12 Noise and vibration effects

Tables

Figures

12.1 OVERVIEW

This chapter provides an assessment of noise and vibration impacts associated with the construction and operation of the Mordialloc Bypass (Freeway) (the project). It is based on the impact assessment prepared by WSP and provided in Appendix E: *Noise and vibration impact assessment*.

Noise from project construction and operation could impact residents' amenity and that of nearby land users. Construction noise and vibration impacts would be temporary, however operational noise impacts are long-term.

Identified sensitive receptors were assessed to understand the potential noise and vibration impacts of the project and to develop environmental performance requirements (EPRs).

The noise and vibration assessment accorded with the *VicRoads Traffic Noise Reduction Policy (TNRP)* 2005, and was also informed by the Environment Effects Statement (EES) scoping requirements and other relevant legislation (Table 12.2).

Project Objective Noise Limits (PONLs) for traffic noise established for the assessment are:

- 63dBA $L_{10,18hour}$ for sensitive receivers of noise from the Mordialloc Bypass (Freeway)
- 68dBA $L_{10,18hour}$ for sensitive receivers of noise from the Mordialloc Bypass (Freeway) and the existing Mornington Peninsula Freeway (MPF) (southern study area).

The project shall limit noise levels from the new alignment to 63dBA $L_{10,18hour}$ whilst overall road traffic noise (from the new and existing freeway) will be limited to 68dBA $L_{10,18hour}$ for sensitive receivers adjacent to the Mornington Peninsula Freeway. Therefore, noise mitigation shall be designed by considering two scenarios: only the new alignment; and the combined new and existing freeway, ensuring both criteria are achieved.

The impact assessment found that operational noise levels would exceed the PONLs of the VicRoads *Traffic Noise Reduction Policy 2005* at nearby sensitive receptors without noise control measures, and that noise mitigation would be required. Noise barriers were chosen as the most appropriate noise mitigation measure and a barrier design was developed to meet the target PONLs.

Construction noise and vibration impacts would be managed through measures outlined in a Construction Noise and Vibration Management Plan (CNVMP) which will be developed in accordance with Environment Protection Authority (EPA) Guidelines for construction noise.

NOISE ASSESSMENT TERMINOLOGY

Noise measurements (dB): Noise is usually measured in decibels (dB), a logarithmic measure of sound pressure. A-weighted decibel (dBA) is a unit used to represent the airborne sound pressure level. A-weighting applies a frequency filter to measured noise to represent how the human ear hears sound. In dBA, decibel values at low frequencies are reduced because the human ear is less sensitive at low frequencies. Noise limits for environmental impacts are typically specified in dBA.

Human response to noise level changes:

- ± less than 3dBA = no perceivable difference
- ± 3dBA = barely perceptible difference
- ± 5dBA = readily perceptible difference
- ± 10dBA = subjective 'doubling' or 'halving' of sound level.

L_{A90}: Total silence does not exist in natural or built environments; there is only varying degrees of noise. The background noise level is the typical minimum noise level measured without consideration of the noise source under investigation, and excluding other short-term noises such as those caused by traffic, industry, lawnmowers, wind in foliage, insects, animals, etc. It is generally quantified by the noise level exceeded 90 per cent of the measurement period 'T' (L_{A90}, T).

L_{A10}: The A-weighted sound pressure level in decibels exceeded for 10 per cent of the measurement period, T.
The $L_{10,18hour}$ noise levels are used to determine operation traffic noise objectives.

L_{Aeq}: The A-weighted sound pressure level in decibels of a continuous steady sound that has, within a specified time interval, T, the same energy as the sound being measured. It can be considered the 'average' noise over time interval, T.

The L_{eq} was calculated for three time periods: 8, 16 and 24 hours. $L_{eq\ 8hour}$ is the logarithmic average for night time taken between 10pm and 6am; $L_{eq\ 16hour}$ for day time taken between 6am and 10pm; and $L_{eq\ 24hour}$ is all day and night.

12.2 EES OBJECTIVES AND REQUIREMENTS

The draft evaluation objective for noise and vibration effects is defined in the *Scoping Requirements for Mordialloc Bypass Environment Effects Statement* (scoping requirements) (DELWP 2018).

Table 12.1 summarises key noise and vibration issues as identified in the scoping requirements.

This chapter only addresses noise and vibration-related requirements. Noise level impacts on sensitive ecological communities are considered in Chapter 10: *Biodiversity*. Air quality aspects are considered in Chapter 13: *Air quality and greenhouse gas*, while lighting impacts are considered in Chapter 11: *Landscape and visual effects* of this EES.

DRAFT EVALUATION OBJECTIVE

To protect the health and wellbeing of residents and local communities, and minimise effects on air quality, noise and the social amenity of the area, having regard to relevant limits, targets or standards.

Table 12.1 EES key issues – noise and vibration effects

Key issues
The potential for increases in noise and vibration levels during the project construction to significantly affect amenity in adjacent residential and parkland areas.
The potential for increases in noise levels from the project's operation to significantly affect amenity in adjacent residential and parkland areas.

12.3 LEGISLATION AND POLICY

Table 12.2 summarises the legislation and policy relevant to the assessment of noise and vibration impacts for the project.

Table 12.2 Legislation and policy – noise and vibration

Legislation/Policy	Description
International:	
British Standard BS 6472-1:2008 - Guide to evaluation of human exposure to vibration in buildings, Part 1: vibration sources other than blasting.	Adopts a detailed 'dose' approach to assessing intermittent vibration. Criteria are expressed as Vibration Dose Values, which consider the level of vibration, frequency of events per day, duration of each event and the time of day. The standard helps to assess the likelihood of receiving adverse responses from affected occupants.
Building damage criteria DIN 4150-3:1999 - Structural Vibration, Part 3: Effect of vibration on structures.	Deals with the effects of vibration on structures. Establishes guideline values for the initiation of potential cosmetic damage to buildings, measured in peak particle velocities (in millimetres per second).
State:	
VicRoads Traffic Noise Reduction Policy 2005 (VicRoads TNRP).	The policy seeks to limit the effect of traffic noise on nearby residents when new or improved roads are opened to traffic, by: • seeking to reduce noise emitted by vehicles and road surfaces • encouraging compatible land uses next to major roads • limiting traffic noise from new arterial roads and roads upgraded to carry significantly more traffic • retrofitting noise barriers on older freeways. The policy applies to: • freeways and arterial roads built on new alignments • existing freeways and arterial roads widened by two or more lanes, AND where buildings or other significant structures, that previously protected sensitive receivers, are removed to upgrade the road.
VicRoads Road Design Note 06-01 – July 2010 – Interpretation and application of VicRoads Traffic Noise Reduction Policy 2005 (VicRoads RDN 06-01).	Provides guidance for acoustic engineers to assess noise impacts, and considers noise mitigation options in accordance with the VicRoads TNRP for new and improved roads. This design note is used as a reference in this document to provide recommendations for establishing PONLs. Further discussion on PONLs can be found in Section 12.8.2.
Traffic Noise Measurement Requirements for Acoustic Consultants September 2011.	Documents instrumentation and certification requirements for equipment, microphone positioning, and reporting requirements.
State Environmental Protection Policy (Control of Noise from Commerce, Industry and Trade) No N-1 (SEPP N-1).	Prescribes procedures for determining statutory environmental noise limits for noise-sensitive locations (such as residential areas) with regard to noise from commercial, industrial and trade operations.

Legislation/Policy	Description
EPA Victoria, Environmental Guidelines for Major Construction Sites (EPA Publication 480).	Provide guidelines to avoid, minimise and manage environmental impacts associated with major construction sites. States that, 'while no specific statutory controls exist for noise from construction sites, all noise nuisance should be reduced wherever possible from vehicles, fixed machinery within the site, blasting, general construction activities, and from movements of vehicles servicing the site'. Provides noise and vibration objectives and recommends measures to limit noise during construction.
EPA Victoria, Noise Control Guidelines (EPA Publication 1254).	Contains information regarding night-time construction noise and the acceptable levels of noise on weekends, evenings and nights.
VicRoads Noise Guidelines – Construction and Maintenance Works 2007 (VicRoads Noise Guidelines).	Provides guidance to those involved in construction projects and maintenance activities in understanding: • the relevant legislation and suggested working hours applicable to these activities • the key steps involved in noise management • approaches to community engagement; and • ways to clearly identify and effectively minimise construction noise impacts related to their work.
Occupational Health and Safety Act 2004.	Key administrative and legislative measure to manage occupational health and safety in Victoria. It sets out principles, duties and rights. The Act also establishes the Occupational Health and Safety Regulations (2007), which specify how duties outlined in the Act are to be performed, including specifying noise limits. In particular, it defines exposure levels to minimise the potential for hearing damage.
Local:	
Section 173 Agreements under the Victorian *Planning and Environment Act 1987* (P&E Act) and in agreement with Kingston City Council.	Properties at Waterways are currently party to an agreement under section 173 of the P&E Act, as shown on Figure 12.1. The relevant clauses with respect to noise attenuation are: • VicRoads' obligations during construction of the Mornington Peninsula Freeway • VicRoads agrees that in the design and construction of the Mornington Peninsula Freeway, it would make sufficient allowance for: – provision by VicRoads of suitable acoustic treatment located within the Mornington Peninsula Freeway Reserve to protect the urban areas from the effects of the Mornington Peninsula Freeway traffic. The project may be considered an extension of the Mornington Peninsula Freeway. Hence, the new road would be subject to the above clauses. The road design would maintain sufficient allowance for acoustic treatment throughout the road corridor. The project PONLs would provide sufficient noise attenuation to these properties.

