Historical vertical vibration levels versus distance, Freight trains in Western Australia, Midland, Thornlie areas

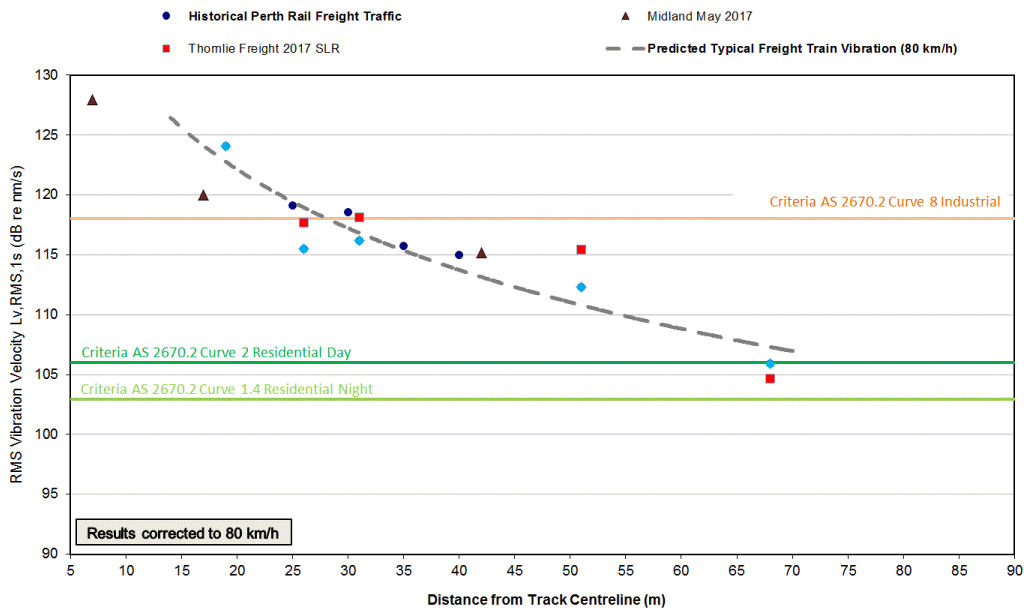
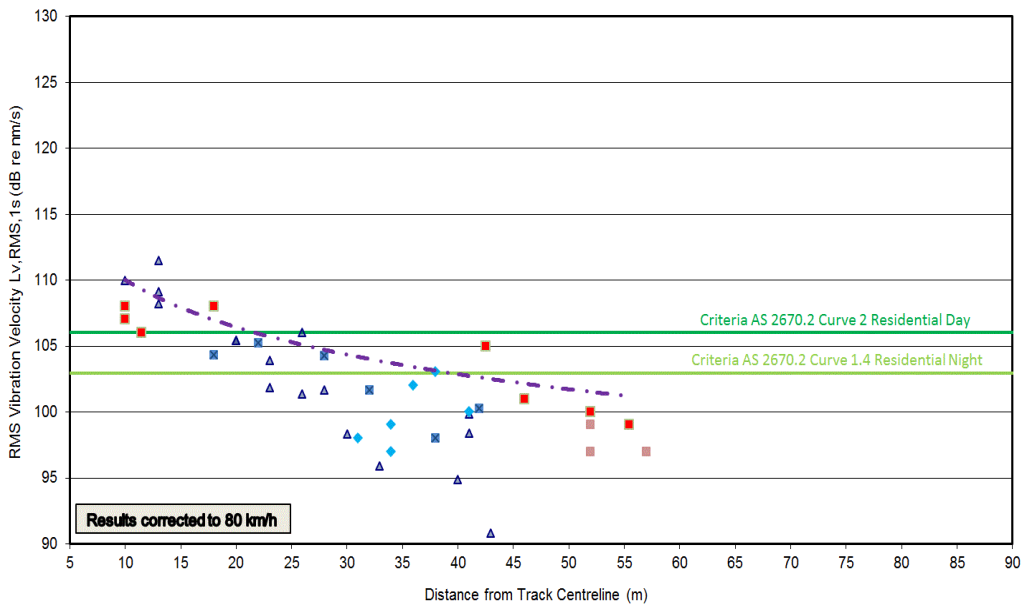


Figure 02 Historical vertical vibration levels versus distance, Perth EMU Series A trains, Midland, Bayswater, Burswood and Thornlie areas



APPENDIX A – SUMMARY OF THE RAIL NOISE AND VIBRATION ASSESSMENT

Based on the above figures, the vibration assessment criteria may be exceeded at the where vibration sensitive buildings are located within the following distances from the track centreline:

- Residential receptors:
  - Located at least 75 m from the Freight line track centreline during daytime rail operations and approximately 90 m from the track centreline during night-time rail operations.
  - Located at least 20 m from the Passenger line track centreline during daytime rail operations and approximately 40 m from the track centreline during night-time rail operations.
- Industrial premises:
  - Located at least 25 m from the Freight line track centreline.
  - Located at least 12 m from the Passenger line track centreline.

**Ground-borne noise assessment**

Ground vibration and GBN levels at the nearest receivers were estimated as follows:

- The relationships between vertical ground vibration level and GBN level versus plan distance (site propagation laws) have been determined from the baseline measurements.
- A building coupling loss spectrum is used to convert ground soil vibration levels to building foundation vibration levels as per **Table 3** based on historical measurements of 1 and 2 storey residences in Perth. The difference in overall level is similar to that suggested in FTA guidelines<sup>3</sup>.

**Table 3 Modelled Building Coupling Loss, dB**

Third octave band centre frequency, Hz	8	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315
Modelled coupling loss	0.7	5.7	1.7	0.3	-3.0	-8.5	-11.4	-13.4	-15.3	-13.5	-11.5	-7.6	-4.3	-4.4	5.7	-5.4	-2.3

- A correction of -27 dB was used to convert building vibration levels into GBN levels. This is considered to be around 5 dB conservative on the basis that the most recent version of the UK Association of Noise Consultants (ANC) guidelines<sup>4</sup> on this topic suggests that a -32 dB correction may be more appropriate.
- Ground vibration and GBN levels were then estimated on the basis of the minimum plan distance to each receiver for both the existing and proposed temporary rail alignments. Some variance is expected in practice depending on geotechnical considerations and the location of any intervening underground structures.
- No correction was applied to account for additional ground retention and stabilisation measures. In practice some additional attenuation is likely to be provided where the intermediate ground is stabilised, or where deep foundations are employed to construct the noise walls.

The figure below presents forecasted internal regenerated noise levels, on the basis of distance from the existing freight track centreline. Ground-borne (regenerated) noise levels are forecast as follows:

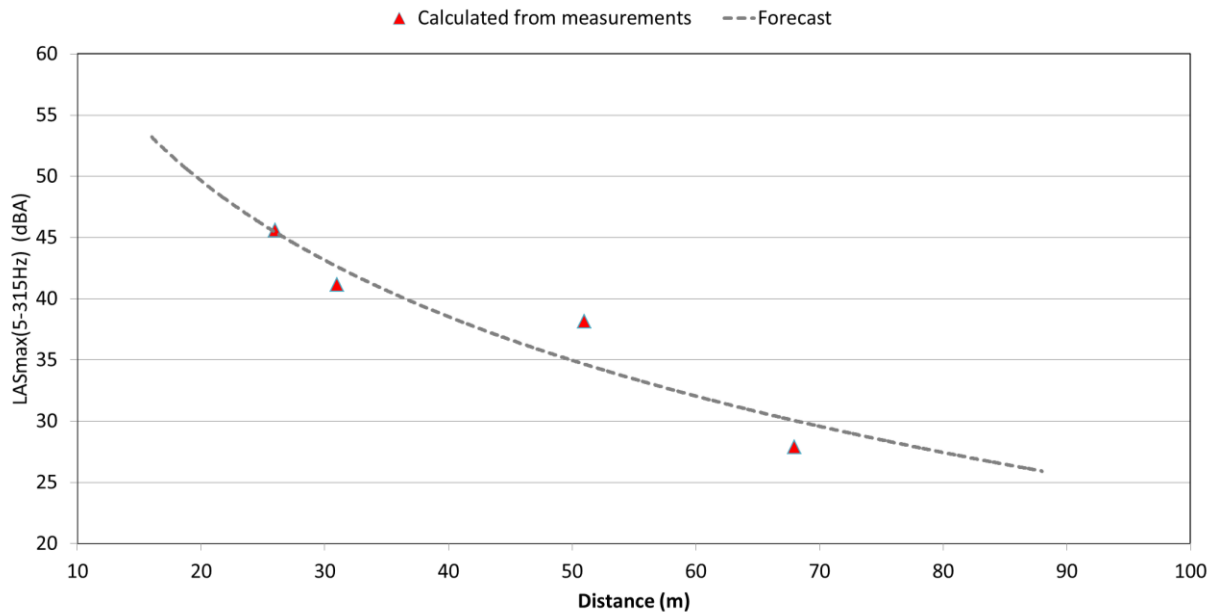
<sup>3</sup> C.E. Hanson, D.A. Towers, and L.D. Meister 2006, Transit Noise and Vibration Impact Assessment, Office of Planning and Environment, Federal Transit Administration, Report FTA-VA-90-1003-06, Washington DC.

<sup>4</sup> Association of Noise Consultants, 2012, ANC Guidelines - Measurement and Assessment of Ground-borne Noise & Vibration



APPENDIX A – SUMMARY OF THE RAIL NOISE AND VIBRATION ASSESSMENT

**Figure 03 Forecast regenerated ground borne noise (95th percentile  $L_{ASmax}$ ) versus distance, freight trains**



Based on the above figure above, the vibration assessment criteria may be exceeded at the where vibration sensitive buildings are located within 35 m from the Freight line track centreline during daytime rail operations and approximately 50 m from the track centreline during night-time rail operations.

**Overall results**

The modelling results indicate that for the freight line only, GBN and GBV levels are forecast to be around 10 to 20 dB above recommended trigger levels without specific vibration mitigation.

For the TCL and existing passenger rail lines, GBN and GBV levels are similarly expected to be up to 5 dB above recommended trigger levels. Therefore, the predictions indicate little change in maximum vibration and ground borne noise (GBN) levels at adjacent residential premises as a result of the proposed new passenger rail operations, as vibration emissions from the freight rail operations will remain significantly higher. Local increases may result from simultaneous train passbys and/or the introduction of track features such as turnouts / crossovers and joints.

With regards to some buried services located approximately 10m south of the existing freight line, the new arrangement (with freight moving away and passenger closer), the freight line still controls the maximum vibration levels and therefore by moving the freight further away as a result of the project, the project is arguably reducing vibration impacts on these utilities.

Given the level of available design detail and based on the review undertaken, resilient ballast matting is considered to be the only practicable option in the context of available vibration controls, providing reductions of typically 5 dB in terms of GBV and 10 dB in terms of GBN for both the passenger and freight railways. Note that it has the potential to reliably reduce emissions from the TCL below the recommended trigger levels, but not so with respect to the existing freight rail lines.

**APPENDIX A – SUMMARY OF THE RAIL NOISE AND VIBRATION ASSESSMENT**

On this basis, a schedule of suitable resilient ballast matting is recommended for both new freight and passenger rail main lines. Advanced vibration modelling (based on local field measurements and geotechnical data) during the detailed design phase can be undertaken to improve certainty in outcome and identify other options for vibration mitigation, such as ground stiffening, deep barriers or ground soil reinforcement techniques.

**Low frequency noise (LFN)**

Allowing for typical building constructions in the locality, internal LFN noise levels are forecast to be above the proposed reference curve at distances up to 350 m in free field, meaning that all residents within this distance may occasionally experience low frequency noise causing disturbance.

The project is not able to effectively improve conditions in this regard because:

- Source noise emissions from freight rail engine exhausts are not specifically regulated in Western Australia.
- It is considered impracticable to meet the reference curve at the nearest residential premises within the current regulatory environment. Low frequency noise emissions are elevated in height relative to rolling noise and also extremely difficult to control via screening elements / noise walls.

The level of community response varies greatly depending on individual train movements, in addition to personal sensitivities and the arrangement and condition of the associated built environment. Reducing the engine exhaust noise leading to low frequency noise is most effectively addressed at the source. In some jurisdictions nationally, freight locomotive noise emissions are regulated and must be under prescribed limits (including those related to low frequency noise) in order to access the rail network.

APPENDIX B – FORECAST AIRBORNE NOISE LEVELS

**APPENDIX B – FORECAST AIRBORNE NOISE LEVELS**

## APPENDIX B – FORECAST AIRBORNE NOISE LEVELS

## Predicted noise levels for train passbys with rail noise barriers in Section 6.1

Receptor	Rail Operations (Existing) (Without mitigation)			Rail Operations Freight and TCL (Mitigated, noise walls)			Rail Operations Freight and TCL (Mitigated, noise walls and passenger rail dampers)		
	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>
399 Sevenoaks St Beckenham	56	52	82	56	51	81	55	50	81
399 Sevenoaks St Beckenham	53	48	77	53	48	77	51	46	76
360 Railway Pde Beckenham	60	55	85	59	54	85	58	53	85
364 Railway Pde Beckenham	58	53	82	58	53	82	56	51	82
66 William St Beckenham	58	53	82	58	53	82	56	51	82
112 Bickley Rd Beckenham	57	53	81	57	52	81	56	51	81
374 A Railway Pde Beckenham	60	55	84	59	54	84	58	53	84
50 William St Beckenham	60	55	84	60	55	84	58	53	84
101 Bickley Rd Beckenham	50	46	75	50	46	75	49	44	75
376 Railway Pde Beckenham	60	55	84	59	55	84	58	53	84
105 Bickley Rd Beckenham	51	46	76	51	46	76	49	45	76
105 Bickley Rd Beckenham	50	45	73	50	45	73	48	43	73
105 Bickley Rd Beckenham	49	44	73	49	44	73	47	43	73
105 Bickley Rd Beckenham	46	41	66	46	41	66	44	39	66
378 Railway Pde Beckenham	60	55	84	59	55	84	58	53	84
380 Railway Pde Beckenham	60	55	85	60	55	85	58	54	85
382 Railway Pde Beckenham	60	56	85	60	55	85	59	54	85
425 Sevenoaks St Beckenham	60	55	83	60	55	84	58	53	83
384 Railway Pde Beckenham	60	56	85	60	55	85	59	54	85
427 Sevenoaks St Beckenham	60	55	83	60	55	84	58	53	83
429 Sevenoaks St Beckenham	60	55	83	60	55	84	58	53	83
431 Sevenoaks St Beckenham	59	55	83	60	55	84	58	53	83
433 Sevenoaks St Beckenham	60	55	84	60	55	84	58	53	84
435 Sevenoaks St Beckenham	60	55	84	60	55	85	58	54	84
435 Sevenoaks St Beckenham	51	46	77	51	47	78	50	45	77
386 Railway Pde Beckenham	60	56	85	60	56	85	59	54	85
437 Sevenoaks St Beckenham	60	55	83	60	55	84	58	53	83
439 Sevenoaks St Beckenham	60	55	83	60	55	84	58	53	83
22 Mona Av Beckenham	49	44	69	50	45	70	48	43	69
24 Carmichael St Beckenham	51	46	73	50	45	71	49	44	71
24 Mona Av Beckenham	50	45	72	50	45	72	49	44	72
3 Dulwich St Beckenham	55	50	79	54	49	77	53	48	77
404 Railway Pde Beckenham	62	57	85	60	56	83	59	54	82
406 Railway Pde Beckenham	62	57	85	61	56	83	60	55	82
441 Sevenoaks St Beckenham	59	54	83	59	54	83	57	52	83
443 Sevenoaks St Beckenham	59	54	83	58	53	83	57	52	83
445 Sevenoaks St Beckenham	61	56	84	60	55	84	58	53	83
63 Beckenham St Beckenham	49	44	71	49	44	68	48	43	68
64 Beckenham St Beckenham	53	48	75	51	46	71	50	45	71
69 Beckenham St Beckenham	61	57	83	58	53	79	57	52	78
7 Dulwich St Beckenham	52	47	75	53	48	75	51	46	75
4 Wilpon St Beckenham	51	46	71	51	46	70	50	45	70
408 Railway Pde Beckenham	63	58	85	61	56	83	60	55	83
451 Sevenoaks St Beckenham	62	57	85	58	54	79	57	52	79
22 Carmichael St Beckenham	48	44	68	50	45	69	48	44	69
410 Railway Pde Beckenham	63	58	85	61	56	83	60	55	82
453 A Sevenoaks St Beckenham	62	57	85	58	53	79	57	52	79
412 Railway Pde Beckenham	63	58	85	61	56	82	60	55	82
6 Wilpon St Beckenham	50	45	70	51	46	70	50	45	70
18 Carmichael St Beckenham	48	43	68	50	45	68	48	44	68
414 Railway Pde Beckenham	63	58	85	61	56	82	60	55	82
16 Carmichael St Beckenham	48	43	68	49	45	69	48	44	69
416 Railway Pde Beckenham	63	58	85	61	56	82	60	55	82
455 Sevenoaks St Beckenham	63	58	85	59	54	79	58	53	79

