

Chapter 13

Noise and vibration



This chapter discusses the potential noise and vibration impacts on human and building receptors associated with the construction and operation of the Gas Import Jetty and Pipeline Project (the Project). A detailed noise and vibration impact assessment is presented in EES Technical Report H: *Noise and vibration impact assessment*.

Potential impacts from noise and vibration on marine animals are discussed in Chapter 6 *Marine biodiversity*. Potential impacts on terrestrial (land-based) and freshwater animals are discussed in Chapter 7 *Terrestrial and freshwater biodiversity*.

13.1 Overview

Noise pollution is sound at a level which is annoying, disruptive or physically harmful to people or animals. Sensitivity to noise is influenced by factors such as the type and duration of the noise, the existing acoustic environment (for example a busy urban environment versus a quiet rural area), the expectations of the community and an individual's perception of and response to noise. The audibility of indoor sound depends on its level, character and on the sound insulation properties of the building.

Adverse noise impacts can include:

- human annoyance
- sleep disturbance causing fatigue
- negative health effects due to long-term exposure
- productivity loss and/or inability to continue to operate a business.

In addition to noise, short-term exposure to continuous or excessive vibration can lead to human disturbance and potentially damage buildings and other structures. Vibration can be generated through construction activities such as demolition, excavation and piling.

The Environment Protection Authority (EPA) Victoria has two publications which establish guidelines and policy requirements for operational noise from 'commercial industrial or trade premises' in Victoria:

- EPA Victoria publication 1411: *Guideline noise from industry in regional Victoria* (NIRV). This guideline applies to noise from commerce, industry and trade premises in regional Victoria.
- EPA Victoria publication S31: *State Environmental Protection Policy (Noise from industry, commerce and trade) No. N-1* (SEPP N-1). This is a statutory policy that applies to noise from commerce, industry and trade premises in the metropolitan Melbourne area.

The *Environmental Protection Act 1970* establishes a framework to protect against objectionable or unreasonable noise or vibration and gives effect to SEPP N-1. Statutory noise limits are only imposed by SEPP N-1 within the SEPP N-1 boundary for metropolitan Melbourne. No part of the Project Area falls within the SEPP N-1 boundary and so operational noise from the Project was assessed using NIRV, which refers to SEPP N-1 procedures for assessment.

Victoria does not have statutory noise or vibration limits which apply to construction work. EPA Victoria provides recommendations for managing construction noise and vibration in the following guidelines:

- EPA Victoria publication 1254: *Noise control guidelines* (October 2008)
- EPA Victoria publication 480: *Best practice environmental management – Environmental guidelines for major construction sites* (February 1996).

Construction and operation vibration criteria for the Project was also based on the following international standards for human amenity and structural damage impacts, which are consistent with those adopted on other Victorian projects:

- British Standard BS 6472-1:2008: *Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting*
- German Standard DIN 4150-3:2016: *Structural vibration in buildings – Effects on structures*.

13.2 EES evaluation objective

The scoping requirements for the EES set out the following relevant draft evaluation objective:

Social, economic, amenity and land use – To minimise potential adverse social, economic, amenity and land use effects at local and regional scales.

To assess the potential impact of the Project on amenity for nearby human receptors, a noise and vibration impact assessment was undertaken (see EES Technical Report H: *Noise and vibration impact assessment*).



How is sound measured?

A decibel (dB) is the measurement unit of sound. The decibel scale is logarithmic in order to produce a better representation of the response of the human ear.

A three decibel increase or decrease is typically considered the smallest change in sound level that a listener can detect.

A change of five decibels is clearly noticeable.

A 10 decibel increase is typically considered to sound twice as loud.

A-weighted sound

When an overall sound level is A-weighted it is expressed in units of dB(A). This is a frequency filter designed to adjust the absolute sound pressure levels to correspond to the subjective response of the human ear.