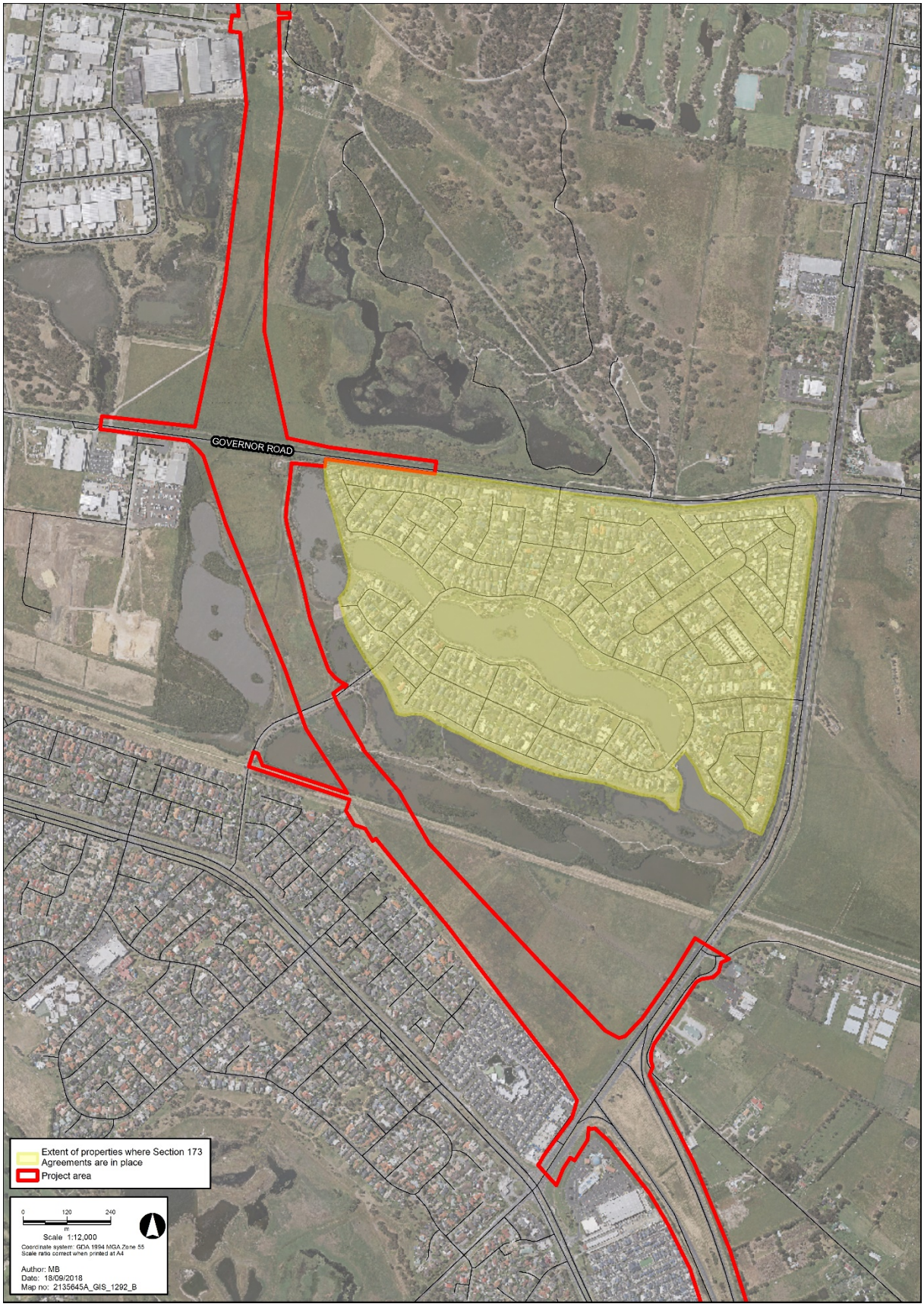

Figure 12.1 Extent of properties where Section 173 Agreements are in place

12.4 METHODOLOGY

The objectives of the assessment were to establish the existing noise conditions in the vicinity of the project site and to determine the potential effects of the project on local amenity relating to noise and vibration. The methodology included:

- noise monitoring at nearby sensitive receptors (in particular residential and commercial properties in use by vulnerable parties such as the elderly (retirement homes) and children) to determine the existing background noise levels and inform PONLs
- identifying noise and vibration risks, including the risk of cumulative effects from the development of the project with other committed developments nearby
- undertaking a risk assessment process as described in Chapter 4: *EES assessment framework and approach*
- noise modelling to predict traffic noise levels from the project and to assess the potential noise impact at the adjacent sensitive receptors
- assessing the potential construction noise and vibration effects
- assessing the potential operational noise and vibration effects against the PONL
- recommend mitigation measures to minimise or avoid noise and vibration impacts, where required.

12.4.1 Noise monitoring

Existing noise levels were characterised through noise monitoring at representative locations. VicRoads and acoustics specialists determined 18 suitable noise monitoring locations, shown in Figure 12.2. Thirteen monitoring locations were in residential areas and five were in parklands (refer to Appendix E: *Noise and vibration impact assessment* for specific details).

Residential noise monitoring locations (0–12) were selected to represent typical conditions at the first-row houses (the dwellings closest to the project). Monitoring involved placing a microphone externally 1m from a habitable room window facing the project alignment.

Parkland locations (locations A–E) were selected in consultation with Parks Victoria. Noise loggers were placed in the open. The primary parameters of interest for these locations were $L_{10,18hour}$, $L_{eq,16hour}$ and $L_{eq,8hour}$, which correspond to the existing ambient noise levels.

Loggers at both residential and parkland locations were left in place for one week.

Noise monitoring was in accordance with the *Traffic Noise Measurement Requirements for Acoustic Consultants* and is presented in Appendix E: *Noise and vibration impact assessment*.