## APPENDIX B – FORECAST AIRBORNE NOISE LEVELS

Receptor	Rail Operations (Existing) (Without mitigation)			Rail Operations Freight and TCL (Mitigated, noise walls)			Rail Operations Freight and TCL (Mitigated, noise walls and passenger rail dampers)		
	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>
8 Wilpon St Beckenham	52	48	74	52	47	71	51	46	71
457 Sevenoaks St Beckenham	62	58	85	59	54	79	58	53	79
10 Wilpon St Beckenham	52	47	73	52	47	71	51	46	71
418 Railway Pde Beckenham	63	58	85	61	56	82	60	55	82
6 Carmichael St Beckenham	50	46	73	50	45	72	49	44	72
2 Carmichael St Beckenham	63	58	85	61	57	82	60	56	82
8 Carmichael St Beckenham	46	41	65	47	43	66	46	42	66
461 Sevenoaks St Beckenham	63	58	86	59	55	80	59	54	80
4 Carmichael St Beckenham	48	43	70	48	43	68	47	42	68
14 Wilpon St Beckenham	53	48	74	53	48	73	52	47	73
463 Sevenoaks St Beckenham	63	58	85	59	54	79	58	53	79
16 Wilpon St Beckenham	52	47	72	52	47	72	51	47	72
18 Wilpon St Beckenham	53	49	76	53	48	73	52	47	73
420 Railway Pde Beckenham	63	58	85	60	55	80	59	55	80
465 Sevenoaks St Beckenham	62	57	85	58	53	80	57	53	80
422 Railway Pde Beckenham	63	58	84	60	55	80	59	54	80
3 Carmichael St Beckenham	49	44	70	50	45	71	49	44	71
3 Carmichael St Beckenham	50	45	68	51	46	69	50	45	69
5 Teele St Beckenham	48	43	67	49	44	68	48	43	68
1 Teele St Beckenham	63	58	85	60	55	80	59	54	80
3 Teele St Beckenham	57	53	80	55	50	76	54	49	76
424 Railway Pde Beckenham	63	58	85	60	55	79	59	54	79
426 Railway Pde Beckenham	63	58	84	59	54	79	58	54	79
428 Railway Pde Beckenham	63	58	85	60	55	79	59	54	79
4 Raglan St Beckenham	52	48	71	53	48	71	52	47	71
6 Raglan St Beckenham	47	42	65	48	43	66	47	42	66
469 Sevenoaks St Beckenham	63	58	85	60	55	80	59	54	80
6 Teele St Beckenham	57	52	79	54	49	75	53	49	75
21 Ireland Cr Beckenham	56	51	77	55	50	73	54	50	73
430 Railway Pde Beckenham	63	58	85	59	55	79	59	54	79
19 Ireland Cr Beckenham	55	50	76	55	50	74	54	49	74
471 Sevenoaks St Beckenham	63	58	85	60	55	80	59	54	80
50 Ireland Cr Beckenham	63	58	84	58	54	78	58	53	78
434 Railway Pde Beckenham	63	58	85	59	54	79	58	53	79
17 Ireland Cr Beckenham	54	49	73	54	50	73	54	49	73
436 Railway Pde Beckenham	63	58	85	59	54	80	58	53	80
473 Sevenoaks St Beckenham	63	58	85	60	55	80	59	54	80
15 Ireland Cr Beckenham	54	49	73	55	50	74	54	49	74
438 Railway Pde Beckenham	63	58	85	59	54	80	58	53	80
475 Sevenoaks St Beckenham	63	58	85	60	55	80	59	55	80
4 Sydenham St Beckenham	54	50	74	54	50	74	54	49	74
440 Railway Pde Beckenham	62	58	84	58	54	80	58	53	80
442 A Railway Pde Beckenham	62	58	84	59	54	81	58	53	81
477 Sevenoaks St Beckenham	62	58	85	59	55	79	59	54	79
442 B Railway Pde Beckenham	62	58	84	59	54	81	58	53	81
1580 Albany Hwy Beckenham	58	53	79	58	53	79	57	52	79
446 Railway Pde Beckenham	61	57	84	59	54	81	58	53	81
450 Railway Pde Beckenham	62	57	84	60	55	81	59	54	81
452 Railway Pde Beckenham	62	58	84	59	55	79	59	54	79
454 Railway Pde Beckenham	61	57	84	58	54	78	58	53	78
456 Railway Pde Beckenham	62	57	84	59	55	79	59	54	79
456 Railway Pde Beckenham	55	50	78	53	48	73	52	47	73
456 Railway Pde Beckenham	54	49	77	52	48	73	52	47	73
6 Brookland St Beckenham	60	55	82	57	52	76	56	51	76
458 Railway Pde Beckenham	61	56	83	59	54	78	58	53	78
462 Railway Pde Beckenham	56	51	75	55	50	73	54	49	73

## Appendix B

Report Number 675.10409.00100

Page 4 of 14

### APPENDIX B – FORECAST AIRBORNE NOISE LEVELS

Receptor	Rail Operations (Existing) (Without mitigation)			Rail Operations Freight and TCL (Mitigated, noise walls)			Rail Operations Freight and TCL (Mitigated, noise walls and passenger rail dampers)		
	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>
464 Railway Pde Beckenham	62	57	83	60	55	80	59	54	80
18 Brookland St Beckenham	61	56	84	57	52	76	56	51	76
18 Brookland St Beckenham	60	55	82	57	52	75	56	51	75
466 Railway Pde Beckenham	61	57	84	59	54	81	58	53	81
20 Brookland St Beckenham	60	56	83	56	51	76	55	50	76
20 Brookland St Beckenham	51	46	71	51	47	71	50	46	70
476 Railway Pde Beckenham	59	55	84	59	55	84	59	54	84
478 Railway Pde Beckenham	59	54	84	59	54	83	59	54	83
34 Brookland St Beckenham	59	54	83	54	49	73	53	48	73
9 Pinewood Wlk	63	58	92	57	52	85	57	52	85
480 Railway Pde Beckenham	59	54	84	59	54	83	58	54	83
482 Railway Pde Beckenham	59	54	84	58	53	83	58	53	83
484 Railway Pde Beckenham	59	54	85	58	54	85	58	53	85
484 Railway Pde Beckenham	57	52	84	58	53	84	57	53	84
2 Rochester Av Beckenham	55	50	82	56	51	82	56	51	82
3 Rochester Av Beckenham	59	54	86	59	54	86	59	54	86
7 Rochester Av Beckenham	59	54	85	59	54	85	59	54	85
23 Burham Rd	56	51	84	52	47	80	52	47	80
19 Burham Rd	59	54	87	53	48	81	53	48	81
15 Burham Rd	61	56	89	54	49	82	54	49	82
13 Burham Rd	61	56	90	55	50	83	55	50	83
11 Burham Rd	62	57	90	56	51	84	56	51	84
7 Burham Rd	63	58	91	58	53	86	57	53	86
3 Burham Rd	60	55	88	58	53	86	57	52	86
5 Burham Rd	61	56	89	58	53	86	58	53	86
1 Burham Rd	59	54	87	58	53	86	57	52	86
40 Dudley Rd	58	54	86	57	52	85	57	52	85
42 Dudley Rd	58	54	86	57	52	85	57	52	85
44 Dudley Rd	59	54	87	57	53	86	57	52	86
46 Dudley Rd	59	54	87	58	53	86	58	53	86
48a Dudley Rd	59	54	87	58	53	86	58	53	86
48b Dudley Rd	59	54	87	58	54	86	58	53	86
50 Dudley Rd	59	54	87	58	53	86	58	53	86
50 Edinbridge Rd	53	49	81	53	48	81	53	48	81
52 Edinbridge Rd	58	54	86	58	53	86	57	53	86
18 Rupert St	55	50	83	55	50	83	54	49	83
25 Rimmer Ln	56	51	84	54	49	82	53	49	82
45 O'dell St	58	53	86	55	50	83	54	50	83
43 O'dell St	58	54	86	55	51	83	55	50	83
41 O'dell St	59	54	87	56	51	84	55	50	84
39 O'dell St	59	54	87	56	51	84	55	50	84
37 O'dell St	59	55	87	56	51	84	55	50	84
35 O'dell St	60	55	88	56	51	84	55	51	84
33 O'dell St	60	55	88	56	52	84	56	51	84
31 O'dell St	60	55	88	57	52	84	56	51	84
19 Corriedale Pl	67	62	95	65	60	93	64	60	93
21 Corriedale Pl	59	54	87	57	52	85	56	51	85
29 O'dell St	60	55	88	57	52	85	56	51	85
27 O'dell St	62	57	90	59	54	87	58	53	87
25 O'dell St	61	56	89	55	50	83	54	49	83
24a Southdown Pl	72	67	98	56	51	85	56	51	85
17 Corriedale Pl	58	54	86	55	50	83	54	49	83
67b Lester Drv	65	60	94	56	51	84	55	50	84
24b Southdown Pl	72	67	98	58	53	87	57	53	87
24c Southdown Pl	72	67	99	58	53	87	57	53	87
67a Lester Drv	63	59	92	57	52	84	56	51	84

## APPENDIX B – FORECAST AIRBORNE NOISE LEVELS

Receptor	Rail Operations (Existing) (Without mitigation)			Rail Operations Freight and TCL (Mitigated, noise walls)			Rail Operations Freight and TCL (Mitigated, noise walls and passenger rail dampers)		
	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>
24d Southdown Pl	72	67	99	58	53	86	57	52	86
24e Southdown Pl	72	68	99	58	53	87	58	53	87
24f Southdown Pl	73	68	99	58	53	87	58	53	87
15 O'dell St	64	59	92	57	52	85	56	51	84
13 O'dell St	64	59	92	57	52	84	55	51	83
24g Southdown Pl	73	68	99	59	54	87	58	53	87
11 O'dell St	64	60	92	57	52	85	56	51	84
9 Nyandi Ct	67	63	97	61	56	89	60	55	89
7 O'dell St	65	61	93	58	53	86	57	52	85
5 O'dell St	66	62	94	57	53	86	57	52	86
3 O'dell St Thornlie	69	65	97	60	55	88	59	54	88
3 O'dell St Thornlie	68	63	95	62	58	91	62	57	91
103 Spring Rd	66	61	93	61	56	89	60	55	88
104 Spring Rd	65	61	92	57	52	85	56	51	85
106 Spring Rd	67	62	94	59	54	87	59	54	87
106 Spring Rd	62	58	90	58	54	86	58	53	86
2 Banksia Circle	56	51	84	55	50	83	54	49	82
110 Lyrebird Way	57	53	86	56	52	85	56	51	85
5 Spencer Rd	57	52	85	57	52	85	57	52	85
123 Lyrebird Way	63	58	92	58	54	87	58	53	87
121 Lyrebird Way	66	61	95	59	54	87	59	54	87
119 Lyrebird Way	63	58	91	59	54	87	58	54	87
117 Lyrebird Way	64	59	92	59	54	87	59	54	87
115 Lyrebird Way	62	57	90	58	53	86	58	53	86
5 Debenham St	53	48	81	53	48	81	52	48	81
113 Lyrebird Way	63	58	91	59	54	87	58	53	87
111 Lyrebird Way	62	57	91	58	54	87	58	53	86
7 Debenham St	55	50	83	55	50	83	54	49	83
109 Lyrebird Way	63	58	92	58	54	87	58	53	86
11 Debenham St	56	51	84	55	50	83	55	50	83
107 Lyrebird Way	61	56	90	58	53	85	57	52	85
105 Lyrebird Way	63	58	91	59	54	87	58	53	87
13 Debenham St	55	50	83	54	50	82	53	49	82
103 Lyrebird Way	59	54	87	57	53	85	57	52	85
15 Debenham St	56	51	83	55	50	83	54	50	82
101 Lyrebird Way	66	61	95	59	54	87	58	53	87
28 Kidman Ct	61	56	89	60	55	88	59	54	88
30 Kidman Ct	58	53	87	57	53	86	57	52	85
34 Kidman Ct	55	50	84	55	50	83	55	50	83
32 Kidman Ct	55	50	84	55	50	83	54	49	83
99 Lyrebird Way	61	56	90	58	53	86	57	53	86
26 Kidman Ct	63	58	92	57	52	84	56	51	84
97 Lyrebird Way	63	58	91	59	54	87	58	53	87
Yale Primary School	56	52	85	55	50	83	54	49	83
24 Kidman Ct	62	58	91	57	53	86	57	52	85
95 Lyrebird Way	61	56	90	58	53	86	57	52	86
22 Kidman Ct	63	58	92	58	53	86	57	53	86
93 Lyrebird Way Thornlie	63	58	91	58	53	86	58	53	86
20 Kidman Ct	64	59	93	58	53	86	58	53	86
91 Lyrebird Way	65	60	93	59	54	87	58	54	87
18 Kidman Ct	63	58	91	58	53	86	57	52	85
88 Partridge Way	63	59	92	59	54	87	59	54	87
86 Partridge Way	63	58	92	59	54	87	59	54	87
16 Kidman Ct	63	58	92	58	53	86	57	52	85
84 Partridge Way	62	57	91	58	54	86	58	53	86
14 Kidman Ct	62	57	91	57	53	85	57	52	85

## APPENDIX B – FORECAST AIRBORNE NOISE LEVELS

Receptor	Rail Operations (Existing) (Without mitigation)			Rail Operations Freight and TCL (Mitigated, noise walls)			Rail Operations Freight and TCL (Mitigated, noise walls and passenger rail dampers)		
	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>
12 Kidman Ct	62	57	91	58	53	86	57	52	85
82 Partridge Way	62	57	91	59	54	87	58	53	87
79 Lyrebird Way	62	58	91	58	53	86	57	53	86
10 Kidman Ct	62	57	90	57	53	85	57	52	85
8 Kidman Ct	62	57	91	58	53	86	57	52	85
77 Lyrebird Way	66	61	94	60	55	88	59	54	87
6 Kidman Ct	61	57	90	57	53	85	57	52	85
75 Lyrebird Way	65	60	93	58	54	86	58	53	86
73 Lyrebird Way	66	61	95	59	55	87	59	54	87
4 Kidman Ct	62	58	91	57	53	85	57	52	85
2 Kidman Ct	63	58	92	58	53	86	57	52	86
71 Lyrebird Way	63	58	92	60	55	88	59	54	88
69 Lyrebird Way	63	58	91	60	55	88	59	54	88
81 Lyrebird Way	62	57	91	59	54	87	58	53	86
67 Lyrebird Way	63	58	92	59	55	87	59	54	87
80 Greenway Ave	61	56	89	57	52	85	57	52	85
65 Lyrebird Way	66	61	94	60	55	88	59	54	88
78 Greenway Ave	60	55	89	57	52	85	56	52	85
76 Greenway Ave	61	56	90	57	52	85	56	51	85
63 Lyrebird Way	60	55	89	59	54	87	58	53	87
74 Greenway Ave	62	58	91	58	53	85	57	52	85
74 Partridge Way	60	55	88	59	54	87	58	53	87
72 Greenway Ave	61	56	89	57	53	85	57	52	85
76 Partridge Way	63	58	91	60	55	88	59	54	88
70 Greenway Ave	64	59	93	57	52	85	57	52	85
78 Partridge Way	62	57	91	58	53	86	58	53	86
68 Greenway Ave	62	57	91	57	53	85	57	52	85
66 Greenway Ave	62	57	91	58	53	86	57	52	85
80 Partridge Way	62	57	91	59	54	87	58	54	87
82 Greenway Ave	63	58	92	58	53	86	57	52	86
83 Lyrebird Way	63	58	92	59	54	87	58	53	87
64 Greenway Ave	61	56	90	57	52	85	56	51	84
62 Greenway Ave	63	59	92	58	53	86	57	52	85
86 Muriel Ct Cockburn Central	56	51	79	58	53	79	57	52	79
60 Greenway Ave	60	55	88	57	52	85	56	52	85
87 Lyrebird Way	61	56	89	58	53	86	57	53	86
58 Greenway Av Thornlie	64	59	93	60	55	88	59	55	88
90 Partridge Way	64	60	93	60	55	88	60	55	88
92 Partridge Way	64	59	92	60	55	89	59	54	89
56 Greenway Av Thornlie	62	57	90	58	53	86	58	53	86
54 Greenway Av Thornlie	65	60	94	60	55	88	59	54	88
94 Partridge Way	67	62	95	60	55	92	60	55	92
52 Greenway Ave	67	62	95	60	55	88	60	55	88
96 Partridge Way	68	63	97	61	56	91	61	56	91
98 Partridge Way	67	63	96	60	56	91	60	55	91
48 Greenway Ave	66	62	95	59	55	87	59	54	87
100 Partridge Way	67	62	96	60	56	92	60	55	92
102 Partridge Way	67	62	96	60	56	92	60	55	92
46 Greenway Ave	65	60	94	59	54	87	58	53	87
44 Greenway Ave	65	60	94	59	54	87	58	53	87
104 Partridge Way	64	60	93	59	55	90	59	54	90
106 Partridge Way	64	59	92	59	54	88	58	53	88
42 Greenway Ave	65	60	94	59	54	87	58	53	87
40 Greenway Ave	65	61	94	59	54	87	58	53	87
108 Partridge Way	63	58	92	59	54	87	58	54	87
38 Greenway Ave	66	61	95	59	54	87	58	54	87