13.3 Methodology

The approach adopted for the noise and vibration impact assessment involved the following key tasks:

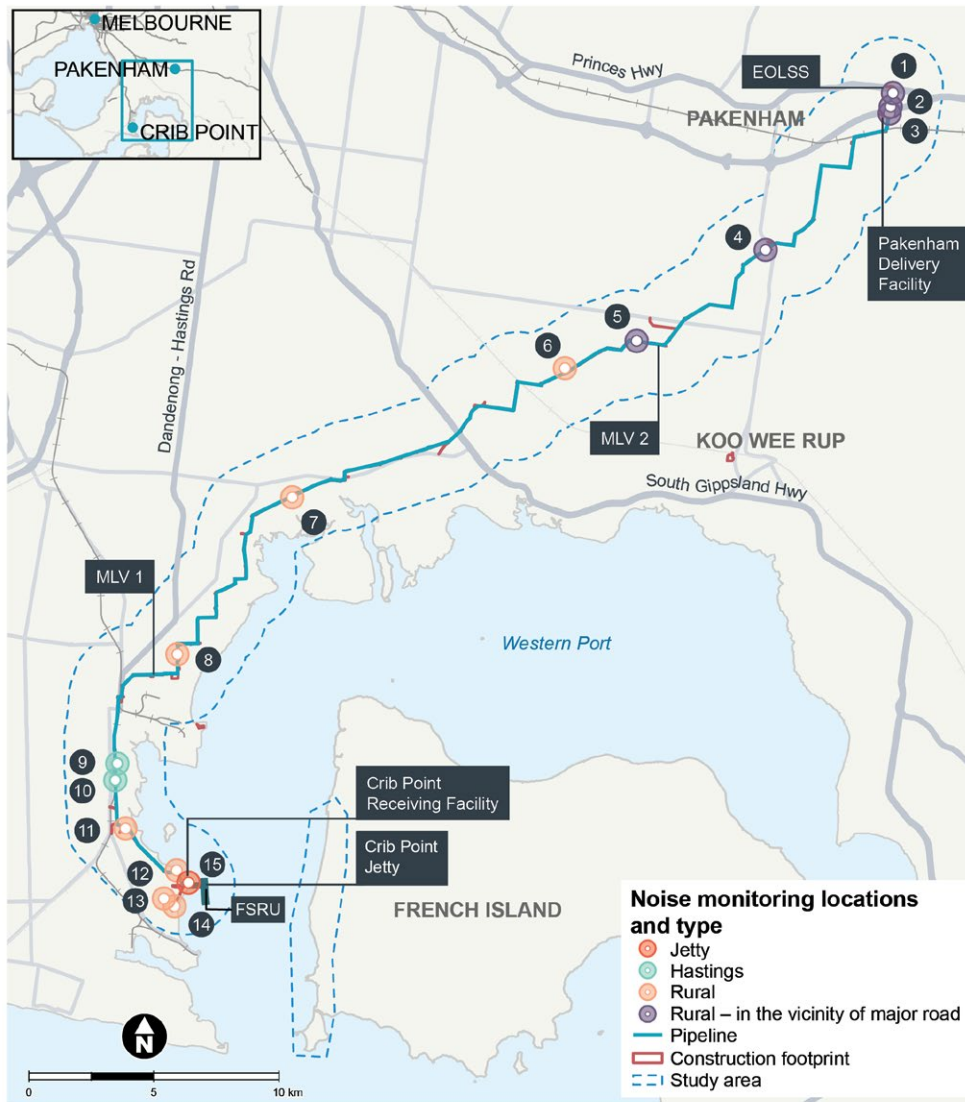
- a review of relevant legislation and policy at Commonwealth, state and local level
- a desktop review of relevant baseline data and reports, including typical construction noise and vibration levels for construction equipment to be used on the Project
- characterisation of existing conditions through baseline noise monitoring at 14 locations for a continuous two-week period as well as five short-term hand-held monitoring measurements in January, February and April 2019
- calculation of noise emissions for the construction and operation phases of the Project
- a risk assessment as described in **Chapter 5 Key approvals and assessment framework** to inform the impact assessment and development of additional mitigation measures
- assessment of noise and vibration impacts due to construction and operation of the Project
- development of mitigation measures in response to the noise and vibration impact assessment.