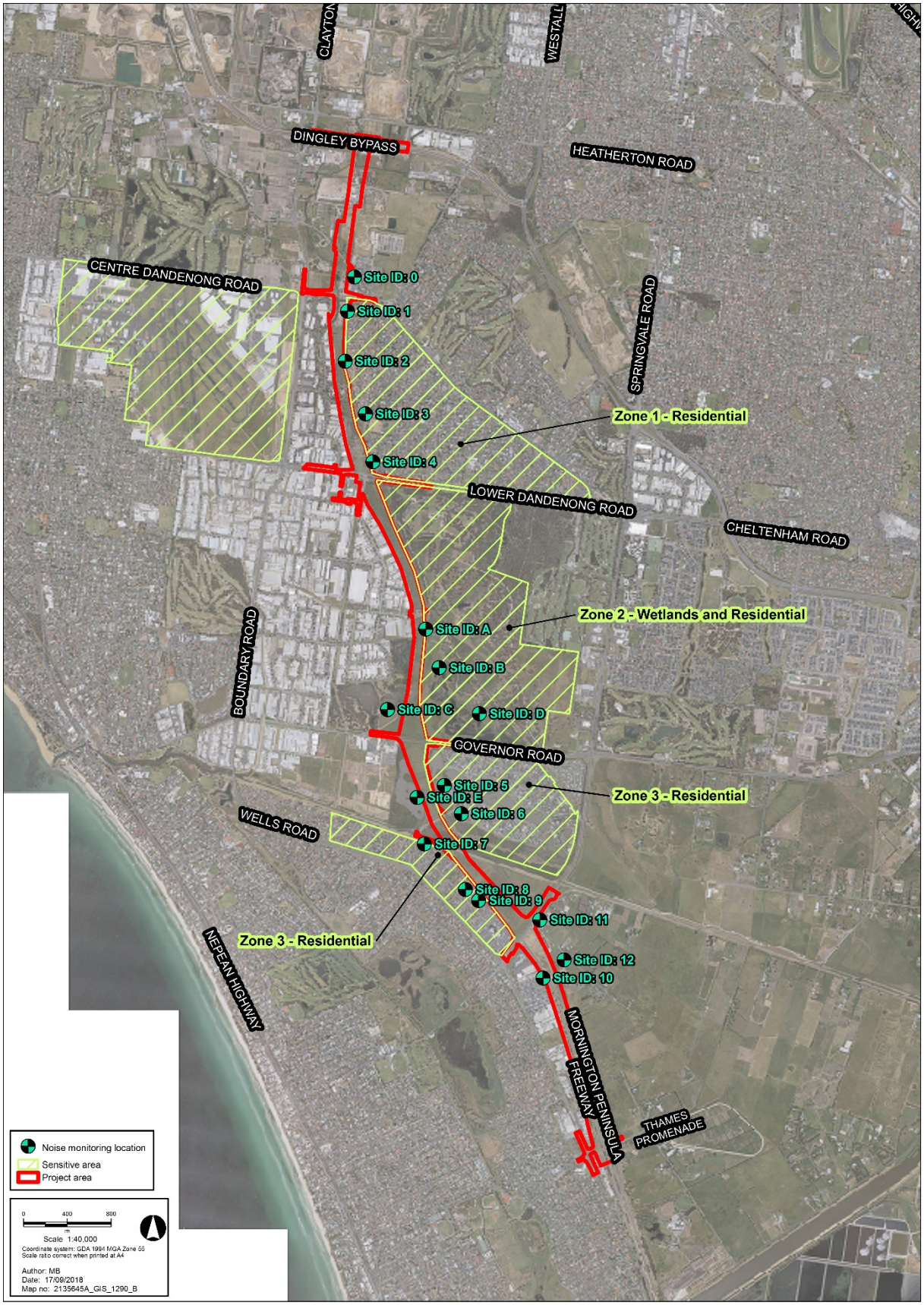

Figure 12.2 Noise monitoring locations

12.4.2 Noise modelling

Noise modelling was undertaken to predict the noise impact of the project on nearby residents and land uses. A noise model was prepared using SoundPLAN 7.4 noise modelling software. The model was based on the United Kingdom's Department of Transport Calculation of Road Traffic Noise (CoRTN) algorithm, which uses the traffic volume, speed, percentage of heavy vehicles, road geometry, and terrain to determine the noise level at locations along a road corridor. The CoRTN algorithm has been widely accepted by VicRoads, and used on numerous road projects in Australia.

Existing arterial roads do not currently have noise barriers, and this project does not propose to upgrade them to qualify for noise attenuation as per the VicRoads TNRP. These roads include:

- Old Dandenong Road
- Centre-Dandenong Road
- Lower-Dandenong Road
- Governor Road
- Springvale Road
- Thames Promenade.

The noise modelling predictions, therefore, do not include the above roads.

Dingley Bypass and Mornington Peninsula Freeway are the only existing roads included in the model because they have 'edge effects' (as per VicRoads RDN 06-01) at the start and finish of the Mordialloc Bypass (Freeway).

Noise levels were predicted for both mitigated (with noise barriers) and unmitigated (without noise barrier) scenarios. Both scenarios were modelled assuming that the road surface was Open Graded Asphalt (OGA). These scenarios were based on traffic predictions for the year 2031, as modelled for the traffic impact assessment provided in Appendix A: *Transport impact assessment*, and included:

- Unmitigated – Mordialloc Bypass (Freeway) (new alignment) and existing Mornington Peninsula Freeway
- Mitigated – Mordialloc Bypass (Freeway) (new alignment) existing Mornington Peninsula Freeway
- Mitigated – Mordialloc Bypass (Freeway) only.

Appendix E: *Noise and vibration impact assessment* sets out the assumptions and modelling inputs used in the assessment.

12.5 STUDY AREA

The study area for the noise and vibration impact assessment includes land adjacent to the project boundary. It focuses on three noise sensitive areas, denoted as Zones 1, 2 and 3 (Figure 12.3). Sensitivity areas and sensitive receivers are areas that are sensitive to a change in noise levels, such as residential receivers and community facilities such as hospitals or schools.

Noise sensitive receivers adjacent to Thames Promenade are also considered as part of the impact assessment. However, they are shielded by the commercial buildings adjacent to Mornington Peninsula Freeway, thereby identified as potentially being relatively less impacted from the project.

The noise and vibration impact assessment included only the area within and directly adjacent to the project boundary, from Thames Promenade to Springvale Road for the assessment of noise impacts as a result of the additional on and off ramps at Thames Promenade. For the most part, no additional works are proposed along this section, however, the noise assessment considered the increase in traffic because of the on and off ramps.

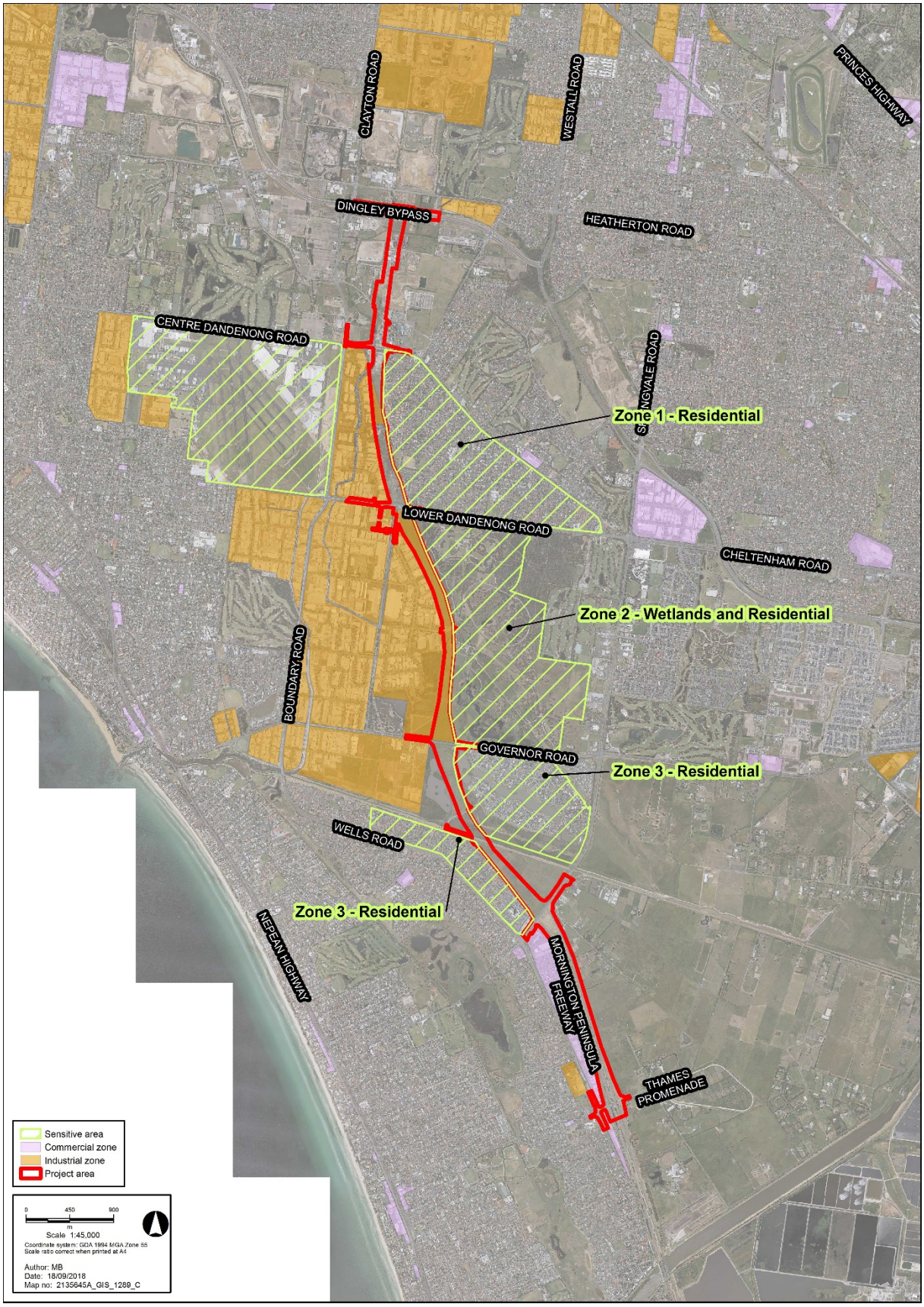

Figure 12.3 Study area with noise and vibration-sensitive areas

12.6 EXISTING CONDITIONS

12.6.1 Existing noise environment

Zone 1 is a mix of residential and industrial uses, and is adjacent to Moorabbin Airport, a general aviation airport for light aircraft. The take-off and landing paths currently expose the surrounding residential areas to aircraft noise. Existing noise sources are mostly traffic on Centre Dandenong Road, Lower Dandenong Road, Boundary Road and Springvale Road; aircraft noise from Moorabbin Airport; and noise emissions from the industrial zone.