APPENDIX B – FORECAST AIRBORNE NOISE LEVELS

Receptor	Rail Operations (Existing) (Without mitigation)			Rail Operations Freight and TCL (Mitigated, noise walls)			Rail Operations Freight and TCL (Mitigated, noise walls and passenger rail dampers)		
	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>
110 Partridge Way	64	59	93	59	54	88	59	54	88
36 Greenway Ave	64	59	93	58	53	86	58	53	86
112 Partridge Way	67	62	96	59	55	87	59	54	87
34 Greenway Ave	66	61	94	59	54	87	59	54	87
114 Partridge Way	66	61	95	60	55	88	60	55	88
32 Greenway Ave	64	59	93	58	53	86	58	53	86
116 Partridge Way	65	60	93	59	54	87	59	54	87
30 Greenway Ave	64	59	92	58	53	86	57	53	86
28 Greenway Ave	65	60	93	59	54	87	58	53	87
120 Partridge Way	64	59	93	59	54	87	59	54	87
26 Greenway Ave	64	59	93	59	54	87	58	54	87
122 Partridge Way	64	59	93	59	54	86	58	53	86
24 Greenway Ave	62	58	91	58	54	86	58	53	86
22 Greenway Ave	61	56	90	58	53	86	58	53	86
124 Partridge Way	63	58	92	59	54	87	58	53	87
20 Greenway Ave	65	60	94	58	53	86	57	52	86
126 Partridge Way	65	60	94	61	56	90	61	56	90
18 Greenway Ave	63	58	91	59	54	87	58	54	87
128 Partridge Way	67	62	96	62	57	91	62	57	91
118 Cameron St	67	62	96	65	60	93	64	60	93
21 Elliot Pl	63	58	92	62	58	90	62	57	90
23 Elliot Pl	68	64	97	61	56	89	60	55	89
14 Carakine Grove	65	60	94	58	53	86	58	53	86
12 Carakine Grove	66	61	95	59	54	87	58	53	87
10 Carakine Grove	66	61	95	58	53	86	57	52	86
8 Carakine Grove	67	62	96	58	54	86	58	53	86
6 Carakine Grove	67	62	96	59	54	86	58	53	86
4 Carakine Grove	67	62	96	58	54	86	58	53	86
2 Carakine Grove	66	61	95	59	54	86	58	53	86
1 Nyandi Ct	67	62	96	59	54	87	59	54	87
3 Nyandi Ct	67	62	96	60	55	88	59	54	88
5 Nyandi Ct	67	62	96	61	56	89	60	55	89
9 Mesa Pl	58	53	87	55	51	83	55	50	83
11 Nyandi Ct	67	62	96	60	55	88	60	55	88
15 Nyandi Ct	67	62	96	60	55	88	59	54	88
17 Nyandi Ct	67	63	97	59	54	87	59	54	87
19 Nyandi Ct	68	63	97	59	54	87	58	54	87
21 Nyandi Ct	68	63	97	59	54	86	58	53	86
23 Nyandi Ct	65	60	94	58	54	86	58	53	86
27 Nyandi Ct	66	61	95	58	53	86	57	53	86
29 Nyandi Ct	67	62	96	58	53	85	57	52	85
31 Nyandi Ct	65	60	94	57	52	85	57	52	85
33 Nyandi Ct	65	60	94	58	53	86	57	52	86
35 Nyandi Ct	64	60	93	57	52	85	57	52	85
37 Nyandi Ct	62	57	92	56	51	84	55	50	84
39 Nyandi Ct	64	60	93	57	52	85	57	52	85
41 Nyandi Ct	64	59	93	57	52	84	56	51	84
43 Nyandi Ct	65	60	94	57	52	85	56	51	85
45 Nyandi Ct	65	60	94	57	52	85	56	51	85
47 Nyandi Ct	65	60	94	57	52	84	56	51	84
101 Hughes St	56	51	85	57	52	85	56	51	85
2 Mclean Rd	60	55	89	58	53	86	57	53	86
4 Mclean Rd	67	62	96	58	54	86	58	53	86
6 Mclean Rd	67	62	96	59	55	87	59	54	87
8 Mclean Rd	67	63	96	59	54	87	58	53	87
10 Mclean Rd	67	63	96	59	54	87	58	53	86

## APPENDIX B – FORECAST AIRBORNE NOISE LEVELS

Receptor	Rail Operations (Existing) (Without mitigation)			Rail Operations Freight and TCL (Mitigated, noise walls)			Rail Operations Freight and TCL (Mitigated, noise walls and passenger rail dampers)		
	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>
12 Mclean Rd	68	63	97	59	54	87	58	53	87
14 Mclean Rd	68	63	97	59	54	87	59	54	87
16 Mclean Rd	68	63	97	59	54	87	58	53	87
18 Mclean Rd	69	64	98	60	55	87	59	54	87
18a Mclean Rd	69	65	98	59	54	87	59	54	87
24 Mclean Rd	68	63	97	58	53	86	58	53	86
26 Mclean Rd	68	63	97	58	54	86	58	53	86
28 Mclean Rd	68	63	97	58	53	86	58	53	86
30 Mclean Rd	68	63	97	58	53	86	58	53	86
32 Mclean Rd	68	63	97	58	53	86	58	53	86
34 Mclean Rd	68	63	97	58	54	86	58	53	86
36 Mclean Rd	68	63	97	58	53	86	57	53	85
38 Mclean Rd	65	60	94	56	51	84	55	50	84
40 Mclean Rd	65	60	94	57	52	84	56	51	84
42 Mclean Rd	64	59	93	56	51	84	55	50	83
44 Mclean Rd	63	58	92	56	51	83	55	50	83
46 Mclean Rd	61	56	90	55	50	83	54	50	83
39 Mclean Rd	62	58	91	59	54	87	59	54	87
48 Mclean Rd	59	54	88	55	50	83	54	49	82
41 Mclean Rd	62	57	91	59	54	87	58	53	86
43 Mclean Rd	61	56	90	58	53	85	57	52	85
12 Dowarn Grn	61	56	90	58	53	86	57	52	86
11 Dowarn Grn	67	62	96	59	54	86	58	53	86
9 Barraberry Rtt	63	58	92	59	55	87	59	54	87
7 Dowarn Grn	64	59	93	56	51	84	56	51	84
3 Dowarn Grn	61	56	90	55	50	83	54	49	82
4 Dowarn Grn	64	59	92	60	55	88	60	55	88
5 Barraberry Rtt	60	55	89	57	53	85	57	52	85
7 Barraberry Rtt	63	58	92	59	54	87	59	54	87
89 Lyrebird Way	62	57	91	59	54	87	58	54	87
11 Barraberry Rtt	63	58	92	59	54	86	58	53	86
13 Barraberry Rtt	62	57	91	59	54	86	58	53	86
15 Barraberry Rtt	64	59	93	60	55	88	59	55	88
17 Barraberry Rtt	62	58	91	59	54	86	58	53	86
19 Barraberry Rtt	57	52	85	53	48	81	52	47	81
2 Nicholson Ct	61	56	90	57	53	85	57	52	85
4 Nicholson Ct	65	60	94	55	50	83	55	50	83
6 Nicholson Ct	64	59	93	55	50	82	54	49	82
8 Nicholson Ct	63	59	92	54	49	82	54	49	82
10 Nicholson Ct	62	57	91	53	48	80	52	47	80
12 Nicholson Ct	63	58	91	54	49	81	53	49	81
14 Nicholson Ct	61	56	90	53	48	81	52	48	80
24 Lansdowne Ent	64	59	93	55	50	83	54	49	82
4 Hedgeley Way	59	54	88	52	47	80	51	46	79
27 Lansdowne Ent	64	59	93	58	53	85	57	52	85
3 Hedgeley Way	57	53	86	51	46	79	50	45	78
1 Hedgeley Way	56	52	85	53	48	81	52	48	81
29 Lansdowne Ent	64	59	93	57	52	85	57	52	84
31 Lansdowne Ent	63	59	92	56	52	84	56	51	84
33 Lansdowne Ent	64	59	92	57	52	85	57	52	84
35 Lansdowne Ent	64	59	93	57	53	85	57	52	85
37 Lansdowne Ent	63	58	92	56	51	86	55	51	86
39 Lansdowne Ent	64	59	93	57	52	85	56	52	85
41 Lansdowne Ent	64	59	93	57	52	85	57	52	85
43 Lansdowne Ent	64	59	93	57	52	84	56	51	84
45 Lansdowne Ent	64	60	93	57	52	85	57	52	85

## APPENDIX B – FORECAST AIRBORNE NOISE LEVELS

Receptor	Rail Operations (Existing) (Without mitigation)			Rail Operations Freight and TCL (Mitigated, noise walls)			Rail Operations Freight and TCL (Mitigated, noise walls and passenger rail dampers)		
	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>
47 Lansdowne Ent	64	59	93	57	52	85	57	52	85
49 Lansdowne Ent	66	61	95	58	53	86	57	53	85
51 Lansdowne Ent	64	59	93	57	52	84	56	51	84
53 Lansdowne Ent	59	55	88	55	50	83	55	50	83
55 Lansdowne Ent	63	58	92	55	50	84	54	50	84
61 Lansdowne Ent	61	56	90	55	50	82	54	49	82
59 Lansdowne Ent	64	59	93	55	51	85	55	50	85
57 Lansdowne Ent	68	63	97	61	56	88	60	56	88
18 Browallia Cl Canning Vale	63	58	92	57	52	84	56	51	84
16 Browallia Cl	62	57	91	57	52	85	57	52	85
21 Jubaea Ct	61	56	90	57	52	85	56	52	85
19 Jubaea Ct	63	59	92	55	50	84	55	50	84
17 Jubaea Ct	63	58	91	55	50	82	54	49	82
15 Jubaea Ct	60	56	89	54	49	81	53	48	81
13 Jubaea Ct	58	53	87	53	48	81	53	48	81
28 Jubaea Ct	62	57	91	56	51	84	56	51	84
26 Jubaea Ct	61	57	90	55	50	85	55	50	85
9 Lakes Way	62	57	91	51	46	79	51	46	79
7 Mesa Pl	60	55	89	56	51	84	55	50	84
5 Mesa Pl	61	56	90	55	50	83	55	50	83
3 Mesa Pl	61	56	90	55	50	83	55	50	83
2 Mesa Pl	60	55	89	55	50	83	55	50	83
34 Woodhouse Cct	58	53	87	55	50	82	54	49	82
32 Woodhouse Cct	58	53	87	56	51	83	55	50	83
30 Woodhouse Cct	57	52	86	56	51	84	56	51	84
28 Woodhouse Cct	57	52	86	56	51	83	55	50	83
26 Woodhouse Cct	59	54	88	56	51	83	55	50	83
24 Woodhouse Cct	59	54	88	56	51	84	55	51	84
22 Woodhouse Cct	58	53	87	56	51	84	55	50	84
20 Woodhouse Cct	58	53	87	54	50	82	54	49	82
18 Woodhouse Cct	59	54	88	55	51	83	55	50	83
16 Woodhouse Cct	59	55	88	56	51	83	55	50	83
14 Woodhouse Cct	60	55	88	56	51	83	55	50	83
12 Woodhouse Cct	59	54	88	56	51	83	55	50	83
10 Woodhouse Cct	58	53	87	56	51	83	55	50	83
8 Woodhouse Cct	60	55	89	56	51	83	55	50	83
15 Woodhouse Cct	62	58	91	55	50	83	55	50	83
6 Woodhouse Cct	60	55	89	56	52	84	56	51	84
13 Woodhouse Cct	61	57	90	54	49	81	53	48	81
11 Woodhouse Cct	62	57	91	53	48	82	53	48	82
Canning Vale Long Day Centre	62	57	91	53	49	82	53	48	82
5 Steppe Ct	54	49	83	53	48	81	52	48	81
3 Steppe Ct	59	54	88	55	50	83	54	50	83
10 Steppe Ct	66	61	95	57	52	84	56	51	84
8 Steppe Ct	66	61	95	57	52	85	57	52	85
6 Steppe Ct	66	61	95	59	54	86	58	54	86
4 Steppe Ct	61	56	90	57	52	85	57	52	85
2 Steppe Ct	61	56	90	57	52	85	57	52	85
5 Woodspring Trl Canning Vale	60	55	89	57	52	85	56	51	85
7 Woodspring Trl Canning Vale	63	58	92	57	52	84	56	52	84
9 Woodspring Trl Canning Vale	64	60	93	56	51	84	56	51	84
11 Woodspring Trl Canning Vale	65	60	94	56	52	84	56	51	84
13 Woodspring Trl Canning Vale	65	60	94	56	51	84	56	51	84
15 Woodspring Trl Canning Vale	65	61	94	56	51	84	56	51	84
17 Woodspring Trl Canning Vale	65	60	94	56	51	84	56	51	84
19 Woodspring Trl Canning Vale	63	58	92	56	51	84	56	51	84

## Appendix B

Report Number 675.10409.00100

Page 10 of 14

### APPENDIX B – FORECAST AIRBORNE NOISE LEVELS

Receptor	Rail Operations (Existing) (Without mitigation)			Rail Operations Freight and TCL (Mitigated, noise walls)			Rail Operations Freight and TCL (Mitigated, noise walls and passenger rail dampers)		
	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>
21 Woodspring Trl Canning Vale	61	56	90	56	51	83	55	50	83
22 Meadowview Mews	62	57	91	57	52	84	56	51	84
20 Meadowview Mews	61	56	90	57	52	84	56	51	84
18 Meadowview Mews	61	56	89	57	52	85	56	52	85
16 Meadowview Mews	60	55	88	56	51	84	56	51	84
14 Meadowview Mews	59	54	88	55	51	83	55	50	83
12 Meadowview Mews	62	57	91	56	51	84	56	51	84
10 Meadowview Mews	60	56	89	54	50	82	54	49	82
8 Meadowview Mews	62	57	90	57	52	84	56	51	84
6 Meadowview Mews	62	57	91	56	51	84	56	51	84
4 Meadowview Mews	63	58	92	57	52	84	56	51	84
5 Pinewood Wlk	63	58	92	56	52	85	56	51	85
7 Pinewood Wlk	63	58	91	56	51	85	55	51	85
9 O'dell St	65	60	93	58	53	85	57	52	85
11 Pinewood Wlk	62	57	91	57	52	84	57	52	84
13 Pinewood Wlk	62	57	91	56	52	84	56	51	84
15 Pinewood Wlk	62	57	91	57	53	85	57	52	85
21 Pinewood Wlk	58	53	87	54	49	82	53	49	82
17 Pinewood Wlk	63	58	92	56	51	83	55	50	83
19 Pinewood Wlk	63	58	92	55	50	84	55	50	84
41 Parkland Trl	62	57	91	54	50	82	54	49	82
43 Parkland Trl	63	58	92	55	50	82	54	50	82
36 Parkland Trl	60	55	89	53	48	81	53	48	80
38 Parkland Trl	62	58	91	55	50	83	55	50	83
13 Park Ln	63	58	92	54	50	82	54	49	82
11 Park Ln	62	57	91	55	50	82	54	49	82
15 Park Ln	65	60	94	57	53	85	57	52	85
17 Park Ln	64	59	93	56	51	84	56	51	84
19 Park Ln	64	59	93	58	53	85	57	52	85
21 Park Ln	65	60	94	58	53	85	57	52	85
23 Park Ln	65	60	94	57	52	85	57	52	85
25 Park Ln	65	60	94	58	53	86	58	53	86
27 Park Ln	65	60	94	58	53	86	58	53	86
29 Park Ln	65	60	94	58	53	86	58	53	86
31 Park Ln	65	60	94	59	54	86	58	53	86
33 Park Ln	64	59	93	58	54	86	58	53	86
35 Park Ln	65	60	94	59	54	87	58	54	87
37 Park Ln	60	55	89	57	53	85	57	52	85
36 Park Ln	63	58	92	57	52	85	57	52	85
38 Park Ln	63	58	92	59	54	87	58	54	87
57 Fairfield Gdn	61	56	90	55	50	84	55	50	84
59 Fairfield Gdn	62	58	91	57	52	85	56	52	85
61 Fairfield Gdn	63	58	92	58	53	86	58	53	86
20 Fernleaf Ct	57	53	86	58	53	86	58	53	86
5 Clements Pl	52	47	80	48	44	76	48	43	76
3 Clements Pl	51	46	80	47	42	74	46	41	74
6 Clements Pl	62	57	90	52	47	80	52	47	80
1 Clements Pl	53	48	81	46	41	73	45	41	73
4 Clements Pl	60	55	89	53	48	81	52	47	81
2 Clements Pl	58	53	87	49	44	76	48	44	76
5 Lakes Way	60	55	89	50	45	78	50	45	78
7 Lakes Way	62	57	91	51	47	79	51	46	79
9 Dowarn Grn	66	62	95	58	54	86	58	53	86
6 Lakes Way	58	53	87	50	45	78	50	45	78
11 Lakes Way	63	58	92	54	49	81	53	49	81
13 Lakes Way	62	58	91	54	50	83	54	49	83