13.4 Study area

Airborne noise impacts have been considered to two kilometres out from the proposed pipeline alignment, which encompasses the pipeline construction right of way (ROW), proposed operational facilities as well as works on and adjacent to the Crib Point Jetty. The noise and vibration impact assessment also included proposed construction sites and laydown areas outside this two-kilometre buffer as well as residential properties on French Island located approximately five kilometres from the Gas Import Jetty Works at Crib Point.

The purpose of this study area was to assess noise in quiet rural areas where receptors with low existing ambient noise levels could be disturbed by the introduction of a new noise source. Noise monitoring locations were selected to be representative of noise sensitive receptors (such as residential buildings) that would most likely be affected by noise and/or vibration from construction and operation of the Project.

The measurement results were used to quantify baseline levels in these existing environments throughout the study area. The study area and unattended noise monitoring locations are shown in **Figure 13-1**.



◀ **Figure 13-1:** Noise and vibration study area

- | | | |
|--|--------------------------------------|--------------------------------------|
| 1 25 Mount Ararat South Rd, Nar Nar Goon | 6 560 Toorandin Station Rd, Cardinia | 11 Warragine Park, Bittern |
| 2 Mt Ararat Rd South, Nar Nar Goon | 7 85 Vowell Dr, Pearcedale | 12 103 The Esplanade, Crib Point |
| 3 240 Oakview Ln, Nar Nar Goon | 8 McKirdys Rd, Tyabb | 13 13 Disney St, Crib Point |
| 4 825 Koo Wee Rup Rd, Pakenham South | 9 16 Rankin Rd, Hastings | 14 Lorimer St - Parkland, Crib Point |
| 5 650 Dalmore Rd, Cardinia | 10 1 Edward Ct, Hastings | 15 Crib Point Jetty Beach |

13.5 Existing conditions

To determine background noise levels, unattended noise monitoring was undertaken at 14 locations throughout the Project study area over a continuous two-week period.

The noise monitoring measurements were used to determine the average background noise levels (L_{A90}) during the day, evening and night-time periods. The background noise monitoring results for each measurement location shown in **Figure 13-1** are summarised in **Table 13-1**.

Background noise levels

The L_{90} sound pressure level is used to quantify background noise. L_{90} is the noise level that is exceeded for 90 per cent of the measurement period.

L_{A90} noise levels (A-weighted) are used to determine the statutory noise limits for fixed plant and equipment under SEPP N-1 and NIRV. L_{A90} noise levels are also used to determine non-statutory construction noise guideline levels under the EPA Victoria publication 1254: Noise control guidelines.

The L_{eq} sound pressure level is the equivalent (energy averaged) noise level measured over the measurement period. The L_{Aeq} is the constant dB(A) noise level which, when occurring over the same period as the measurement period, would result in the receptor experiencing the same amount of sound energy. The L_{eq} is used to describe the ambient level in Victoria.

Table 13-1: Summary of background noise monitoring

Address	Average measured L_{A90} , noise level, dB(A)		
	Day	Evening	Night
25 Mount Ararat Road South, Nar Nar Goon	45	45	36
Near 90 Mt Ararat Road South, Nar Nar Goon	50	52	42
240 Oakview Lane, Nar Nar Goon	56	55	44
825 Koo Wee Rup Road, Pakenham South	42	43	35
650 Dalmore Road, Cardinia	39	41	32
560 Tooradin Station Road, Tooradin	34	35	25
85 Vowell Drive, Pearcedale	35	34	26
McKirdys Road, Tyabb	38	39	32
16 Rankin Road, Hastings	39	39	29
1 Edward Court, Hastings	39	40	29
Warringine Park, Bittern	33	35	29
103 The Esplanade, Crib Point	35	35	26
43 Disney Road, Crib Point	34	34	22
Lorimer Street, Crib Point	34	35	27

The noise measured within urban centres such as Hastings were typically higher than in the rural areas that span most of the Project corridor. However, background noise in the vicinity of major roads was typically higher than those in rural areas and Hastings. Background noise measurements near major roads was greatest at locations near the Princes Highway and Princes Freeway in Pakenham.