The northern part of Zone 2 contains Braeside Park, which is a protected Wetland area managed by Parks Victoria. The southern part of Zone 2 contains the residential suburb of Waterways. Major noise sources in the area include traffic on Springvale Road to the east and Governor Road running east-west immediately north of Waterways.

Zone 3 is mostly residential with some commercial uses south-east of Springvale Road. The dominant noise sources in the area are from traffic on Springvale Road, Boundary Road and the Mornington Peninsula Freeway.

The area west of the project alignment for Zones 1 and 2 is primarily industrial. Noise emissions from these areas must comply with industrial noise limits defined by State Environment Protection Policy No. N-1 (SEPP N-1). Compliance with the environmental noise limits is the responsibility of these industries and has not been assessed as part of this EES.

12.6.2 Existing noise levels

The existing ambient noise levels based on field noise monitoring are shown in Table 12.3. The noise levels are consistent with what is expected for suburban areas, where arterial roads are spread throughout the suburb. With the exception of locations 10, 11 and 12 the existing noise levels are between 48 and 55dBA $L_{10,18hour}$. Locations 10, 11 and 12 are adjacent to the existing Mornington Peninsular Freeway and have the existing noise levels are between 58 and 60dBA $L_{10,18hour}$.

Table 12.3 Existing noise levels

Location index	Location	Zone/usage	Existing noise levels (dBA)			
			$L_{10,18hour}$	$L_{eq,16hour}$	$L_{eq,8hour}$	$L_{eq,24hour}$
Residential dwellings						
0	375 Old Dandenong Road, Dingley Village	1 – Residential	53	52	45	51
1	11 Ridder Court, Dingley Village	1 – Residential	49	40	42	50
2	14 Oploo Court, Dingley Village	1 – Residential	49	49	40	48
3	8 Torquay Close, Dingley Village	1 – Residential	51	52	43	50
4	2 Casco Place, Dingley Village	1 – Residential	51	52	41	50
5	34 Portland Place, Waterways	2 – Residential	50	50	41	48
6	5 Spoonbill Place, Waterways	2 – Residential	49	51	43	49
7	22 Jackie Court, Aspendale Gardens	3 – Residential	51	54	43	52
8	5 Pandan Place, Aspendale Gardens	3 – Residential	48	48	40	46
9	7 Ferntree Grove, Aspendale Gardens	3 – Residential	48	50	40	49
10	68 29 Wells Road, Aspendale Gardens	3 – Residential	59	57	53	56

Location index	Location	Zone/usage	Existing noise levels (dBA)			
			$L_{10,18hour}$	$L_{eq,16hour}$	$L_{eq,8hour}$	$L_{eq,24hour}$
11	21 Soden Road, Bangholme	3 – Residential	60	57	52	56
12	80 Soden Road, Bangholme	3 – Residential	58	57	51	55
Community aspects						
A	Rangers Station	2 – Parkland	53	53	46	52
B	Braeside Bird Hide	2 – Parkland	50	49	44	48
C	Governors Road Wells	2 – Parkland	53	52	46	51
D	Wetlands	2 – Parkland	55	53	49	52
E	Mordialloc Creek Trail	2 – Parkland	52	53	43	51

For the purposes of characterising the background noise levels at different times of day, the definitions for Day, Evening and Night have been adopted from SEPP N-1 – these definitions are presented in Table 12.4.

Table 12.4 SEPP N-1 time periods

SEPP N-1 time period	Time
Day	7am to 6pm Weekdays 7am to 1pm Saturdays
Evening	6pm to 10pm Weekdays 1pm to 10pm Saturdays 7am to 10pm Sundays and Public Holidays
Night	10pm to 7am All Days

Background noise levels for each location have been calculated for each period and are presented in Table 12.5. Background noise levels is the typical minimum level of noise measured in the absence of the noise under investigation and excluding other short-term noises such as those caused by all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc. Establishing the background noise levels is important to assess construction noise.

Table 12.5 Existing background noise levels

Location Index	Location	Background Noise level, L_{90} dBA Period		
		Day	Evening	Night
0	375 Old Dandenong Rd, Dingley Village	45	42	36
1	11 Ridder Ct, Dingley Village	41	37	33
2	14 Oploo Ct, Dingley Village	40	36	33
3	8 Torquay Cl, Dingley Village	43	39	35
4	2 Casco Pl, Dingley Village	46	43	37
5	34 Portland Pl Waterways, Waterways	45	40	36
6	5 Spoonbill Pl, Waterways	39	42	37
7	22 Jackie Ct, Aspendale Gardens	41	38	36

Location Index	Location	Background Noise level, L_{90} dBA Period		
		Day	Evening	Night
8	5 Pandan Pl, Aspendale Gardens	43	44	36
9	7 Ferntree Gr, Aspendale Gardens	41	41	34
10	68/29 Wells Rd, Aspendale Gardens	52	49	40
11	21 Soden Rd	54	52	44
12	80 Soden Rd	53	52	43
A	Rangers Station	47	45	42
B	Braeside Bird Hide	42	38	39
C	Governors Rd Wells	48	46	42
D	Wetlands	49	46	41
E	Mordialloc Creek Trail	45	44	38

Location 10, 11 and 12 are adjacent to the existing Mornington Peninsula Freeway and therefore were found to have higher background noise levels for all periods. The difference between day and night period noise levels is larger for residential locations than parkland locations. This is most likely due to the influence of adjacent roads, which follow a diurnal pattern.

12.6.3 Baseline vibration

Baseline vibration monitoring was not undertaken as baseline vibration levels in the project area surroundings are expected to be insignificant since there are no major vibration-inducing sources in the area currently. Also, best practice vibration management guidelines employed for such projects establish absolute vibration levels as targets, and are independent of baseline levels, thereby negating the need to undertake baseline vibration monitoring.

12.7 RISK ASSESSMENT

An environmental risk assessment (ERA) was undertaken to identify environmental risks associated with the construction and operation of the project. Where initial risks were rated as 'medium' or higher (with standard controls in place) these issues were further assessed and investigated in the Noise and Vibration Impact Assessment Report. Where necessary, additional controls were identified as part of the Impact Assessment to reduce the identified risks to acceptable levels. These controls have been incorporated into the environmental performance requirements (EPRs) for the project. The initial risks were then re-assessed following application of the environmental performance requirements to derive the residual risk ratings. The methodology for the risk assessment has been described in Chapter 4: *EES assessment framework and approach*.

The initial risk assessment identified two main categories of risk: increased road traffic noise (operational noise) and increased noise and vibration from construction and maintenance activities. One operational and four construction primary risks related to noise and vibration were seen to be potentially significant with an initial risk rating of Medium (refer to Table 12.6).

The impact assessment discusses management measures and detailed options for managing construction noise and vibration impacts on surrounding sensitive users/receptors. Construction noise and vibration will be managed through a CNVMP, as outlined in EPR NV1. Section 12.8.2 states the mitigation measures required to achieve the PONLs for the project. Implementing these mitigation measures will decrease the risk of operational noise leading to amenity issues to Low.

A full list of all noise and vibration related risks and further information on potential impacts determined to be low risk, are contained in Appendix E: *Noise and vibration impact assessment* or Attachment I: *Environmental risk assessment report.*

Table 12.6 Noise and vibration risk

Risk ID	Impact pathway	Primary impact	Project phase	Initial risk rating	EPR ref.	Residual risk rating
R-NV2	Noise and vibration from clearing (construction phase)	Increases in noise and vibration from clearing activities leading to amenity issues for local residents, businesses and wildlife.	C	Medium	NV2	Low
R-NV3	Noise and vibration from earthworks (construction phase)	Increases in noise and vibration from earthworks activities leading to amenity issues for local residents, businesses and wildlife.	C	Medium	NV2	Low
R-NV4	Noise and vibration from construction activities (construction phase)	Increases in noise and vibration from piling leading to amenity issues for local residents, businesses and wildlife.	C	Medium	NV2	Low
R-NV5	Noise and vibration from construction activities (construction phase)	Increases in noise and vibration from construction activities leading to amenity issues for local residents, businesses and wildlife.	C	Medium	NV2	Low
R-NV6	Noise and vibration during operations	Increases in noise and vibration from operation of the bypass leading to amenity issues for local residents, businesses and wildlife.	O	Medium	NV1 NV3	Low

12.8 IMPACT ASSESSMENT AND MITIGATION

12.8.1 Construction

Risks R-NV2, R-NV3, R-NV4 and R-NV5

CONSTRUCTION NOISE IMPACTS

The magnitude of noise impact during the road construction would depend on several factors, including:

- the intensity and location of construction activities
- the type of equipment used
- current background noise levels
- terrain and structures that can change the way noise travels
- the prevailing weather conditions.