APPENDIX B – FORECAST AIRBORNE NOISE LEVELS

Receptor	Rail Operations (Existing) (Without mitigation)			Rail Operations Freight and TCL (Mitigated, noise walls)			Rail Operations Freight and TCL (Mitigated, noise walls and passenger rail dampers)		
	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>
10 Lakes Way	55	51	84	50	45	78	50	45	78
15 Lakes Way	60	55	88	53	48	82	53	48	82
23 Turtle Point Cov	60	55	89	50	45	77	49	44	77
21 Turtle Point Cov	60	55	89	51	46	79	50	45	79
19 Turtle Point Cov	61	57	90	50	45	78	49	45	78
17 Turtle Point Cov	55	50	85	51	46	79	51	46	79
15 Turtle Point Cov	56	51	85	52	47	80	52	47	80
13 Turtle Point Cov	49	45	78	49	45	77	49	44	77
11 Turtle Point Cov	54	49	83	52	47	80	51	46	80
7 Turtle Point Cov	49	45	79	51	46	78	50	45	78
5 Turtle Point Cov	54	49	83	52	47	80	51	47	80
3 Turtle Point Cov	54	49	83	52	47	80	51	47	80
97 Glen Iris Drv	54	49	82	52	47	79	51	47	79
99 Glen Iris Drv	59	55	89	52	47	79	51	46	79
101 Glen Iris Dr Jandakot	57	52	86	53	49	80	52	47	80
103 Glen Iris Drv	52	47	81	54	49	80	52	48	80
105 Glen Iris Drv	53	48	81	52	48	78	51	46	78
109 Glen Iris Drv	50	45	79	51	47	77	50	45	77
111 Glen Iris Drv	48	44	74	54	49	75	51	47	75
113 Glen Iris Drv	48	43	76	52	48	76	50	46	76
115 Glen Iris Drv	48	43	76	52	47	76	50	45	76
117 Glen Iris Drv	49	44	76	53	48	76	51	46	76
119 Glen Iris Drv	51	46	77	53	49	77	52	47	77
121 Glen Iris Drv	49	44	75	50	45	74	49	44	74
123 Glen Iris Drv	49	44	74	50	45	73	49	44	73
14 Tulipwood Pl	57	53	84	54	49	79	54	49	79
125 Glen Iris Drv	51	46	74	51	46	74	50	45	74
16 Tulipwood Pl	57	52	83	54	49	78	54	49	78
127 Glen Iris Drv	51	46	74	51	46	73	50	45	73
18 Tulipwood Pl	58	53	81	56	51	81	56	51	81
18a Tulipwood Pl South Lake	56	51	79	54	49	78	54	49	78
20 Tulipwood Pl	59	54	82	58	53	82	58	53	82
129 Glen Iris Dr Jandakot	49	44	73	49	44	72	48	44	72
7 Bangalow Pl South Lake	58	53	83	57	52	83	57	52	83
131 Glen Iris Dr Jandakot	50	45	72	49	45	71	49	44	70
6 Bangalow Pl South Lake	59	54	82	58	53	82	58	53	82
133 Glen Iris Dr Jandakot	47	42	69	47	42	67	46	41	67
4 Bangalow Pl South Lake	58	54	82	57	53	82	57	52	82
135 Glen Iris Dr Jandakot	47	42	68	47	43	67	47	42	67
137 Glen Iris Dr Jandakot	48	43	68	48	44	67	48	43	66
139 Glen Iris Dr Jandakot	47	42	67	48	43	66	47	42	66
141 Glen Iris Dr Jandakot	45	40	66	46	41	65	45	40	65
143 Glen Iris Dr Jandakot	45	41	65	46	41	64	45	40	64
145 Glen Iris Dr Jandakot	46	42	68	47	42	67	46	41	67
4 Bonville Glen Jandakot	45	41	65	46	42	65	45	41	64
6 Bonville Glen Jandakot	45	40	65	46	41	65	45	40	65
8 Bonville Glen Jandakot	45	40	65	46	41	65	45	40	64
10 Bonville Glen Jandakot	45	40	65	46	41	65	45	40	64
14 Bonville Glen Jandakot	45	40	65	46	41	65	45	40	65
16 Bonville Glen Jandakot	47	42	65	48	43	65	47	42	64
18 Bonville Glen Jandakot	48	43	65	49	44	65	48	43	65
15 The Pines Gr Jandakot	47	42	67	48	43	67	47	43	67
11 The Pines Gr Jandakot	48	43	67	49	44	67	48	44	67
9 Seale St Beckenham	53	48	77	54	49	77	54	49	77
7 The Pines Gr Jandakot	50	45	70	51	47	70	51	46	70
5 The Pines Gr Jandakot	52	47	73	53	48	73	52	47	73

## APPENDIX B – FORECAST AIRBORNE NOISE LEVELS

Receptor	Rail Operations (Existing) (Without mitigation)			Rail Operations Freight and TCL (Mitigated, noise walls)			Rail Operations Freight and TCL (Mitigated, noise walls and passenger rail dampers)		
	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>
3 The Pines Gr Jandakot	51	47	72	53	48	72	52	47	72
32 Virgilia Tce South Lake	60	55	82	61	56	82	60	55	82
180 Glen Iris Dr Jandakot	52	47	72	53	48	72	52	47	72
30 Virgilia Tce South Lake	60	55	82	60	56	82	60	55	82
28 Virgilia Tce South Lake	60	55	82	61	56	82	60	55	82
182 Glen Iris Dr Jandakot	50	45	72	51	46	72	50	45	72
26 Virgilia Tce South Lake	60	55	82	61	56	82	60	56	82
184 Glen Iris Dr Jandakot	53	48	73	54	49	73	53	49	73
24 Virgilia Tce South Lake	60	56	82	61	56	82	61	56	82
190 Glen Iris Dr Jandakot	52	47	73	53	49	73	53	48	73
22 Virgilia Tce South Lake	60	55	82	60	56	82	60	55	82
192 Glen Iris Dr Jandakot	52	47	71	53	48	71	52	47	71
20 Virgilia Tce South Lake	62	57	83	62	58	83	62	57	83
20 Virgilia Tce South Lake	59	54	81	60	55	81	59	54	81
198 Glen Iris Dr Jandakot	52	47	71	53	48	71	53	48	71
16 Virgilia Tce South Lake	60	55	81	60	56	81	60	55	81
1 Eadie Ct Jandakot	52	48	73	54	49	73	53	48	73
3 Eadie Ct Jandakot	43	38	62	44	39	62	43	38	61
14 Virgilia Tce South Lake	59	55	81	60	55	81	60	55	81
12 Virgilia Tce South Lake	60	55	82	61	56	82	60	56	82
2 Eadie Ct Jandakot	53	48	73	55	50	73	54	49	73
4 Eadie Ct Jandakot	45	41	64	47	42	65	46	41	65
10 Virgilia Tce South Lake	60	55	82	61	56	82	60	55	82
1 Glacier Way Jandakot	53	48	72	54	49	73	53	49	72
8 Virgilia Tce South Lake	57	52	79	58	53	79	57	52	79
6 Virgilia Tce South Lake	60	55	82	61	56	82	60	55	82
2 Glacier Way Jandakot	52	48	72	54	49	72	53	48	72
4 Virgilia Tce South Lake	57	53	80	59	54	80	58	53	80
4 Glacier Way Jandakot	42	37	61	43	39	61	42	38	61
13a Zillner Cl South Lake	62	57	84	63	58	84	62	58	84
210 Glen Iris Dr Jandakot	52	48	72	54	49	72	53	48	72
210 Glen Iris Dr Jandakot	51	46	70	53	48	70	52	47	70
212 Glen Iris Dr Jandakot	48	43	69	49	45	69	48	44	69
20 Zillner Cl South Lake	47	42	67	49	44	67	48	43	67
22 Zillner Cl South Lake	52	47	73	54	49	73	53	48	73
11 Curalo Mews South Lake	60	56	83	62	57	83	61	56	83
201 Glen Iris Dr Jandakot	61	56	82	62	57	82	61	56	82
13 Curalo Mews South Lake	60	55	82	61	57	83	61	56	83
44 Turnbury Park Dr Jandakot	57	52	77	58	53	77	57	52	77
44 Turnbury Park Dr Jandakot	54	49	73	55	50	73	54	50	73
44 Turnbury Park Dr Jandakot	51	46	71	52	47	71	51	46	71
14 Curalo Mews South Lake	58	53	81	60	55	81	59	54	81
42 Turnbury Park Dr Jandakot	54	49	74	55	51	74	55	50	74
42 Turnbury Park Dr Jandakot	49	44	66	50	45	66	49	44	66
12 Curalo Mews South Lake	59	54	81	60	55	81	59	54	81
10 Curalo Mews South Lake	58	54	81	60	55	82	59	54	81
40 Turnbury Park Dr Jandakot	46	41	65	47	43	65	47	42	65
38 Turnbury Park Dr Jandakot	53	48	74	54	49	74	53	49	74
6 Curalo Mews South Lake	45	40	64	46	42	65	46	41	64
8 Curalo Mews South Lake	58	53	82	59	55	82	59	54	82
36a Turnbury Park Dr Jandakot	53	48	73	54	50	73	54	49	73
36a Turnbury Park Dr Jandakot	52	47	71	53	49	72	53	48	71
11a Jeavons Pl South Lake	64	59	87	64	59	87	63	59	87
11 Jeavons Pl South Lake	49	44	68	51	46	69	50	45	68
15 Jeavons Pl South Lake	61	56	83	61	56	83	60	56	83
49 Turnbury Park Dr Jandakot	52	47	72	53	48	73	52	47	72

## APPENDIX B – FORECAST AIRBORNE NOISE LEVELS

Receptor	Rail Operations (Existing) (Without mitigation)			Rail Operations Freight and TCL (Mitigated, noise walls)			Rail Operations Freight and TCL (Mitigated, noise walls and passenger rail dampers)		
	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>
17 Jeavons Pl South Lake	58	54	82	60	55	82	59	54	82
47 Turnbury Park Dr Jandakot	51	46	73	53	48	73	52	47	73
16 Jeavons Pl South Lake	56	51	80	57	53	80	57	52	80
45 Turnbury Park Dr Jandakot	52	47	73	53	48	73	52	47	73
23 Nagambie Cl South Lake	58	53	80	59	54	80	58	53	80
43 Turnbury Park Dr Jandakot	52	47	73	54	49	73	53	48	73
18 Nagambie Cl South Lake	59	54	81	60	56	81	60	55	81
16 Nagambie Cl South Lake	59	54	81	60	55	81	59	55	81
41 Turnbury Park Dr Jandakot	52	47	72	53	48	73	52	47	72
39 Turnbury Park Dr Jandakot	52	47	71	53	48	71	52	47	71
14 Nagambie Cl South Lake	58	53	80	59	54	80	58	54	80
37 Turnbury Park Dr Jandakot	52	47	71	53	48	71	52	47	71
12 Nagambie Cl South Lake	49	45	70	51	46	70	50	45	70
35 Turnbury Park Dr Jandakot	51	46	70	52	47	70	51	46	70
15 Mclernon Pl South Lake	59	55	81	61	56	82	60	55	82
15 Mclernon Pl South Lake	57	53	78	59	54	79	58	53	79
33 Turnbury Park Dr Jandakot	49	44	69	50	46	70	49	44	70
34 Turnbury Park Dr Jandakot	49	44	67	50	46	67	50	45	67
17 Mclernon Pl South Lake	55	50	76	57	52	76	56	51	76
32 Turnbury Park Dr Jandakot	48	43	69	49	44	69	48	43	69
4 Brookford Ct Jandakot	50	45	69	51	47	69	50	46	69
19 Mclernon Pl South Lake	52	47	74	54	49	74	52	47	74
6 Brookford Ct Jandakot	50	45	69	51	46	69	50	45	69
18 Jindabyne Hts South Lake	53	49	73	55	50	73	54	49	73
3 Brookford Ct Jandakot	46	41	66	48	43	66	47	42	66
8 Brookford Ct Jandakot	50	45	69	51	47	69	50	46	69
16 Jindabyne Hts South Lake	53	48	73	54	50	73	53	49	73
10 Brookford Ct Jandakot	50	45	68	52	47	68	51	46	68
12 Brookford Ct Jandakot	49	44	67	50	45	67	49	45	67
12 Brookford Ct Jandakot	49	44	66	50	46	67	50	45	66
14 Jindabyne Hts South Lake	53	48	73	55	50	73	53	49	73
22 Eastney Ct Jandakot	50	45	70	51	46	70	50	45	70
20 Eastney Ct Jandakot	51	46	72	53	48	72	52	47	72
15 Wapengo Cl South Lake	50	45	72	52	47	72	51	46	72
15 Wapengo Cl South Lake	48	43	69	50	45	70	49	44	69
18 Eastney Ct Jandakot	48	43	68	49	45	68	48	44	68
16 Eastney Ct Jandakot	44	39	62	45	41	63	45	40	62
17 Wapengo Cl South Lake	48	43	67	50	45	67	49	44	67
16 The Lakes Bvd Jandakot	48	43	69	49	44	69	48	43	69
18 The Lakes Bvd Jandakot	47	43	69	49	44	69	48	43	69
20 The Lakes Bvd Jandakot	57	52	78	58	53	78	57	52	78
20 The Lakes Bvd Jandakot	49	45	70	51	46	70	50	45	70
26 The Lakes Bvd Jandakot	51	47	72	53	48	72	52	47	72
26 The Lakes Bvd Jandakot	49	44	68	50	45	68	50	45	68
28 The Lakes Bvd Jandakot	56	52	78	57	52	78	57	52	78
30 The Lakes Bvd Jandakot	54	50	76	56	51	76	55	50	76
32 The Lakes Bvd Jandakot	54	49	75	55	50	75	54	49	75
34 The Lakes Bvd Jandakot	51	46	70	52	47	70	51	47	70
36 The Lakes Bvd Jandakot	50	45	69	51	46	69	50	46	69
38 The Lakes Bvd Jandakot	53	48	73	54	49	73	53	48	73
38 The Lakes Bvd Jandakot	51	46	69	52	47	69	51	47	69
42 The Lakes Bvd Jandakot	53	48	73	54	49	73	53	49	73
44 The Lakes Bvd Jandakot	52	47	71	53	48	71	52	47	71
46 The Lakes Bvd Jandakot	52	47	72	53	48	72	52	48	72
48 The Lakes Bvd Jandakot	51	46	72	52	47	72	51	47	72
50 The Lakes Bvd Jandakot	50	46	69	52	47	69	51	46	69

## Appendix B

Report Number 675.10409.00100

Page 14 of 14

### APPENDIX B – FORECAST AIRBORNE NOISE LEVELS

Receptor	Rail Operations (Existing) (Without mitigation)			Rail Operations Freight and TCL (Mitigated, noise walls)			Rail Operations Freight and TCL (Mitigated, noise walls and passenger rail dampers)		
	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>	L <sub>Aeq,day</sub>	L <sub>Aeq,night</sub>	L <sub>Amax</sub>
52 The Lakes Bvd Jandakot	51	46	70	52	47	70	51	46	70
54 The Lakes Bvd Jandakot	52	47	72	53	48	72	52	47	72
56 The Lakes Bvd Jandakot	50	45	71	52	47	71	51	46	71
58 The Lakes Bvd Jandakot	50	45	71	51	47	71	51	46	71
60 The Lakes Bvd Jandakot	50	45	71	51	47	71	51	46	71
62 The Lakes Bvd Jandakot	51	47	71	53	48	71	52	47	71
51 The Lakes Bvd Jandakot	51	46	71	52	48	71	52	47	71
25 Imlah Ct Jandakot	51	47	72	53	48	72	52	47	72
21 Imlah Ct Jandakot	52	47	72	53	48	72	52	48	72
60 Muriel Ct Cockburn Central	52	47	75	53	48	75	52	48	75
72 Muriel Ct Cockburn Central	53	49	75	55	50	75	54	49	75
85 Lyrebird Way	64	59	93	59	54	87	58	53	87
23 Kentucky Ct Cockburn Central	54	49	76	55	51	77	55	50	77
23 Junction Bvd Cockburn Central	53	49	77	53	48	77	52	48	77
9 The Pines Gr Jandakot	49	44	68	50	45	69	49	44	68



APPENDIX C – FORECAST GROUND BORNE VIBRATION AND GROUND BORNE NOISE LEVELS

**APPENDIX C – FORECAST GROUND BORNE VIBRATION  
AND GROUND BORNE NOISE LEVELS**

**APPENDIX C – FORECAST GROUND BORNE VIBRATION AND GROUND BORNE NOISE LEVELS**

**Table 04 Forecast vibration and GBN level exceeding results summary by address (including u<sub>90</sub>), prior to mitigation**

ID #	Street Address	Usage	GBV, L <sub>v,RMS,1s</sub> – dB re 1 nm/s					GBN, L <sub>ASmax</sub> – dB re 20 µPa				
			Existing Freight	Future T line	Limit	Margin	Change	Existing Freight	Future T line	Limit	Margin	Change
83	24 SOUTHDOWN PL THORNLIE	Residential	112	100	106	6	0	37	26	35	2	0
84	24 SOUTHDOWN PL THORNLIE	Residential	112	100	106	6	0	37	26	35	2	0
87	24 SOUTHDOWN PL THORNLIE	Residential	125	103	106	19	0	54	32	35	19	0
88	24 SOUTHDOWN PL THORNLIE	Residential	125	103	106	19	0	54	32	35	19	0
89	24 SOUTHDOWN PL THORNLIE	Residential	116	101	106	10	0	42	28	35	7	0
90	24 SOUTHDOWN PL THORNLIE	Residential	116	101	106	10	0	42	28	35	7	0
91	24 SOUTHDOWN PL THORNLIE	Residential	113	101	106	7	0	39	27	35	4	0
92	24 SOUTHDOWN PL THORNLIE	Residential	113	101	106	7	0	39	27	35	4	0
93	24 SOUTHDOWN PL THORNLIE	Residential	109	99	106	3	0	34	25	35	-1	0
94	24 SOUTHDOWN PL THORNLIE	Residential	109	99	106	3	0	34	25	35	-1	0
97	24 SOUTHDOWN PL THORNLIE	Residential	113	100	106	7	0	38	26	35	3	0
98	24 SOUTHDOWN PL THORNLIE	Residential	113	100	106	7	0	38	26	35	3	0
100	24 SOUTHDOWN PL THORNLIE	Residential	122	102	106	16	0	50	30	35	15	0
101	24 SOUTHDOWN PL THORNLIE	Residential	122	102	106	16	0	50	30	35	15	0
102	24 SOUTHDOWN PL THORNLIE	Residential	112	100	106	6	0	38	26	35	3	0
103	24 SOUTHDOWN PL THORNLIE	Residential	112	100	106	6	0	38	26	35	3	0
107	24 SOUTHDOWN PL THORNLIE	Residential	126	103	106	20	0	55	32	35	20	0
108	24 SOUTHDOWN PL THORNLIE	Residential	126	103	106	20	0	55	32	35	20	0
109	24 SOUTHDOWN PL THORNLIE	Residential	108	99	106	2	0	32	24	35	-3	0
110	24 SOUTHDOWN PL THORNLIE	Residential	108	99	106	2	0	32	24	35	-3	0
111	24 SOUTHDOWN PL THORNLIE	Residential	113	101	106	7	0	39	27	35	4	0
112	24 SOUTHDOWN PL THORNLIE	Residential	113	101	106	7	0	39	27	35	4	0
113	24 SOUTHDOWN PL THORNLIE	Residential	118	102	106	12	0	45	29	35	10	0
114	24 SOUTHDOWN PL THORNLIE	Residential	118	102	106	12	0	45	29	35	10	0
115	24 SOUTHDOWN PL THORNLIE	Residential	126	103	106	20	0	55	32	35	20	0
118	24 SOUTHDOWN PL THORNLIE	Residential	126	103	106	20	0	55	32	35	20	0
119	24 SOUTHDOWN PL THORNLIE	Residential	114	101	106	8	0	40	27	35	5	0
130	24 SOUTHDOWN PL THORNLIE	Residential	114	101	106	8	0	40	27	35	5	0
131	24 SOUTHDOWN PL THORNLIE	Residential	114	101	106	8	0	39	27	35	4	0
132	24 SOUTHDOWN PL THORNLIE	Residential	114	101	106	8	0	39	27	35	4	0
133	24 SOUTHDOWN PL THORNLIE	Residential	112	100	106	6	0	38	26	35	3	0
137	24 SOUTHDOWN PL THORNLIE	Residential	112	100	106	6	0	38	26	35	3	0
138	24 SOUTHDOWN PL THORNLIE	Residential	125	103	106	19	0	54	32	35	19	0
146	24 SOUTHDOWN PL THORNLIE	Residential	125	103	106	19	0	54	32	35	19	0
147	24 SOUTHDOWN PL THORNLIE	Residential	112	100	106	6	0	38	26	35	3	0
153	24 SOUTHDOWN PL THORNLIE	Residential	112	100	106	6	0	38	26	35	3	0
154	24 SOUTHDOWN PL THORNLIE	Residential	110	100	106	4	0	34	25	35	-1	0
157	24 SOUTHDOWN PL THORNLIE	Residential	110	100	106	4	0	34	25	35	-1	0
158	24 SOUTHDOWN PL THORNLIE	Residential	113	101	106	7	0	39	27	35	4	0
166	24 SOUTHDOWN PL THORNLIE	Residential	113	101	106	7	0	39	27	35	4	0
167	24 SOUTHDOWN PL THORNLIE	Residential	127	104	106	21	0	57	32	35	22	0
186	24 SOUTHDOWN PL THORNLIE	Residential	127	104	106	21	0	57	32	35	22	0
187	67 LESTER DR THORNLIE	Residential	109	103	106	3	0	34	31	35	-1	0
190	67 LESTER DR THORNLIE	Residential	109	103	106	3	0	34	31	35	-1	0
191	24 SOUTHDOWN PL THORNLIE	Residential	114	101	106	8	0	39	27	35	4	0
198	24 SOUTHDOWN PL THORNLIE	Residential	114	101	106	8	0	39	27	35	4	0
199	24 SOUTHDOWN PL THORNLIE	Residential	113	101	106	7	0	39	27	35	4	0
203	24 SOUTHDOWN PL THORNLIE	Residential	113	101	106	7	0	39	27	35	4	0
204	24 SOUTHDOWN PL THORNLIE	Residential	114	101	106	8	0	40	27	35	5	0
207	24 SOUTHDOWN PL THORNLIE	Residential	114	101	106	8	0	40	27	35	5	0
208	24 SOUTHDOWN PL THORNLIE	Residential	127	104	106	21	0	56	32	35	21	0
209	24 SOUTHDOWN PL THORNLIE	Residential	127	104	106	21	0	56	32	35	21	0
210	24 SOUTHDOWN PL THORNLIE	Residential	124	103	106	18	0	53	32	35	18	0
211	24 SOUTHDOWN PL THORNLIE	Residential	124	103	106	18	0	53	32	35	18	0
212	67 LESTER DR THORNLIE	Residential	108	102	106	2	0	32	30	35	-3	0
233	67 LESTER DR THORNLIE	Residential	108	102	106	2	0	32	30	35	-3	0
237	15 ODELL ST THORNLIE	Residential	112	104	106	6	0	37	34	35	2	0
264	15 ODELL ST THORNLIE	Residential	109	103	106	3	0	33	31	35	-2	0
267	17 SOUTHDOWN PL THORNLIE	Commercial	122	103	112	10	0	50	32	55	-5	0

**APPENDIX C – FORECAST GROUND BORNE VIBRATION AND GROUND BORNE NOISE LEVELS**

ID #	Street Address	Usage	GBV, $L_{v,RMS,1s}$ – dB re 1 nm/s					GBN, $L_{ASmax}$ – dB re 20 $\mu$ Pa				
			Existing Freight	Future T line	Limit	Margin	Change	Existing Freight	Future T line	Limit	Margin	Change
268	17 SOUTHDOWN PL THORNLIE	Commercial	122	103	112	10	0	50	32	55	-5	0
277	13 ODELL ST THORNLIE	Residential	110	104	106	4	0	35	32	35	0	0
311	11 ODELL ST THORNLIE	Residential	110	103	106	4	0	34	32	35	-1	0
320	17 SOUTHDOWN PL THORNLIE	Commercial	121	103	112	9	0	49	32	55	-6	0
336	210 SPENCER RD THORNLIE	Residential	121	103	106	15	0	49	32	35	14	0
337	17 SOUTHDOWN PL THORNLIE	Commercial	121	103	112	9	0	49	32	55	-6	0
339	9 ODELL ST THORNLIE	Residential	110	103	106	4	0	34	32	35	-1	0
340	7 ODELL ST THORNLIE	Residential	110	103	106	4	0	35	32	35	0	0
341	5 ODELL ST THORNLIE	Residential	111	104	106	5	0	36	33	35	1	0
342	210 SPENCER RD THORNLIE	Commercial	119	103	112	7	0	46	31	55	-9	0
362	5 ODELL ST THORNLIE	Residential	113	105	106	7	0	38	35	35	3	0
380	3 ODELL ST THORNLIE	Residential	113	105	106	7	0	38	35	35	3	0
392	3 ODELL ST THORNLIE	Residential	113	105	106	7	0	38	35	35	3	0
398	101 SPRING RD THORNLIE	Residential	108	102	106	2	0	31	29	35	-4	0
399	101 SPRING RD THORNLIE	Residential	108	102	106	2	0	31	29	35	-4	0
400	5 ODELL ST THORNLIE	Residential	108	102	106	2	0	31	29	35	-4	0
409	3 ODELL ST THORNLIE	Residential	113	105	106	7	0	38	35	35	3	0
410	3 ODELL ST THORNLIE	Residential	113	105	106	7	0	38	35	35	3	0
411	3 ODELL ST THORNLIE	Residential	109	103	106	3	0	33	31	35	-2	0
422	3 ODELL ST THORNLIE	Residential	109	103	106	3	0	33	31	35	-2	0
423	103 SPRING RD THORNLIE	Residential	108	102	106	2	0	32	30	35	-3	0
424	103 SPRING RD THORNLIE	Residential	108	102	106	2	0	32	30	35	-3	0
425	110 LYREBIRD WAY THORNLIE	Residential	109	100	106	3	0	33	26	35	-2	0
437	123 LYREBIRD WAY THORNLIE	Residential	113	101	106	7	0	39	28	35	4	0
438	121 LYREBIRD WAY THORNLIE	Residential	114	102	106	8	0	40	29	35	5	0
459	106 SPRING RD THORNLIE	Residential	108	102	106	2	0	32	30	35	-3	0
491	104 SPRING RD THORNLIE	Residential	108	102	106	2	0	32	30	35	-3	0
515	119 LYREBIRD WAY THORNLIE	Residential	114	102	106	8	0	40	29	35	5	0
516	119 LYREBIRD WAY THORNLIE	Residential	120	103	106	14	0	48	32	35	13	0
517	117 LYREBIRD WAY THORNLIE	Residential	115	102	106	9	0	41	29	35	6	0
533	115 LYREBIRD WAY THORNLIE	Residential	113	101	106	7	0	38	28	35	3	0
542	117 LYREBIRD WAY THORNLIE	Residential	121	103	106	15	0	49	32	35	14	0
544	113 LYREBIRD WAY THORNLIE	Residential	113	101	106	7	0	38	28	35	3	0
603	113 LYREBIRD WAY THORNLIE	Residential	121	103	106	15	0	48	32	35	13	0
607	111 LYREBIRD WAY THORNLIE	Residential	114	101	106	8	0	39	28	35	4	0
628	109 LYREBIRD WAY THORNLIE	Residential	114	102	106	8	0	40	29	35	5	0
635	111 LYREBIRD WAY THORNLIE	Residential	121	103	106	15	0	49	32	35	14	0
645	107 LYREBIRD WAY THORNLIE	Residential	113	101	106	7	0	38	28	35	3	0
666	105 LYREBIRD WAY THORNLIE	Residential	114	102	106	8	0	40	29	35	5	0
690	103 LYREBIRD WAY THORNLIE	Residential	116	102	106	10	0	42	30	35	7	0
716	101 LYREBIRD WAY THORNLIE	Residential	118	103	106	12	0	44	32	35	9	0
724	103 LYREBIRD WAY THORNLIE	Residential	122	104	106	16	0	50	34	35	15	0
736	99 LYREBIRD WAY THORNLIE	Residential	113	102	106	7	0	39	30	35	4	0
738	101 LYREBIRD WAY THORNLIE	Residential	121	104	106	15	0	49	34	35	14	0
762	97 LYREBIRD WAY THORNLIE	Residential	115	103	106	9	0	42	31	35	7	0
775	95 LYREBIRD WAY THORNLIE	Residential	113	102	106	7	0	39	30	35	4	0
786	97 LYREBIRD WAY THORNLIE	Residential	121	105	106	15	0	49	35	35	14	0
795	93 LYREBIRD WAY THORNLIE	Residential	114	103	106	8	0	39	31	35	4	0
812	95 LYREBIRD WAY THORNLIE	Residential	121	105	106	15	0	49	35	35	14	0
824	91 LYREBIRD WAY THORNLIE	Residential	118	104	106	12	0	45	34	35	10	0
833	89 LYREBIRD WAY THORNLIE	Residential	116	103	106	10	0	42	32	35	7	0
840	26 KIDMAN CT THORNLIE	Residential	121	108	106	15	0	49	41	35	14	0
844	87 LYREBIRD WAY THORNLIE	Residential	114	103	106	8	0	39	30	35	4	0
852	28 KIDMAN CT THORNLIE	Residential	111	103	106	5	0	36	31	35	1	0
861	87 LYREBIRD WAY THORNLIE	Residential	121	105	106	15	0	49	36	35	14	0
870	85 LYREBIRD WAY THORNLIE	Residential	114	103	106	8	0	40	31	35	5	0
871	24 KIDMAN CT THORNLIE	Residential	117	105	106	11	0	44	36	35	9	0
876	22 KIDMAN CT THORNLIE	Residential	123	108	106	17	0	51	41	35	16	0
890	83 LYREBIRD WAY THORNLIE	Residential	114	103	106	8	0	39	31	35	4	0
891	22 KIDMAN CT THORNLIE	Residential	118	106	106	12	0	45	37	35	10	0
909	83 LYREBIRD WAY THORNLIE	Residential	121	105	106	15	0	49	35	35	14	0
914	20 KIDMAN CT THORNLIE	Residential	119	106	106	13	0	46	37	35	11	0