The type and number of machinery and plant needed for construction of a project is generally not determined until the detailed construction planning stage. Likely noise levels during the project construction were therefore predicted using sound power data in the *Construction Noise and Vibration Guideline – August 2016* developed by NSW Roads and Maritime Services (RMS). This data is based on typical machinery and construction activities present in Australia.

The total sound pressure level for scenarios including corridor clearing, earthworks, bridge construction and road paving were predicted at varying distances. The construction noise results are presented in Figure 12.4.

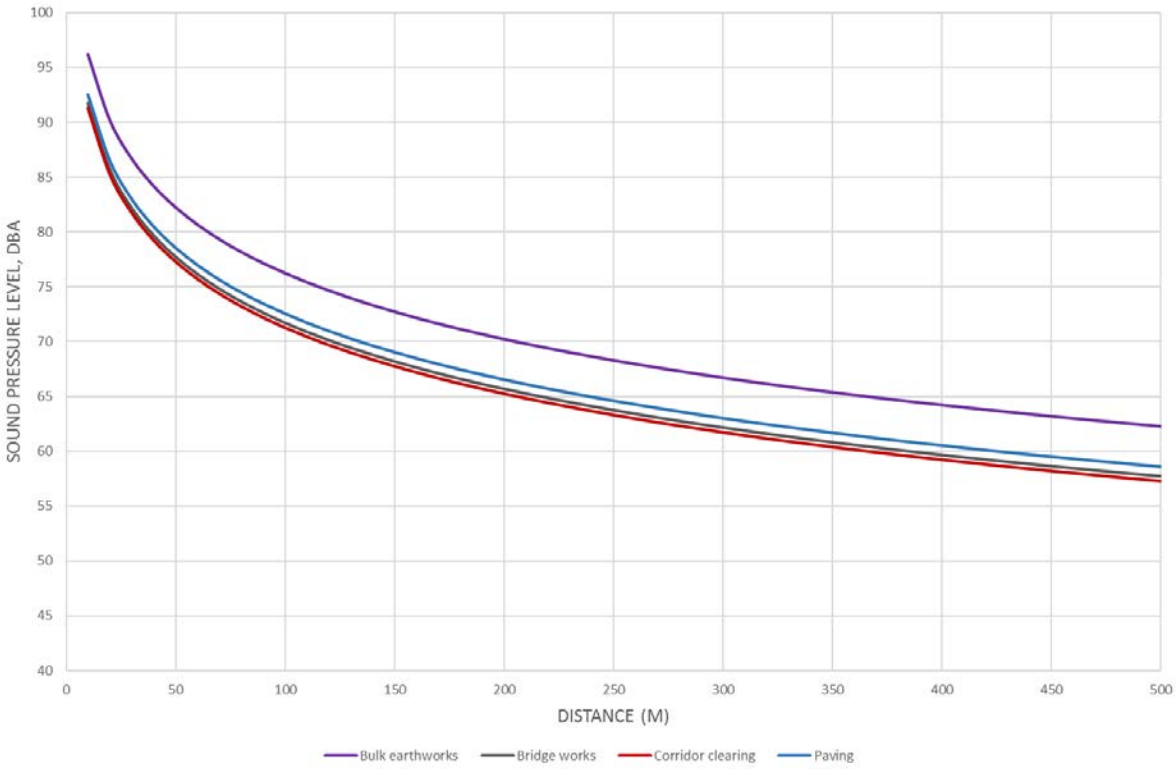

Figure 12.4 Construction noise over distance

The results indicate potential for construction noise to cause a nuisance at nearby residences and to affect amenity in adjacent residential and public open space areas.

As discussed in Chapter 6: *Project description*, construction work for the project would be undertaken during the standard construction work hours as outlined in VicRoads specifications, which are:

- Monday to Friday: between 7.00am and 6.00pm
- Saturday: typically, 7.00am to 1.00pm.

EPA publication 480 states the following regarding construction noise:

While no specific statutory controls exist for noise from construction sites, all noise nuisance should be reduced wherever possible from vehicles, fixed machinery within the site, blasting, general construction activities, and from movements of vehicles servicing the site.

EPA publication 1254 contains additional guidance for managing airborne noise from construction activities. Table 12.7 shows the Guideline Noise Levels.

Table 12.7 EPA Guideline 1254 noise levels

Applicable hours	Guideline Noise Levels, L_{Aeq}, 15mins	
	Up to 18 months after project commencement	**18 months or more after project commencement**
Normal working hours • 7am to 6pm Monday to Friday • 7am to 1pm Saturday	No specified Guideline Noise Levels – noise reduction measures apply.	
Weekend and evening hours • 6pm to 10pm Monday to Friday • 1pm to 10pm Saturday • 7am to 10pm Sunday and Public Holidays	Noise level at any residential premises not to exceed background noise (L_{A90}) by 10 dB(A) or more.	Noise level at any residential premises not to exceed background noise (L_{A90}) by 5dB(A) or more.
Night time • 10pm to 7am Monday to Sunday	Noise is to be inaudible within a habitable room of any residential premises.	

No Guideline Noise Levels are specified for daytime construction. However, daytime noise emissions must be controlled to ensure they are not unreasonable.

Exceptions to the EPA 1254 Guideline Noise Levels include Unavoidable Works – those that cannot meet the time schedule requirements because the work is continuous (such as a concrete pour) or would otherwise pose an unacceptable risk to life or property, or risk a major traffic hazard. Affected premises should be notified of such works, including their scheduled times and durations.

These guidelines apply to all residential receivers, and are equally appropriate for facilities related to children and the elderly.

Construction outside the standard hours (e.g. evening and weekend work) may occur at certain stages to undertake particular tasks more safely. Night works could be required in some locations to minimise impact on traffic or nearby stakeholders. If the contractor proposes to undertake construction works outside the standard hours, prior VicRoads superintendent approval would be needed in accordance with the CNVMP (EPR NV2).

The CNVMP would be required to minimise construction noise impacts as far as practicable. The CNVMP would be expected to contain the following information:

- Project-specific noise targets for construction to manage noise in accordance with EPA Publication 1254, EPA Publication 480 and VicRoads Noise Guidelines.
- Predicted noise from each construction scenario.
- Assessment of each construction scenario against the established targets.
- Mitigation measures to be implemented to control noise levels as far as practicable, including:
  - scheduling of work for less sensitive time periods, where possible
  - a noise compliance monitoring regime, if required
  - trigger levels for management actions to be taken if project-specific noise targets are not met
  - the management actions to be taken
  - advanced notification of affected premises of unavoidable works to be undertaken outside of standard hours, including their scheduled times and durations
  - noise complaint management protocols for the construction phase
  - requirements for substituting high noise or vibration construction plant or processes with a lower noise or vibration option.

To minimise construction noise as part of the CNVMP, the most effective noise reduction is to reduce noise at the source by:

- selecting less noisy plant and equipment
- maximising offset distances between sources and sensitive receptors
- regularly maintaining all plant and machinery
- localised shielding of stationary plant and equipment
- using site buildings as shielding, where possible
- ensuring all mufflers/silencers are in good repair
- using non-tonal (broadband) reversing beepers
- using normal working hours to:
  - schedule noisy activities in less sensitive times of the day
  - provide respite periods for noisier works
- scheduling quieter activities for evening/weekend periods
- minimising out-of-hours work (no work between 8pm and 7am Monday–Friday, 8pm–9am weekends and public holidays), wherever practicable.

Where works need to be undertaken outside of regular working hours, contractors would need to act to limit impacts and seek necessary approvals from the relevant authority. These unavoidable works are recommended to be indicated in the CNVMP to seek approval from relevant stakeholders.

Where night works or high noise works are required, stakeholder engagement is critical to lessen the impact on surrounding land users. The following actions would help minimise community impacts:

- Give notice as early as possible of necessary noisy works, describing the activities and how long they are expected to take.
- Keep affected residents informed of progress.
- Appoint a principal contact person for community queries.
- Provide 24-hour contact details through letters and site signage.
- Record complaints and follow a complaint response procedure appropriate for the scale of works.
- Conduct ongoing monitoring of sensitive receivers during critical construction periods to identify and manage high-risk noise events.

CONSTRUCTION VIBRATION IMPACTS

Energy from construction equipment is transmitted into the ground and transformed into vibration, which dissipates with distance.