**APPENDIX C – FORECAST GROUND BORNE VIBRATION AND GROUND BORNE NOISE LEVELS**

ID #	Street Address	Usage	GBV, $L_{v,RMS,1s}$ – dB re 1 nm/s					GBN, $L_{ASmax}$ – dB re 20 $\mu$ Pa				
			Existing Freight	Future T line	Limit	Margin	Change	Existing Freight	Future T line	Limit	Margin	Change
915	81 LYREBIRD WAY THORNLIE	Residential	116	103	106	10	0	42	32	35	7	0
927	81 LYREBIRD WAY THORNLIE	Residential	121	105	106	15	0	49	35	35	14	0
934	79 LYREBIRD WAY THORNLIE	Residential	115	103	106	9	0	41	32	35	6	0
945	18 KIDMAN CT THORNLIE	Residential	116	105	106	10	0	43	35	35	8	0
950	77 LYREBIRD WAY THORNLIE	Residential	111	102	106	5	0	36	29	35	1	0
963	77 LYREBIRD WAY THORNLIE	Residential	116	103	106	10	0	42	32	35	7	0
967	16 KIDMAN CT THORNLIE	Residential	118	106	106	12	0	45	37	35	10	0
976	75 LYREBIRD WAY THORNLIE	Residential	118	104	106	12	0	44	33	35	9	0
993	14 KIDMAN CT THORNLIE	Residential	117	105	106	11	0	44	36	35	9	0
1011	73 LYREBIRD WAY THORNLIE	Residential	117	104	106	11	0	44	33	35	9	0
1017	12 KIDMAN CT THORNLIE	Residential	116	105	106	10	0	43	35	35	8	0
1023	10 KIDMAN CT THORNLIE	Residential	120	107	106	14	0	48	38	35	13	0
1030	71 LYREBIRD WAY THORNLIE	Residential	115	103	106	9	0	40	31	35	5	0
1052	10 KIDMAN CT THORNLIE	Residential	116	105	106	10	0	42	35	35	7	0
1055	69 LYREBIRD WAY THORNLIE	Residential	115	103	106	9	0	41	31	35	6	0
1057	71 LYREBIRD WAY THORNLIE	Residential	117	104	106	11	0	44	33	35	9	0
1072	8 KIDMAN CT THORNLIE	Residential	117	105	106	11	0	44	36	35	9	0
1076	67 LYREBIRD WAY THORNLIE	Residential	114	103	106	8	0	40	31	35	5	0
1087	6 KIDMAN CT THORNLIE	Residential	124	109	106	18	0	53	42	35	18	0
1101	6 KIDMAN CT THORNLIE	Residential	115	104	106	9	0	41	34	35	6	0
1110	67 LYREBIRD WAY THORNLIE	Residential	121	105	106	15	0	49	35	35	14	0
1111	63 LYREBIRD WAY THORNLIE	Residential	110	101	106	4	0	35	28	35	0	0
1112	61 LYREBIRD WAY THORNLIE	Residential	110	101	106	4	0	35	28	35	0	0
1123	65 LYREBIRD WAY THORNLIE	Residential	119	104	106	13	0	46	34	35	11	0
1124	65 LYREBIRD WAY THORNLIE	Residential	119	104	106	13	0	46	34	35	11	0
1125	74 PARTRIDGE WAY THORNLIE	Residential	108	100	106	2	0	31	26	35	-4	0
1127	4 KIDMAN CT THORNLIE	Residential	118	106	106	12	0	45	36	35	10	0
1145	74 PARTRIDGE WAY THORNLIE	Residential	111	102	106	5	0	36	29	35	1	0
1147	2 KIDMAN CT THORNLIE	Residential	117	105	106	11	0	43	35	35	8	0
1168	82 GREENWAY AV THORNLIE	Residential	117	105	106	11	0	43	35	35	8	0
1176	76 PARTRIDGE WAY THORNLIE	Residential	117	104	106	11	0	44	33	35	9	0
1177	78 GREENWAY AV THORNLIE	Residential	122	108	106	16	0	50	40	35	15	0
1181	76 PARTRIDGE WAY THORNLIE	Residential	116	103	106	10	0	42	32	35	7	0
1184	80 GREENWAY AV THORNLIE	Residential	114	104	106	8	0	40	33	35	5	0
1194	78 PARTRIDGE WAY THORNLIE	Residential	118	104	106	12	0	45	34	35	10	0
1200	78 GREENWAY AV THORNLIE	Residential	116	105	106	10	0	42	34	35	7	0
1207	80 PARTRIDGE WAY THORNLIE	Residential	116	103	106	10	0	42	32	35	7	0
1209	76 GREENWAY AV THORNLIE	Residential	120	106	106	14	0	47	38	35	12	0
1220	80 PARTRIDGE WAY THORNLIE	Residential	121	105	106	15	0	48	35	35	13	0
1221	82 PARTRIDGE WAY THORNLIE	Residential	114	103	106	8	0	40	31	35	5	0
1230	74 GREENWAY AV THORNLIE	Residential	117	105	106	11	0	44	36	35	9	0
1239	82 PARTRIDGE WAY THORNLIE	Residential	119	105	106	13	0	47	34	35	12	0
1246	84 PARTRIDGE WAY THORNLIE	Residential	114	103	106	8	0	40	31	35	5	0
1255	72 GREENWAY AV THORNLIE	Residential	115	104	106	9	0	41	34	35	6	0
1263	70 GREENWAY AV THORNLIE	Residential	119	106	106	13	0	47	38	35	12	0
1265	86 PARTRIDGE WAY THORNLIE	Residential	114	103	106	8	0	40	31	35	5	0
1283	88 PARTRIDGE WAY THORNLIE	Residential	114	103	106	8	0	40	31	35	5	0
1294	68 GREENWAY AV THORNLIE	Residential	116	105	106	10	0	42	34	35	7	0
1299	90 PARTRIDGE WAY THORNLIE	Residential	113	102	106	7	0	39	30	35	4	0
1305	66 GREENWAY AV THORNLIE	Residential	116	105	106	10	0	42	34	35	7	0
1309	90 PARTRIDGE WAY THORNLIE	Residential	121	105	106	15	0	49	35	35	14	0
1312	92 PARTRIDGE WAY THORNLIE	Residential	113	102	106	7	0	39	30	35	4	0
1319	92 PARTRIDGE WAY THORNLIE	Residential	118	104	106	12	0	45	34	35	10	0
1320	64 GREENWAY AV THORNLIE	Residential	114	104	106	8	0	40	33	35	5	0
1328	94 PARTRIDGE WAY THORNLIE	Residential	114	103	106	8	0	40	31	35	5	0
1334	92 PARTRIDGE WAY THORNLIE	Residential	119	105	106	13	0	47	34	35	12	0
1339	94 PARTRIDGE WAY THORNLIE	Residential	119	104	106	13	0	46	34	35	11	0
1341	62 GREENWAY AV THORNLIE	Residential	119	106	106	13	0	46	37	35	11	0
1350	60 GREENWAY AV THORNLIE	Residential	121	107	106	15	0	49	40	35	14	0
1352	96 PARTRIDGE WAY THORNLIE	Residential	116	103	106	10	0	42	32	35	7	0
1356	98 PARTRIDGE WAY THORNLIE	Residential	111	101	106	5	0	35	28	35	0	0
1360	60 GREENWAY AV THORNLIE	Residential	115	104	106	9	0	41	34	35	6	0

**APPENDIX C – FORECAST GROUND BORNE VIBRATION AND GROUND BORNE NOISE LEVELS**

ID #	Street Address	Usage	GBV, $L_{v,RMS,1s}$ – dB re 1 nm/s					GBN, $L_{ASmax}$ – dB re 20 $\mu$ Pa				
			Existing Freight	Future T line	Limit	Margin	Change	Existing Freight	Future T line	Limit	Margin	Change
1362	58 GREENWAY AV THORNLIE	Residential	125	109	106	19	0	54	43	35	19	0
1374	98 PARTRIDGE WAY THORNLIE	Residential	114	103	106	8	0	40	31	35	5	0
1380	58 GREENWAY AV THORNLIE	Residential	117	105	106	11	0	43	35	35	8	0
1386	56 GREENWAY AV THORNLIE	Residential	124	109	106	18	0	52	42	35	17	0
1389	100 PARTRIDGE WAY THORNLIE	Residential	114	103	106	8	0	40	31	35	5	0
1403	56 GREENWAY AV THORNLIE	Residential	116	105	106	10	0	42	35	35	7	0
1406	54 GREENWAY AV THORNLIE	Residential	124	109	106	18	0	52	42	35	17	0
1412	102 PARTRIDGE WAY THORNLIE	Residential	115	103	106	9	0	41	31	35	6	0
1413	52 GREENWAY AV THORNLIE	Residential	124	109	106	18	0	53	42	35	18	0
1417	54 GREENWAY AV THORNLIE	Residential	117	105	106	11	0	44	36	35	9	0
1429	104 PARTRIDGE WAY THORNLIE	Residential	114	103	106	8	0	40	31	35	5	0
1435	102 PARTRIDGE WAY THORNLIE	Residential	121	105	106	15	0	48	35	35	13	0
1441	52 GREENWAY AV THORNLIE	Residential	114	104	106	8	0	40	33	35	5	0
1452	106 PARTRIDGE WAY THORNLIE	Residential	120	105	106	14	0	47	35	35	12	0
1461	50 GREENWAY AV THORNLIE	Residential	117	105	106	11	0	44	36	35	9	0
1469	108 PARTRIDGE WAY THORNLIE	Residential	116	104	106	10	0	43	32	35	8	0
1476	48 GREENWAY AV THORNLIE	Residential	118	106	106	12	0	45	36	35	10	0
1482	110 PARTRIDGE WAY THORNLIE	Residential	115	103	106	9	0	40	31	35	5	0
1487	108 PARTRIDGE WAY THORNLIE	Residential	121	105	106	15	0	48	35	35	13	0
1492	46 GREENWAY AV THORNLIE	Residential	115	104	106	9	0	41	34	35	6	0
1501	112 PARTRIDGE WAY THORNLIE	Residential	119	104	106	13	0	46	34	35	11	0
1506	44 GREENWAY AV THORNLIE	Residential	115	104	106	9	0	41	34	35	6	0
1508	42 GREENWAY AV THORNLIE	Residential	123	108	106	17	0	52	41	35	17	0
1519	114 PARTRIDGE WAY THORNLIE	Residential	117	104	106	11	0	44	33	35	9	0
1520	42 GREENWAY AV THORNLIE	Residential	116	105	106	10	0	42	34	35	7	0
1523	114 PARTRIDGE WAY THORNLIE	Residential	118	104	106	12	0	46	34	35	11	0
1533	116 PARTRIDGE WAY THORNLIE	Residential	115	103	106	9	0	42	32	35	7	0
1535	40 GREENWAY AV THORNLIE	Residential	117	105	106	11	0	43	35	35	8	0
1545	38 GREENWAY AV THORNLIE	Residential	116	105	106	10	0	43	35	35	8	0
1546	116 PARTRIDGE WAY THORNLIE	Residential	120	105	106	14	0	48	35	35	13	0
1547	118 PARTRIDGE WAY THORNLIE	Residential	116	103	106	10	0	42	32	35	7	0
1548	36 GREENWAY AV THORNLIE	Residential	124	109	106	18	0	53	42	35	18	0
1553	118 PARTRIDGE WAY THORNLIE	Residential	121	105	106	15	0	48	35	35	13	0
1554	34 GREENWAY AV THORNLIE	Residential	124	109	106	18	0	53	42	35	18	0
1558	120 PARTRIDGE WAY THORNLIE	Residential	116	103	106	10	0	42	32	35	7	0
1560	36 GREENWAY AV THORNLIE	Residential	116	104	106	10	0	42	34	35	7	0
1568	120 PARTRIDGE WAY THORNLIE	Residential	119	105	106	13	0	47	34	35	12	0
1569	34 GREENWAY AV THORNLIE	Residential	117	105	106	11	0	44	36	35	9	0
1572	32 GREENWAY AV THORNLIE	Residential	124	109	106	18	0	53	42	35	18	0
1574	122 PARTRIDGE WAY THORNLIE	Residential	120	105	106	14	0	48	35	35	13	0
1584	32 GREENWAY AV THORNLIE	Residential	117	105	106	11	0	43	35	35	8	0
1587	124 PARTRIDGE WAY THORNLIE	Residential	117	104	106	11	0	43	33	35	8	0
1603	30 GREENWAY AV THORNLIE	Residential	116	105	106	10	0	43	35	35	8	0
1613	126 PARTRIDGE WAY THORNLIE	Residential	119	105	106	13	0	46	34	35	11	0
1615	126 PARTRIDGE WAY THORNLIE	Residential	121	105	106	15	0	48	35	35	13	0
1619	28 GREENWAY AV THORNLIE	Residential	117	105	106	11	0	44	36	35	9	0
1622	130 PARTRIDGE WAY THORNLIE	Residential	111	101	106	5	0	36	28	35	1	0
1626	24 GREENWAY AV THORNLIE	Residential	124	109	106	18	0	52	42	35	17	0
1630	26 GREENWAY AV THORNLIE	Residential	116	105	106	10	0	43	35	35	8	0
1632	130 PARTRIDGE WAY THORNLIE	Residential	118	104	106	12	0	46	34	35	11	0
1633	128 PARTRIDGE WAY THORNLIE	Residential	118	104	106	12	0	46	34	35	11	0
1636	116 CAMERON ST THORNLIE	Residential	111	102	106	5	0	36	29	35	1	0
1643	22 GREENWAY AV THORNLIE	Residential	124	109	106	18	0	53	42	35	18	0
1644	24 GREENWAY AV THORNLIE	Residential	115	104	106	9	0	41	34	35	6	0
1649	118 CAMERON ST THORNLIE	Residential	119	104	106	13	0	46	34	35	11	0
1651	22 GREENWAY AV THORNLIE	Residential	117	105	106	11	0	43	35	35	8	0
1656	20 GREENWAY AV THORNLIE	Residential	122	107	106	16	0	50	40	35	15	0
1661	20 GREENWAY AV THORNLIE	Residential	123	108	106	17	0	52	41	35	17	0
1670	23 ELLIOT PL THORNLIE	Residential	124	109	106	18	0	53	42	35	18	0
1671	18 GREENWAY AV THORNLIE	Residential	115	104	106	9	0	40	33	35	5	0
1687	23 ELLIOT PL THORNLIE	Residential	122	108	106	16	0	50	40	35	15	0
1689	16 GREENWAY AV THORNLIE	Residential	109	101	106	3	0	33	28	35	-2	0

**APPENDIX C – FORECAST GROUND BORNE VIBRATION AND GROUND BORNE NOISE LEVELS**

ID #	Street Address	Usage	GBV, L <sub>v,RMS,1s</sub> – dB re 1 nm/s					GBN, L <sub>ASmax</sub> – dB re 20 µPa				
			Existing Freight	Future T line	Limit	Margin	Change	Existing Freight	Future T line	Limit	Margin	Change
1696	21 ELLIOT PL THORNLIE	Residential	113	103	106	7	0	38	32	35	3	0
1705	19 ELLIOT PL THORNLIE	Residential	108	101	106	2	0	32	28	35	-3	0
1717	32 ELLIOT PL THORNLIE	Residential	118	106	106	12	0	45	36	35	10	0
1718	30 ELLIOT PL THORNLIE	Residential	118	106	106	12	0	45	36	35	10	0
1728	30 ELLIOT PL THORNLIE	Residential	116	105	106	10	0	43	35	35	8	0
1739	48 TARRADEE CCT THORNLIE	Residential	116	105	106	10	0	42	34	35	7	0
1749	46 TARRADEE CCT THORNLIE	Residential	116	105	106	10	0	43	35	35	8	0
1760	44 TARRADEE CCT THORNLIE	Residential	117	105	106	11	0	44	35	35	9	0
1769	42 TARRADEE CCT THORNLIE	Residential	119	106	106	13	0	46	37	35	11	0
1779	38 TARRADEE CCT THORNLIE	Residential	119	106	106	13	0	47	38	35	12	0
1780	40 TARRADEE CCT THORNLIE	Residential	119	106	106	13	0	47	38	35	12	0
1786	38 TARRADEE CCT THORNLIE	Residential	117	105	106	11	0	44	35	35	9	0
1787	36 TARRADEE CCT THORNLIE	Residential	117	105	106	11	0	44	35	35	9	0
1792	36 TARRADEE CCT THORNLIE	Residential	118	106	106	12	0	45	37	35	10	0
1805	34 TARRADEE CCT THORNLIE	Residential	114	104	106	8	0	40	33	35	5	0
1810	32 TARRADEE CCT THORNLIE	Residential	116	105	106	10	0	42	34	35	7	0
1817	30 TARRADEE CCT THORNLIE	Residential	116	105	106	10	0	42	35	35	7	0
1827	18 CARAKINE GR THORNLIE	Residential	116	105	106	10	0	43	35	35	8	0
1835	16 CARAKINE GR THORNLIE	Residential	115	104	106	9	0	41	34	35	6	0
1841	12 CARAKINE GR THORNLIE	Residential	120	107	106	14	0	48	39	35	13	0
1843	14 CARAKINE GR THORNLIE	Residential	116	105	106	10	0	42	35	35	7	0
1849	10 CARAKINE GR THORNLIE	Residential	121	107	106	15	0	49	39	35	14	0
1852	12 CARAKINE GR THORNLIE	Residential	114	104	106	8	0	40	33	35	5	0
1862	10 CARAKINE GR THORNLIE	Residential	114	104	106	8	0	40	33	35	5	0
1868	8 CARAKINE GR THORNLIE	Residential	115	104	106	9	0	41	34	35	6	0
1878	6 CARAKINE GR THORNLIE	Residential	115	104	106	9	0	41	34	35	6	0
1884	4 CARAKINE GR THORNLIE	Residential	115	104	106	9	0	41	34	35	6	0
1895	2 CARAKINE GR THORNLIE	Residential	114	104	106	8	0	40	33	35	5	0
1901	1 NYANDI CT THORNLIE	Residential	119	106	106	13	0	47	38	35	12	0
1919	1 NYANDI CT THORNLIE	Residential	115	104	106	9	0	41	34	35	6	0
1930	5 NYANDI CT THORNLIE	Residential	120	107	106	14	0	48	39	35	13	0
1931	3 NYANDI CT THORNLIE	Residential	114	104	106	8	0	40	33	35	5	0
1950	5 NYANDI CT THORNLIE	Residential	115	104	106	9	0	41	33	35	6	0
1951	9 NYANDI CT THORNLIE	Residential	121	107	106	15	0	49	39	35	14	0
1952	7 NYANDI CT THORNLIE	Residential	121	107	106	15	0	49	39	35	14	0
1959	7 NYANDI CT THORNLIE	Residential	116	105	106	10	0	43	35	35	8	0
1974	9 NYANDI CT THORNLIE	Residential	115	104	106	9	0	41	34	35	6	0
1986	11 NYANDI CT THORNLIE	Residential	115	104	106	9	0	41	33	35	6	0
2001	13 NYANDI CT THORNLIE	Residential	113	103	106	7	0	38	32	35	3	0
2012	15 NYANDI CT THORNLIE	Residential	114	104	106	8	0	40	33	35	5	0
2027	17 NYANDI CT THORNLIE	Residential	114	104	106	8	0	40	33	35	5	0
2044	19 NYANDI CT THORNLIE	Residential	115	104	106	9	0	41	34	35	6	0
2051	21 NYANDI CT THORNLIE	Residential	116	105	106	10	0	43	35	35	8	0
2057	23 NYANDI CT THORNLIE	Residential	119	106	106	13	0	46	37	35	11	0
2064	23 NYANDI CT THORNLIE	Residential	115	104	106	9	0	41	33	35	6	0
2073	25 NYANDI CT THORNLIE	Residential	116	105	106	10	0	42	34	35	7	0
2081	27 NYANDI CT THORNLIE	Residential	117	105	106	11	0	43	35	35	8	0
2083	29 NYANDI CT THORNLIE	Residential	119	106	106	13	0	47	38	35	12	0
2090	31 NYANDI CT THORNLIE	Residential	118	105	106	12	0	44	36	35	9	0
2101	33 NYANDI CT THORNLIE	Residential	121	107	106	15	0	48	39	35	13	0
2110	35 NYANDI CT THORNLIE	Residential	120	107	106	14	0	48	39	35	13	0
2115	37 NYANDI CT THORNLIE	Residential	125	109	106	19	0	53	43	35	18	0
2125	37 NYANDI CT THORNLIE	Residential	124	109	106	18	0	53	42	35	18	0
2141	39 NYANDI CT THORNLIE	Residential	120	107	106	14	0	48	38	35	13	0
2150	41 NYANDI CT THORNLIE	Residential	124	109	106	18	0	53	43	35	18	0
2159	43 NYANDI CT THORNLIE	Residential	120	107	106	14	0	48	39	35	13	0
2162	38 NYANDI CT THORNLIE	Residential	108	101	106	2	0	31	27	35	-4	0
2168	45 NYANDI CT THORNLIE	Residential	121	108	106	15	0	49	41	35	14	0
2177	47 NYANDI CT THORNLIE	Residential	124	110	106	18	0	53	45	35	18	0
2189	47 NYANDI CT THORNLIE	Residential	122	109	106	16	0	50	43	35	15	0
2195	44 NYANDI CT THORNLIE	Residential	108	101	106	2	0	31	28	35	-4	0
2210	51 NYANDI CT THORNLIE	Residential	110	102	106	4	0	34	30	35	-1	0