Potential vibration impacts would likely be caused by driven piling works (when a machine inserts poles below ground) and compacting ground surfaces. Vibration levels depend on several factors including:

- the source of the vibration, including equipment specifications and operation mode
- soil properties
- the building foundation type and vibration loss between the soil and the foundation
- the structural condition of the affected building and building type.

As general guidance, Table 12.8 provides guidance on safe working distances from dwellings for typical plant items (extracted from the *NSW RMS Construction Noise and Vibration Guideline – August 2016*).

Table 12.8 Recommended minimum working distances from sensitive receivers for vibration intensive plant

Plant item	Rating/description	Minimum working distance (m)	
		Cosmetic damage	Human comfort
Vibratory roller	<50kN (typically 1–2 tonnes)	5	15 to 20
	<100kN (typically 2–4 tonnes)	6	20
	<200kN (typically 4–6 tonnes)	12	40
	<300kN (typically 7–13 tonnes)	15	100
	>300kN (typically 13–18 tonnes)	20	100
	>300kN (>18 tonnes)	25	100
Small hydraulic hammer	(300kg – 5 to 12t excavator)	2	7
Medium hydraulic hammer	(900kg – 12 to 18t excavator)	7	23
Large hydraulic hammer	(1600kg – 18 to 34t excavator)	22	73
Vibratory pile driver	Sheet piles	2 to 20	20
Pile boring	≤800mm	2 (nominal)	4
Jackhammer	Hand held	1 (nominal)	2

Note: More stringent safe working distances may apply to any heritage structures

Once construction techniques and equipment types are finalised, vibration impacts would be predicted. In accordance with EPR NV2, a CNVMP would be developed to minimise the impacts of construction vibration wherever practicable. Active vibration monitoring would also occur during major construction activities.

In accordance with EPR NV2, the CNVMP would include measures to manage vibration in accordance with human response to vibration targets as per *BS 6472 Evaluation of human exposure to vibration in buildings (1–80Hz)* or equivalent, and structural damage targets in line with *DIN 4150 Structural vibration - Effects of vibration on structures* or equivalent.

12.8.2 Operation

Operational road noise (R-NV6)

Operational noise impacts were assessed by modelling future road traffic noise associated with the project, and comparing the generated road noise to the PONLs set out in the VicRoads TNRP at sensitive receptors. For this assessment, sensitive receptors identified during field investigations, and included primarily the residential properties along the alignment.

The scenarios modelled for the project included:

- Mordialloc Bypass (Freeway) along with existing Mornington Peninsula Freeway (2031 design year) – Unmitigated
- Mordialloc Bypass (Freeway) only (2031 design year) – Mitigated
- Mordialloc Bypass (Freeway) along with existing Mornington Peninsula Freeway (2031 design year)– Mitigated.

Full details of the model parameters applied and assumptions used are provided in Appendix E: *Noise and vibration impact assessment.*

The project is considered a freeway built on a new alignment. As such, the noise level objective outlined in the VicRoads TNRP for noise from new roads is 63dBA, $L_{10,18hour}$ for residential dwellings, aged persons' homes, hospitals, motels, caravan parks and other buildings of a residential nature. This criteria has been adopted for all areas of new freeway. Noise sensitive receivers adjacent to Mornington Peninsula Freeway are currently exposed to road traffic noise from the existing freeway (Figure 12.5). The VicRoads TNRP states that noise attenuation would be retrofitted to freeways and arterial roads which were previously eligible for noise attenuation works (e.g. the Mornington Peninsula Freeway). The noise objective levels for retrofit attenuation in this area is 68dBA $L_{10,18hour}$.

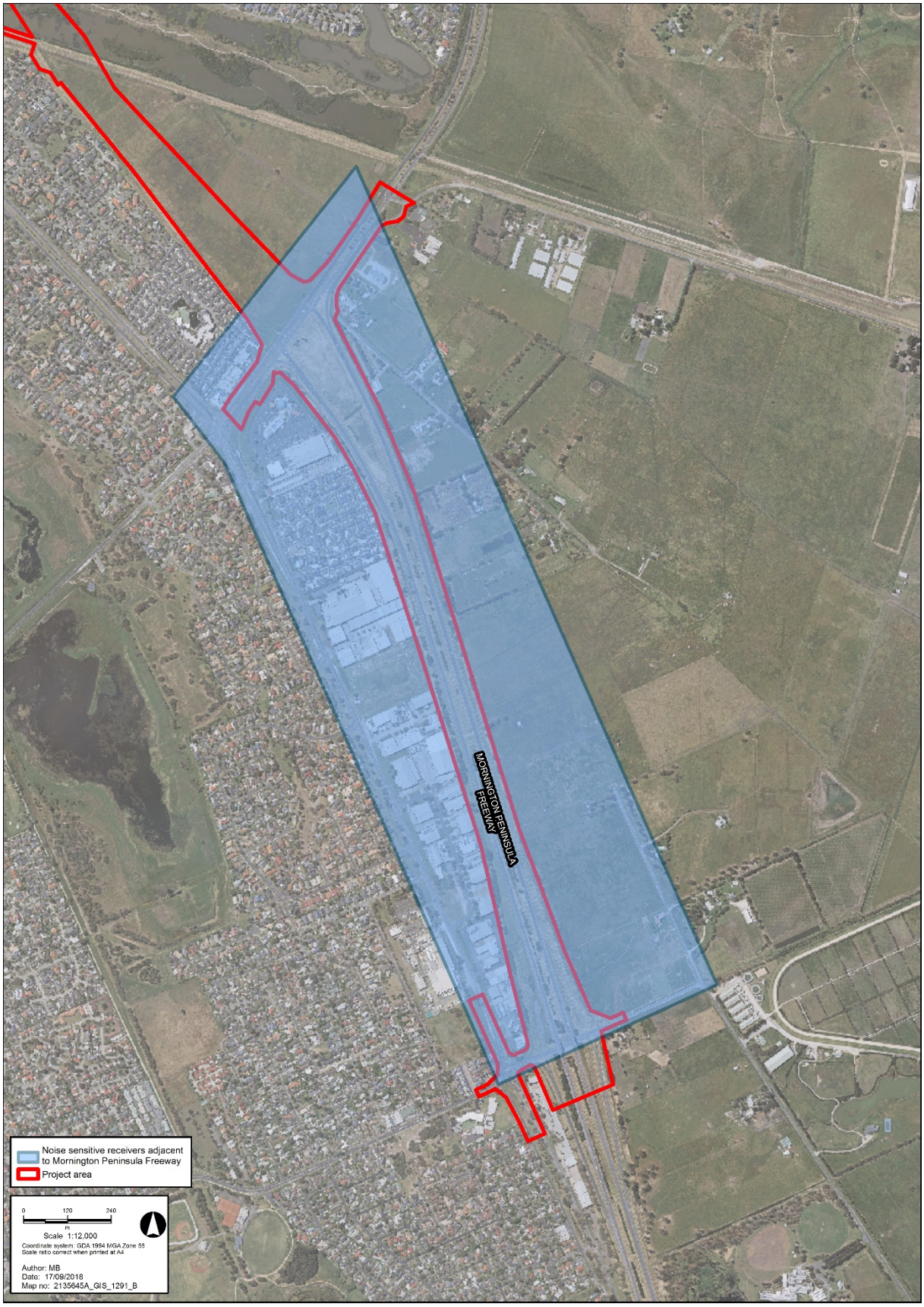

Figure 12.5 Mornington Peninsula Freeway section

For this section of road (south of Springvale Road), there will be two PONLs, one for the new section of freeway, and one for the combined new and existing modelled road traffic noise. The PONL for the new section of road is consistent with the wider project, 63dBA $L_{10,18hour}$. The PONL for the combined new and existing road traffic noise will be 68dBA $L_{10,18hour}$ at sensitive receivers.

Table 12.9 shows predicted noise levels from the new alignment, with and without mitigation (discussed below) for predicted 2031 traffic levels, at the most exposed or closest row of houses along the entire project boundary. As described in section 12.6.2, existing noise levels along the majority of the alignment are between 48 and 55dBA $L_{10,18hour}$. Without mitigation, noise increase could be up to 30dBA $L_{10,18hour}$ (quietest monitoring location to loudest receptor), however once mitigation is applied, the noise level increase is limited to a maximum of 15dBA $L_{10,18hour}$.

Figure 12.6 shows the contour maps of the predicted noise levels without mitigation. More detailed contour maps are provided in Attachment III: *Maps and figures.*

Table 12.9 Predicted unmitigated and mitigated road traffic noise levels from the project

Predicted noise level range dBA $L_{10,18hour}$	Unmitigated		Mitigated (noise barriers)	
	Number of first row houses at this noise level	Percentage of Receptors at this noise level	Number of first row houses at this noise level	Percentage of Receptors at this noise level
54 to 57	3	1%	15	5%
57 to 60	7	2%	51	17%
60 to 63	38	13%	233	78%
63 to 66	92	31%	0	0%
66 to 69	42	14%	0	0%
69 to 72	49	16%	0	0%
72 to 75	49	16%	0	0%
75 to 78	20	7%	0	0%
78 to 81	0	0%	0	0%

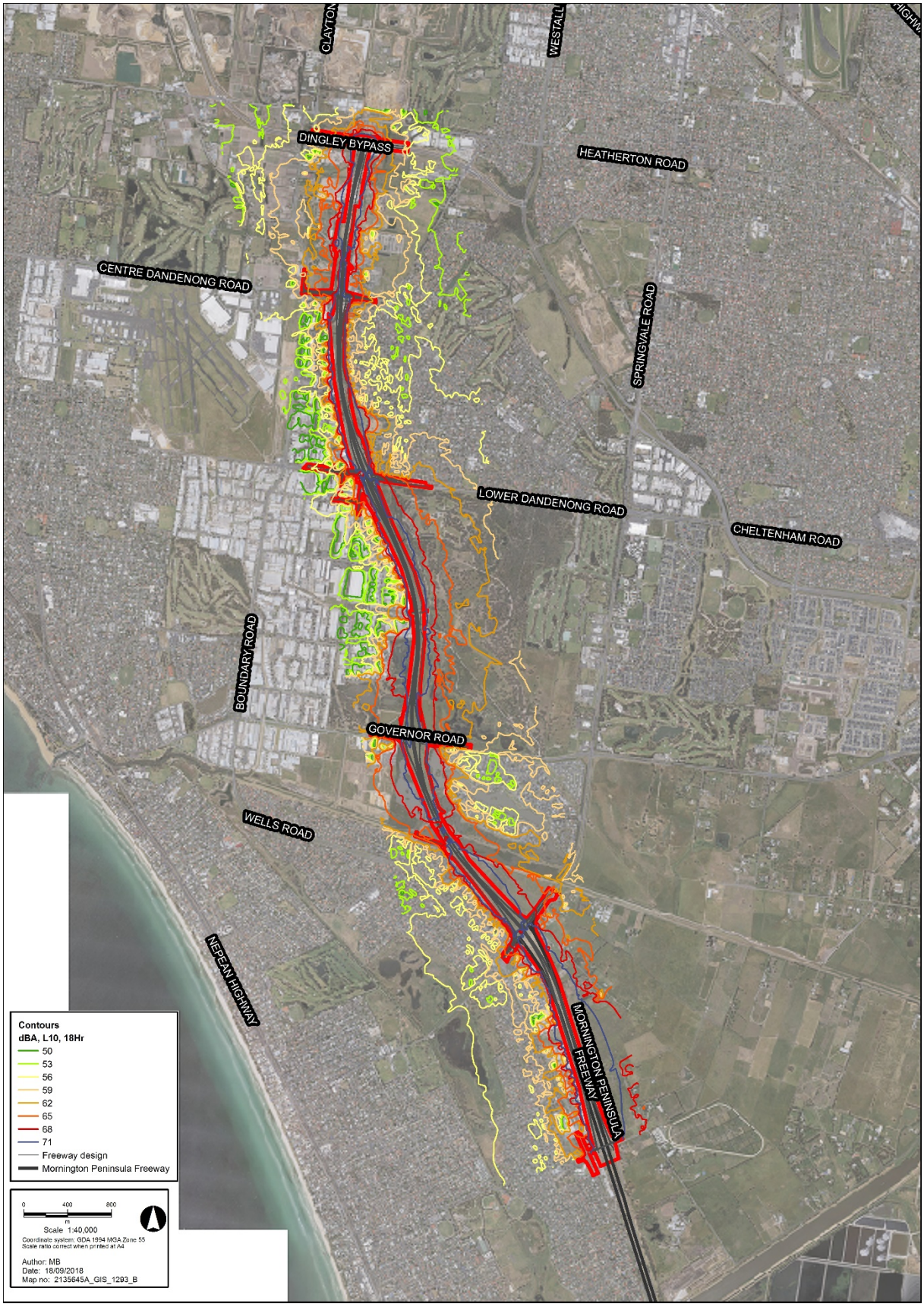

Figure 12.6 Predicted 2031 noise levels without mitigation measures

Controlling road traffic noise can be achieved using a variety of methods, each with their own costs and limitations. Selecting the most appropriate mitigation measure should also consider factors such as community acceptance, urban design, access, and safety. Table 12.10 describes noise mitigation options for road traffic noise sources. The options may be used in combination; however, the total noise reduction may not achieve the sum of each of the reductions listed.

Table 12.10 Noise mitigation options

Mitigation option	Approximate noise reduction	Possible limitations
Road alignment	3dBA per doubling of distance	Major road alignment changes usually only suitable for greenfield roads with less space limitations.
Speed reduction	2dBA to 3dBA	Total traffic flow-through may be affected; safety considerations.
Surface treatments (OGA, etc.)	3dBA	Longevity of surface treatments requires regular road surface replacement.
Earth berms	3dBA to 8dBA	Space constraints limit the suitability in all cases.
Noise barriers	5dBA to 10dBA	The efficacy of noise barriers reduces as barrier heights increase. Typically, barriers above 4m also require increased footings to withstand higher wind loads.
Off-Reservation Treatment	5dBA to 12dBA	Only cost effective for smaller numbers of houses. Does not protect outdoor amenity.

Once impacts on sensitive receptors were defined, modelling was undertaken to determine if mitigation treatments could manage road noise at the sensitive receptors.

The modelling results demonstrate that the PONLs can be met with the inclusion of acoustic barriers. The design also demonstrated compliance against a 68dBA $L_{10,18hour}$ PONL for the new bypass alignment together with the existing Mornington Peninsula Freeway. As such, the reference design has incorporated noise barrier provision in areas nearest to the sensitive noise receptors as shown in Figure 12.7, which also shows the expected noise levels.

To provide further noise reduction, the use of OGA pavement type would be adopted in the reference design for freeway pavement. In areas where the sensitive receptors are more spread out, the contractor could consider off-reservation treatments such as double glazing, or perimeter fences at properties.

Table 12.11 summarises the noise mitigation measures incorporated into the project reference design and provides an assessment of their anticipated impact. Further details of the location and extent of these measures is described in Appendix E: *Noise and vibration impact assessment*.

Alternative noise mitigation solutions may be developed to meet the PONL and several mitigation options may be used in conjunction with each other during Detailed Design. Regardless of the mitigation measures employed, the project must comply with the Traffic Noise Reduction Policy and PONLs (EPR NV1):

- 63dBA $L_{10,\ 18Hr}$ for the new bypass
- 68dBA $L_{10,\ 18Hr}$ for the existing Mornington Peninsula Freeway combined with the new bypass.

The modelling outcomes demonstrate that these requirements can be met.

Table 12.11 Design noise mitigation measures

Mitigation used	Overall length and details	Anticipated dBA reduction
Low noise pavement (open grade asphalt)	OGA pavement type would be adopted for all paved areas including the new ramps.	3dBA
Noise barriers	A barrier design has been developed to meet the 63dBA $L_{10,18hour}$ PONL for all the project's sensitive receivers along the new alignment. The design also complies with 68dBA $L_{10,18hour}$ PONL for the new project alignment together with the existing Mornington Peninsula Freeway area. The design uses barriers between 0.5m and 6m in height.	5dBA to 15dBA

Consistent with the requirements of the VicRoads *Traffic Noise Measurement Requirements for Acoustic Consultants – September 2011*, traffic noise would be monitored after project construction to verify conformance with the external traffic noise performance requirements set out in EPR NV1. Remedial action must be taken as soon as practicable if the performance requirements set out in NV1 are not met (EPR NV3).

There are no criteria for parklands under the VicRoads TNRP. Noise levels have been predicted for passive recreation areas adjacent to the proposed alignment within Braeside Park, which includes Federation Picnic Area and Telford Picnic Area. Based on the future (2031) road traffic noise model, the noise levels at Federation Picnic Area and Telford Picnic Area are predicted to be 65dBA $L_{10,\ 18\ hr}$ and 58dBA $L_{10,\ 18\ hr}$ respectively without mitigation, which reflects an increase in noise levels ($L_{10,\ 18\ hr}$) with the new alignment estimated at 5 to 12dBA.

The modelled predicted noise levels within the Braeside Park picnic areas are generally in the range of what is being targeted for residential sensitive receptors along the alignment. These modelled levels include peak hour traffic periods where the use of the park is expected to be low. In addition, the modelling is completed for work week conditions, whereas park use is expected to be greatest on weekends. As such, the likely amenity impact from noise on park users is anticipated to be low.