**APPENDIX C – FORECAST GROUND BORNE VIBRATION AND GROUND BORNE NOISE LEVELS**

ID #	Street Address	Usage	GBV, $L_{v,RMS,1s}$ – dB re 1 nm/s					GBN, $L_{ASmax}$ – dB re 20 $\mu$ Pa				
			Existing Freight	Future T line	Limit	Margin	Change	Existing Freight	Future T line	Limit	Margin	Change
2214	51 NYANDI CT THORNLIE	Residential	108	102	106	2	0	32	29	35	-3	0
2347	58 TULLOCH WAY CANNING VALE	Industrial	125	111	118	7	0	54	46	55	-1	0
2348	60 TULLOCH WAY CANNING VALE	Industrial	125	111	118	7	0	54	46	55	-1	0
2359	58 TULLOCH WAY CANNING VALE	Industrial	125	110	118	7	0	54	44	55	-1	0
2360	56 TULLOCH WAY CANNING VALE	Industrial	125	110	118	7	0	54	44	55	-1	0
2372	56 TULLOCH WAY CANNING VALE	Industrial	125	109	118	7	0	54	43	55	-1	0
2374	54 TULLOCH WAY CANNING VALE	Industrial	125	109	118	7	0	54	43	55	-1	0
2375	54 TULLOCH WAY CANNING VALE	Industrial	125	109	118	7	0	54	43	55	-1	0
2376	54 TULLOCH WAY CANNING VALE	Industrial	125	109	118	7	0	54	43	55	-1	0
2394	50 TULLOCH WAY CANNING VALE	Industrial	125	109	118	7	0	54	43	55	-1	0
2395	54 TULLOCH WAY CANNING VALE	Industrial	125	109	118	7	0	54	43	55	-1	0
2396	54 TULLOCH WAY CANNING VALE	Industrial	125	109	118	7	0	54	43	55	-1	0
2398	54 TULLOCH WAY CANNING VALE	Industrial	125	109	118	7	0	54	43	55	-1	0
2399	46 TULLOCH WAY CANNING VALE	Industrial	125	109	118	7	0	54	43	55	-1	0
2487	34 TULLOCH WAY CANNING VALE	Industrial	125	109	118	7	0	54	43	55	-1	0
2488	30 TULLOCH WAY CANNING VALE	Industrial	125	109	118	7	0	54	43	55	-1	0
2517	38 SORBONNE CR CANNING VALE	Industrial	119	105	118	1	0	46	34	55	-9	0
2536	42 SORBONNE CR CANNING VALE	Industrial	121	105	118	3	0	49	36	55	-6	0
2537	42 SORBONNE CR CANNING VALE	Industrial	121	105	118	3	0	49	36	55	-6	0
2548	26 TULLOCH WAY CANNING VALE	Industrial	125	109	118	7	0	54	43	55	-1	0
2550	16 TULLOCH WAY CANNING VALE	Industrial	125	109	118	7	0	54	43	55	-1	0
2556	46 SORBONNE CR CANNING VALE	Industrial	119	105	118	1	0	46	34	55	-9	0
2557	42 SORBONNE CR CANNING VALE	Industrial	119	105	118	1	0	46	34	55	-9	0
2558	42 SORBONNE CR CANNING VALE	Industrial	119	105	118	1	0	46	34	55	-9	0
2598	46 SORBONNE CR CANNING VALE	Industrial	120	105	118	2	0	47	35	55	-8	0
2662	26 HUGHES ST CANNING VALE	Residential	114	104	106	8	0	40	33	35	5	0
2670	26 HUGHES ST CANNING VALE	Residential	111	102	106	5	0	35	30	35	0	0
2672	24 HUGHES ST CANNING VALE	Residential	109	101	106	3	0	33	28	35	-2	0
2677	54 SORBONNE CR CANNING VALE	Industrial	119	105	118	1	0	46	34	55	-9	0
2680	4 MCLEAN RD CANNING VALE	Residential	113	103	106	7	0	38	32	35	3	0
2686	58 SORBONNE CR CANNING VALE	Industrial	120	105	118	2	0	47	35	55	-8	0
2688	6 MCLEAN RD CANNING VALE	Residential	113	103	106	7	0	39	32	35	4	0
2696	8 MCLEAN RD CANNING VALE	Residential	114	104	106	8	0	39	32	35	4	0
2703	10 MCLEAN RD CANNING VALE	Residential	113	103	106	7	0	38	32	35	3	0
2718	12 MCLEAN RD CANNING VALE	Residential	113	103	106	7	0	38	32	35	3	0
2726	14 MCLEAN RD CANNING VALE	Residential	113	103	106	7	0	38	32	35	3	0
2731	22 to 24 WITTENBERG DR CANNING VALE	Industrial	120	105	118	2	0	47	35	55	-8	0
2748	16 MCLEAN RD CANNING VALE	Residential	113	103	106	7	0	38	32	35	3	0
2765	18 MCLEAN RD CANNING VALE	Residential	113	103	106	7	0	38	32	35	3	0
2766	18 MCLEAN RD CANNING VALE	Residential	113	103	106	7	0	38	32	35	3	0
2775	18 MCLEAN RD CANNING VALE	Residential	113	103	106	7	0	38	32	35	3	0
2776	18 MCLEAN RD CANNING VALE	Residential	113	103	106	7	0	38	32	35	3	0
2866	24 MCLEAN RD CANNING VALE	Residential	113	103	106	7	0	38	32	35	3	0
2890	26 MCLEAN RD CANNING VALE	Residential	113	103	106	7	0	39	32	35	4	0
2924	28 MCLEAN RD CANNING VALE	Residential	113	103	106	7	0	38	32	35	3	0
2943	30 MCLEAN RD CANNING VALE	Residential	113	103	106	7	0	38	32	35	3	0
2970	32 MCLEAN RD CANNING VALE	Residential	113	103	106	7	0	38	32	35	3	0
2976	32 MCLEAN RD CANNING VALE	Residential	108	101	106	2	0	32	28	35	-3	0
2987	34 MCLEAN RD CANNING VALE	Residential	113	103	106	7	0	38	32	35	3	0
3003	36 MCLEAN RD CANNING VALE	Residential	113	103	106	7	0	38	32	35	3	0
3017	38 MCLEAN RD CANNING VALE	Residential	112	103	106	6	0	37	31	35	2	0
3025	42 WITTENBERG DR CANNING VALE	Industrial	120	105	118	2	0	48	35	55	-7	0
3035	40 MCLEAN RD CANNING VALE	Residential	110	102	106	4	0	34	29	35	-1	0
3049	42 MCLEAN RD CANNING VALE	Residential	108	101	106	2	0	32	28	35	-3	0
3053	39 MCLEAN RD CANNING VALE	Residential	116	105	106	10	0	42	34	35	7	0
3061	50 to 52 WITTENBERG DR CANNING VALE	Industrial	120	105	118	2	0	47	35	55	-8	0
3068	41 MCLEAN RD CANNING VALE	Residential	114	104	106	8	0	40	33	35	5	0
3083	43 MCLEAN RD CANNING VALE	Residential	112	103	106	6	0	37	31	35	2	0
3084	12 DOWARN GRN CANNING VALE	Residential	116	105	106	10	0	43	35	35	8	0
3101	45 MCLEAN RD CANNING VALE	Residential	109	102	106	3	0	33	29	35	-2	0
3105	11 DOWARN GRN CANNING VALE	Residential	112	103	106	6	0	38	31	35	3	0
3112	47 MCLEAN RD CANNING VALE	Residential	108	101	106	2	0	32	28	35	-3	0

APPENDIX C – FORECAST GROUND BORNE VIBRATION AND GROUND BORNE NOISE LEVELS

ID #	Street Address	Usage	GBV, $L_{v,RMS,1s}$ – dB re 1 nm/s					GBN, $L_{ASmax}$ – dB re 20 $\mu$ Pa				
			Existing Freight	Future T line	Limit	Margin	Change	Existing Freight	Future T line	Limit	Margin	Change
3113	9 DOWARN GRN CANNING VALE	Residential	112	103	106	6	0	37	31	35	2	0
3121	6 DOWARN GRN CANNING VALE	Residential	116	105	106	10	0	42	35	35	7	0
3129	7 DOWARN GRN CANNING VALE	Residential	110	102	106	4	0	34	29	35	-1	0
3131	6 DOWARN GRN CANNING VALE	Residential	116	105	106	10	0	43	35	35	8	0
3141	4 DOWARN GRN CANNING VALE	Residential	114	104	106	8	0	40	33	35	5	0
3145	5 BARRABERRY RTT CANNING VALE	Residential	116	105	106	10	0	42	35	35	7	0
3160	5 BARRABERRY RTT CANNING VALE	Residential	111	102	106	5	0	36	30	35	1	0
3168	7 BARRABERRY RTT CANNING VALE	Residential	110	102	106	4	0	34	29	35	-1	0
3174	9 BARRABERRY RTT CANNING VALE	Residential	110	102	106	4	0	34	29	35	-1	0
3179	11 BARRABERRY RTT CANNING VALE	Residential	110	102	106	4	0	35	30	35	0	0
3182	13 BARRABERRY RTT CANNING VALE	Residential	110	102	106	4	0	35	29	35	0	0
3189	15 BARRABERRY RTT CANNING VALE	Residential	111	103	106	5	0	36	30	35	1	0
3190	17 BARRABERRY RTT CANNING VALE	Residential	111	103	106	5	0	36	30	35	1	0
3196	17 BARRABERRY RTT CANNING VALE	Residential	110	102	106	4	0	35	30	35	0	0
3207	2 NICHOLSON CT CANNING VALE	Residential	111	102	106	5	0	36	30	35	1	0
3220	4 NICHOLSON CT CANNING VALE	Residential	109	101	106	3	0	33	28	35	-2	0
3272	27 LANSDOWNE ENT CANNING VALE	Residential	110	102	106	4	0	34	29	35	-1	0
3281	29 LANSDOWNE ENT CANNING VALE	Residential	109	102	106	3	0	33	29	35	-2	0
3286	31 LANSDOWNE ENT CANNING VALE	Residential	110	102	106	4	0	34	29	35	-1	0
3289	33 LANSDOWNE ENT CANNING VALE	Residential	110	102	106	4	0	35	30	35	0	0
3297	35 LANSDOWNE ENT CANNING VALE	Residential	110	102	106	4	0	35	30	35	0	0
3305	37 LANSDOWNE ENT CANNING VALE	Residential	111	102	106	5	0	35	30	35	0	0
3309	39 LANSDOWNE ENT CANNING VALE	Residential	109	102	106	3	0	34	29	35	-1	0
3320	41 LANSDOWNE ENT CANNING VALE	Residential	109	102	106	3	0	34	29	35	-1	0
3330	43 LANSDOWNE ENT CANNING VALE	Residential	109	101	106	3	0	33	28	35	-2	0
3336	45 LANSDOWNE ENT CANNING VALE	Residential	109	102	106	3	0	34	29	35	-1	0
3344	53 LANSDOWNE ENT CANNING VALE	Residential	111	103	106	5	0	36	31	35	1	0
3345	55 LANSDOWNE ENT CANNING VALE	Residential	111	103	106	5	0	36	31	35	1	0
3348	47 LANSDOWNE ENT CANNING VALE	Residential	109	101	106	3	0	33	28	35	-2	0
3363	51 LANSDOWNE ENT CANNING VALE	Residential	109	101	106	3	0	33	28	35	-2	0
3364	49 LANSDOWNE ENT CANNING VALE	Residential	109	101	106	3	0	33	28	35	-2	0
3369	51 LANSDOWNE ENT CANNING VALE	Residential	109	102	106	3	0	33	29	35	-2	0
3372	55 LANSDOWNE ENT CANNING VALE	Residential	111	102	106	5	0	36	30	35	1	0
3375	53 LANSDOWNE ENT CANNING VALE	Residential	110	102	106	4	0	34	29	35	-1	0
3389	57 LANSDOWNE ENT CANNING VALE	Residential	112	103	106	6	0	36	31	35	1	0
3403	18 BROWALLIA CL CANNING VALE	Residential	111	102	106	5	0	36	30	35	1	0
3406	59 LANSDOWNE ENT CANNING VALE	Residential	109	101	106	3	0	33	28	35	-2	0
3407	57 LANSDOWNE ENT CANNING VALE	Residential	109	101	106	3	0	33	28	35	-2	0
3416	16 BROWALLIA CL CANNING VALE	Residential	111	102	106	5	0	35	30	35	0	0
3421	21 JUBAEA CT CANNING VALE	Residential	111	103	106	5	0	36	30	35	1	0
3422	20 BROWALLIA CL CANNING VALE	Residential	108	101	106	2	0	32	28	35	-3	0
3439	19 JUBAEA CT CANNING VALE	Residential	109	101	106	3	0	33	28	35	-2	0
3445	28 JUBAEA CT CANNING VALE	Residential	111	102	106	5	0	36	30	35	1	0
3455	9 MESA PL CANNING VALE	Residential	111	103	106	5	0	36	30	35	1	0
3457	26 JUBAEA CT CANNING VALE	Residential	110	102	106	4	0	34	29	35	-1	0
3469	7 MESA PL CANNING VALE	Residential	110	102	106	4	0	34	29	35	-1	0
3477	2 MESA PL CANNING VALE	Residential	111	102	106	5	0	36	30	35	1	0
3504	32 WOODHOUSE CCT CANNING VALE	Residential	109	102	106	3	0	34	29	35	-1	0
3506	30 WOODHOUSE CCT CANNING VALE	Residential	111	103	106	5	0	36	30	35	1	0
3513	28 WOODHOUSE CCT CANNING VALE	Residential	110	102	106	4	0	35	30	35	0	0
3524	26 WOODHOUSE CCT CANNING VALE	Residential	109	102	106	3	0	33	29	35	-2	0
3527	24 WOODHOUSE CCT CANNING VALE	Residential	110	102	106	4	0	34	29	35	-1	0
3530	22 WOODHOUSE CCT CANNING VALE	Residential	111	102	106	5	0	36	30	35	1	0
3541	18 WOODHOUSE CCT CANNING VALE	Residential	111	103	106	5	0	36	31	35	1	0
3542	20 WOODHOUSE CCT CANNING VALE	Residential	109	102	106	3	0	34	29	35	-1	0
3557	16 WOODHOUSE CCT CANNING VALE	Residential	110	102	106	4	0	34	29	35	-1	0
3560	14 WOODHOUSE CCT CANNING VALE	Residential	110	102	106	4	0	34	29	35	-1	0
3569	12 WOODHOUSE CCT CANNING VALE	Residential	110	102	106	4	0	34	29	35	-1	0
3571	10 WOODHOUSE CCT CANNING VALE	Residential	111	102	106	5	0	35	30	35	0	0
3577	8 WOODHOUSE CCT CANNING VALE	Residential	110	102	106	4	0	34	29	35	-1	0
3584	6 WOODHOUSE CCT CANNING VALE	Residential	110	102	106	4	0	35	29	35	0	0
3617	10 STEPPE CT CANNING VALE	Residential	110	102	106	4	0	34	29	35	-1	0