In the southern portion of Braeside Park, a multi-function fauna barrier is proposed to manage impacts on the wetland ecosystem. This barrier is described in Chapter 10: *Biodiversity*. The purpose of the multi-function fauna barrier is to protect the wetland ecosystem from vehicle lights and to prevent birds and other wildlife from being hit by vehicles. The barrier will also have acoustic benefits.

Short term noise events

The Victorian Government has currently limited control over individual short-term noise events such as engine brake noise, whilst there are federal regulations that mandate exhaust and pass-by noise limits from vehicles. Given the freeway nature of the road, engine brakes are expected to be limited around the ramps. The short-term impacts of these, whilst having a potential to cause annoyance, are expected to be similar to noise impacts on receivers adjacent to any arterial road with truck movements.

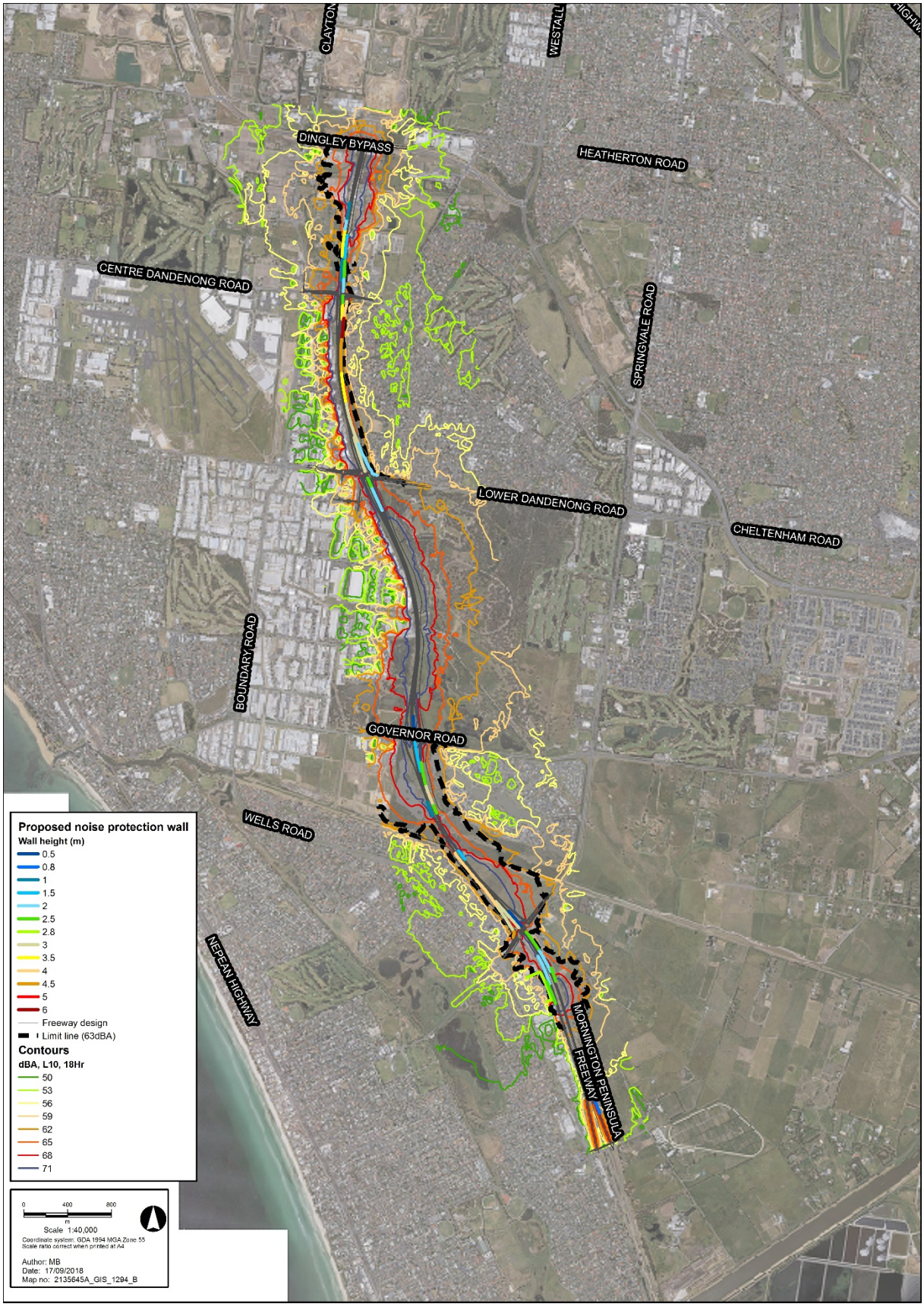

Figure 12.7 Predicted 2031 noise levels with mitigation measures

12.9 ENVIRONMENTAL PERFORMANCE REQUIREMENTS (EPRs)

Table 12.12 states the EPRs developed to minimise noise and vibration impacts from the project.

Table 12.12 Environmental performance requirements (EPRs)

EPR number	Environmental performance requirements	Project phase
NV1	**Noise and vibration (operation)** Noise and vibration impacts on residents and the community during operation must be minimised by the inclusion of appropriate noise attenuation measures and road surface specifications in the design. Operational phase road traffic noise emissions must comply with the *Traffic Noise Reduction Policy and Project Objective Noise Levels*: • 63dBA L10, 18Hr for the new bypass, and • 68dBA L10, 18Hr for the Mornington Peninsula Freeway works.	Design and Operation
NV2	**Construction Noise and Vibration Management Plan** A Construction Noise and Vibration Management Plan (CNVMP) prepared in consultation with EPA Victoria must be implemented during construction to: • manage noise in accordance with EPA Publication 1254 Noise Control Guidelines, EPA Publication 480 Environmental guidelines for major construction sites and VicRoads Noise Guidelines, unless otherwise specified in the CNVMP • include measures to manage vibration in accordance with human response to vibration targets (BS 6472 Evaluation of human exposure to vibration in buildings (1–80Hz) or equivalent) and structural damage targets (DIN 4150 Structural vibration - Effects of vibration on structures or equivalent). The CNVMP must include requirements for substituting high noise or vibration construction plant or processes with a lower noise or vibration option. The CNVMP must make provision for *ad hoc*, targeted and routine noise and vibration monitoring to inform management and mitigation. The CNVMP should highlight potential unavoidable night works and consult with relevant stakeholders prior to construction.	Construction
NV3	**Traffic noise verification** Traffic noise must be measured between 6 to 12 months after opening of the project, in accordance with the VicRoads *Traffic Noise Measurement Requirements for Acoustic Consultants – September 2011*, to verify conformance with the external traffic noise performance requirements set out in EPR NV1. Remedial action must be completed by Final Completion (at the completion of the Defects Liability Period) the performance requirements set out in EPR NV1 are met.	Operation

12.10 CONCLUSIONS

Construction noise and vibration targets were developed in accordance with EPA publications 480 *Best Practice Environment Management Environmental Guidelines for Major Construction Sites* and 1254 *Noise Control Guidelines* as well as VicRoads, Australian and international standards. Construction works would generally occur during standard construction work hours as outlined in VicRoads specifications, which are:

- Monday to Friday: between 7.00am and 6.00pm
- Saturday: typically, 7.00am to 1.00pm.

In accordance with EPR NV2, a CNVMP would be required for the project to address construction noise and vibration impacts to the satisfaction of the relevant authorities. The CNVMP would include requirements for substituting high noise or vibration construction plant or processes with a lower noise or vibration option, and would make provision for impact assessments, along with *ad hoc*, targeted and routine noise and vibration monitoring to inform management and mitigation.

The operational noise and vibration impact assessment predicted noise levels at sensitive receptors for the design year of 2031.

PONLs for the project and existing Mornington Peninsula Freeway have been established in accordance with the VicRoads TNRP and RDN 06-01. Modelling results for the impact assessment indicated that PONLs can be achieved at all identified receptors through the design and implementation of OGA and noise barriers along the alignment. The project would be required to comply with EPR NV1, which would ensure PONLs are met. All noise and vibration risks will be reduced to low (from an initial medium risk) with application of standard and project-specific controls as outlined in Section 12.8 and in accordance with the EPRs in Section 12.9.

During operation, traffic noise would be monitored to verify conformance with the external traffic noise performance requirements set out in EPR NV1. As required by EPR NV3, remedial action would be required as soon as practicable if the performance requirements set out in EPR NV1 are not met.

Through implementation of the EPRs the project would minimise effects on noise and amenity of the area, having regard to the relevant EPA and VicRoads limits, targets and standards.