**APPENDIX C – FORECAST GROUND BORNE VIBRATION AND GROUND BORNE NOISE LEVELS**

ID #	Street Address	Usage	GBV, $L_{v,RMS,1s}$ – dB re 1 nm/s					GBN, $L_{ASmax}$ – dB re 20 $\mu$ Pa				
			Existing Freight	Future T line	Limit	Margin	Change	Existing Freight	Future T line	Limit	Margin	Change
3624	8 STEPPE CT CANNING VALE	Residential	111	102	106	5	0	36	30	35	1	0
3638	4 STEPPE CT CANNING VALE	Residential	111	102	106	5	0	36	30	35	1	0
3639	6 STEPPE CT CANNING VALE	Residential	109	101	106	3	0	33	28	35	-2	0
3640	4 STEPPE CT CANNING VALE	Residential	109	101	106	3	0	33	28	35	-2	0
3647	5 WOODSPRING TRL CANNING VALE	Residential	110	102	106	4	0	35	30	35	0	0
3656	2 STEPPE CT CANNING VALE	Residential	109	101	106	3	0	33	28	35	-2	0
3657	4 STEPPE CT CANNING VALE	Residential	109	101	106	3	0	33	28	35	-2	0
3675	7 WOODSPRING TRL CANNING VALE	Residential	108	101	106	2	0	32	28	35	-3	0
3677	9 WOODSPRING TRL CANNING VALE	Residential	109	101	106	3	0	33	28	35	-2	0
3690	11 WOODSPRING TRL CANNING VALE	Residential	109	101	106	3	0	33	28	35	-2	0
3694	13 WOODSPRING TRL CANNING VALE	Residential	109	102	106	3	0	34	29	35	-1	0
3708	15 WOODSPRING TRL CANNING VALE	Residential	110	102	106	4	0	35	30	35	0	0
3709	17 WOODSPRING TRL CANNING VALE	Residential	110	102	106	4	0	35	30	35	0	0
3722	19 WOODSPRING TRL CANNING VALE	Residential	110	102	106	4	0	35	29	35	0	0
3741	21 WOODSPRING TRL CANNING VALE	Residential	109	101	106	3	0	33	29	35	-2	0
3754	22 MEADOWVIEW MEWS CANNING VALE	Residential	110	102	106	4	0	35	29	35	0	0
3762	20 MEADOWVIEW MEWS CANNING VALE	Residential	110	102	106	4	0	34	29	35	-1	0
3765	18 MEADOWVIEW MEWS CANNING VALE	Residential	110	102	106	4	0	35	29	35	0	0
3780	16 MEADOWVIEW MEWS CANNING VALE	Residential	109	102	106	3	0	33	29	35	-2	0
3801	14 MEADOWVIEW MEWS CANNING VALE	Residential	109	101	106	3	0	33	28	35	-2	0
3802	12 MEADOWVIEW MEWS CANNING VALE	Residential	110	102	106	4	0	35	30	35	0	0
3820	8 MEADOWVIEW MEWS CANNING VALE	Residential	111	102	106	5	0	36	30	35	1	0
3823	10 MEADOWVIEW MEWS CANNING VALE	Residential	109	101	106	3	0	33	28	35	-2	0
3834	6 MEADOWVIEW MEWS CANNING VALE	Residential	110	102	106	4	0	34	29	35	-1	0
3843	4 MEADOWVIEW MEWS CANNING VALE	Residential	110	102	106	4	0	35	29	35	0	0
3854	7 PINWOOD WALK CANNING VALE	Residential	111	102	106	5	0	36	30	35	1	0
3859	5 PINWOOD WALK CANNING VALE	Residential	109	102	106	3	0	34	29	35	-1	0
3875	9 PINWOOD WALK CANNING VALE	Residential	110	102	106	4	0	34	29	35	-1	0
3880	11 PINWOOD WALK CANNING VALE	Residential	110	102	106	4	0	34	29	35	-1	0
3894	13 PINWOOD WALK CANNING VALE	Residential	109	102	106	3	0	34	29	35	-1	0
3898	15 PINWOOD WALK CANNING VALE	Residential	111	102	106	5	0	35	30	35	0	0
3905	17 PINWOOD WALK CANNING VALE	Residential	111	102	106	5	0	36	30	35	1	0
3966	15 PARK LANE CANNING VALE	Residential	111	102	106	5	0	35	30	35	0	0
3985	17 PARK LANE CANNING VALE	Residential	109	102	106	3	0	34	29	35	-1	0
3988	19 PARK LANE CANNING VALE	Residential	110	102	106	4	0	35	30	35	0	0
4003	21 PARK LANE CANNING VALE	Residential	109	101	106	3	0	33	28	35	-2	0
4013	23 PARK LANE CANNING VALE	Residential	109	102	106	3	0	33	29	35	-2	0
4014	25 PARK LANE CANNING VALE	Residential	110	102	106	4	0	34	29	35	-1	0
4025	27 PARK LANE CANNING VALE	Residential	110	102	106	4	0	35	29	35	0	0
4032	29 PARK LANE CANNING VALE	Residential	110	102	106	4	0	34	29	35	-1	0
4037	31 PARK LANE CANNING VALE	Residential	110	102	106	4	0	35	30	35	0	0
4041	33 PARK LANE CANNING VALE	Residential	111	102	106	5	0	36	30	35	1	0
4046	37 PARK LANE CANNING VALE	Residential	111	102	106	5	0	36	30	35	1	0
4049	35 PARK LANE CANNING VALE	Residential	110	102	106	4	0	35	29	35	0	0
4063	38 PARK LANE CANNING VALE	Residential	111	102	106	5	0	36	30	35	1	0
4083	61 FAIRFIELD GDNS CANNING VALE	Residential	111	102	106	5	0	36	30	35	1	0
4110	59 FAIRFIELD GDNS CANNING VALE	Residential	108	101	106	2	0	31	27	35	-4	0
4795	6 CLEMENTS PL JANDAKOT	Residential	109	102	106	3	0	33	29	35	-2	0
4797	6 CLEMENTS PL JANDAKOT	Residential	108	101	106	2	0	31	27	35	-4	0
4805	4 CLEMENTS PL JANDAKOT	Residential	108	101	106	2	0	32	28	35	-3	0
4932	13 LAKES WAY JANDAKOT	Residential	112	103	106	6	0	37	31	35	2	0
4953	21 TURTLE POINT COVE JANDAKOT	Residential	112	103	106	6	0	37	31	35	2	0
4955	19 TURTLE POINT COVE JANDAKOT	Residential	114	104	106	8	0	40	33	35	5	0
4960	17 TURTLE POINT COVE JANDAKOT	Residential	113	103	106	7	0	38	32	35	3	0
4965	15 TURTLE POINT COVE JANDAKOT	Residential	113	103	106	7	0	38	32	35	3	0
4967	13 TURTLE POINT COVE JANDAKOT	Residential	114	104	106	8	0	39	33	35	4	0
4971	11 TURTLE POINT COVE JANDAKOT	Residential	113	103	106	7	0	38	32	35	3	0
4972	9 TURTLE POINT COVE JANDAKOT	Residential	114	104	106	8	0	40	33	35	5	0
4977	7 TURTLE POINT COVE JANDAKOT	Residential	114	104	106	8	0	39	33	35	4	0
4979	5 TURTLE POINT COVE JANDAKOT	Residential	113	103	106	7	0	38	32	35	3	0
4986	3 TURTLE POINT COVE JANDAKOT	Residential	113	104	106	7	0	39	33	35	4	0
4991	97 GLEN IRIS DR JANDAKOT	Residential	113	104	106	7	0	39	34	35	4	0

APPENDIX C – FORECAST GROUND BORNE VIBRATION AND GROUND BORNE NOISE LEVELS

ID #	Street Address	Usage	GBV, $L_{v,RMS,1s}$ – dB re 1 nm/s					GBN, $L_{ASmax}$ – dB re 20 $\mu$ Pa				
			Existing Freight	Future T line	Limit	Margin	Change	Existing Freight	Future T line	Limit	Margin	Change
4999	99 GLEN IRIS DR JANDAKOT	Residential	113	106	106	7	0	38	36	35	3	0
5008	101 GLEN IRIS DR JANDAKOT	Residential	112	105	106	6	0	36	36	35	1	0
5017	103 GLEN IRIS DR JANDAKOT	Residential	110	105	106	4	0	34	36	35	1	2
5018	105 GLEN IRIS DR JANDAKOT	Residential	110	105	106	4	0	34	36	35	1	2
5046	21 TULIPWOOD PL SOUTH LAKE	Residential	114	98	106	8	0	39	22	35	4	0
5047	19 TULIPWOOD PL SOUTH LAKE	Residential	113	97	106	7	0	39	21	35	4	0
5052	17 TULIPWOOD PL SOUTH LAKE	Residential	113	97	106	7	0	39	20	35	4	0
5057	15 TULIPWOOD PL SOUTH LAKE	Residential	110	96	106	4	0	34	18	35	-1	0
5061	13 TULIPWOOD PL SOUTH LAKE	Residential	108	96	106	2	0	32	17	35	-3	0

## **APPENDIX D – INDICATIVE NOISE AND VIBRATION CONTROLS**



LEGEND	
	DG DN Main
	DG UP Main
	Existing DG DN Main
	Existing DG UP Main
	T DN Main
	T UP Main
	Existing T DN Main
	Existing T UP Main
	Wall Heights
	2.4m
	3m
	4m
	Existing Walls not to be Modified

Note: Heights indicative subject to detailed survey and design, community consultation.



**LEGEND**

DG DN Main	Existing T DN Main	<b>Wall Heights</b>	Existing Walls not to be Modified
DG UP Main	Existing T UP Main	2.4m	
Existing DG DN Main	T DN Main	3m	
Existing DG UP Main	T UP Main	4m	

Note: Heights indicative subject to detailed survey and design, community consultation.

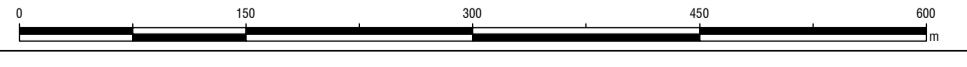
Scale: 1:5,000  
GDA 1994 Perth Coastal Grid 1994  
15-Jan-2016  
675-11409



**LEGEND**

DG DN Main	Existing T DN Main	Wall Heights 2.4m	Existing Walls not to be Modified
DG UP Main	Existing T UP Main	3m	
Existing DG DN Main	T DN Main	4m	
Existing DG UP Main	T UP Main		

Note: Heights indicative subject to detailed survey and design, community consultation.



Scale: 1:5,000  
GDA 1994 Perth Coastal Grid 1994

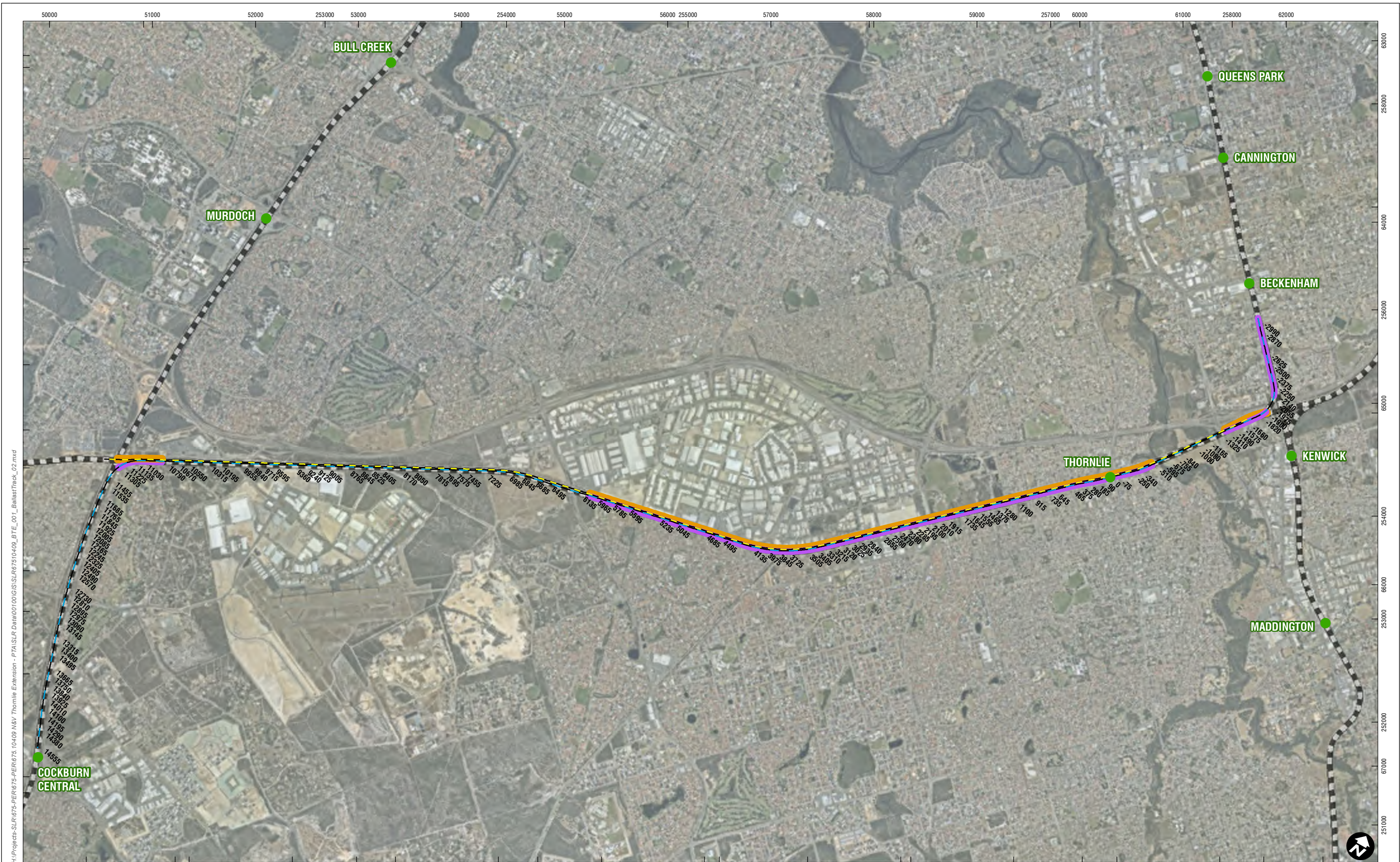
15-Jan-2016  
675-11409



**LEGEND**

DG DN Main	Existing T DN Main	<b>Wall Heights</b>	Existing Walls not to be Modified
DG UP Main	Existing T UP Main	2.4m	
Existing DG DN Main	T DN Main	3m	
Existing DG UP Main	T UP Main	4m	

Note: Heights indicative subject to detailed survey and design, community consultation



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0 400 800 1,200 1,600  
m

Scale: 1:40,000  
GDA 1994 Perth Coastal Grid 1994

19-Jan-2018  
5

**LEGEND**

- Existing Rail Corridors
- Proposed New Alignment
- Ballast Matting Extent - Passenger
- Proposed New Freight Alignment
- Ballast Matting Extent - Freight
- Existing Train Stations



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**Thornlie Rail Extension  
Ballast Track Extent**

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