The measured evening background noise levels were marginally greater than the day-time background levels at some locations. This is likely due to external noise sources such as evening peak hour traffic. Night-time background noise levels were lower than day and evening which is typical for most habitable areas.

Attended (short-term) noise measurements were also conducted at coastal locations near the Crib Point Jetty as shown in **Figure 13-2**. These results are presented in **Table 13-2**.



Figure 13-2:
Attended noise
monitoring locations
near Crib Point Jetty

Table 13-2: Attended noise monitoring results

Location	Measured noise level, dB(A)		Adjusted level for tonality	Observation of noise sources
	L_{Aeq}	L_{A90}		
103 The Esplanade, Crib Point (residence near Crib Point Jetty)	40	37	42	Bird noise. Noise produced by the onshore pump located at the Crib Point Jetty facilities and moored United Petroleum vessel.
Woolleys Beach, Crib Point	48	44	N/A	Wind through trees, and waves lapping at the beach.
Jacks Beach, Crib Point	41	35	N/A	Road traffic noise, birds and aircraft noise.
Warringine Park, near Reid Parade, Hastings	48	45	N/A	Road noise from Frankston–Flinders Road, birds and wind through the trees.
Warringine Park, Bittern Coastal Wetlands Boardwalk	44	42	N/A	Crickets buzzing, bird noise, road traffic and aircraft noise, and wind through the trees.

The measurement at 103 The Esplanade, Crib Point was undertaken when there was a vessel docked at Berth 1 of the Crib Point Jetty. The highest noise contribution was attributed to the landside pump that is intermittently used for offloading petroleum when a vessel is docked at Berth 1. Passing motorboat (assumed recreational) noise is also audible in this area.

Noise levels at Woolleys Beach, Jacks Beach and Warringine Park were measured in the absence of the petroleum vessel docked at Berth 1. It is expected the onshore pump would be clearly audible at Woolleys Beach when operating. Other environmental noise sources, such as road traffic or birds, are typical for the type of environment where the measurement was undertaken.

13.6 Risk assessment

The risk assessment conducted for this EES identified the risks associated with potential noise and vibration impacts of the Project during its construction and operation. These considered the environmental, social, economic and health and safety consequences of each risk and their likelihood of occurring.

Risk ratings were applied to each of the identified risk pathways assuming that initial mitigation measures were in place. The initial mitigation measures applied were either regulatory requirements or are considered standard practice for construction projects. Where the initial risk ratings were categorised as medium or higher, additional mitigation measures were developed to lower the residual risk where practicable.

Identified risks relating to noise and vibration are summarised in **Table 13-3**.

The identified risks are further discussed in **Section 13.7** (Construction impacts) and **Section 13.8** (Operational impacts) of this chapter. Mitigation measures relating to noise and vibration impacts are presented in **Section 13.9** (Mitigation measures) of this chapter and **Chapter 25 Environmental Management Framework**.

A complete risk register, including the likelihood and consequence of each risk pathway is provided in Attachment III *Environmental risk report*.

Table 13-3: Risk assessment – noise and vibration

Risk ID	Works area	Risk pathway	Initial mitigation measures	Initial risk rating	Additional mitigation measures	Residual risk rating
Construction						
NV1	Gas Import Jetty Works	Noise generated by construction works at the Gas Import Facility causes an increase in noise or vibration affecting amenity at nearby sensitive receptors.	<p>MM-NV01 Managing noise and vibration from construction activities Application of mitigation measures with reference to EPA Victoria publications 1254 (Section 2) and 480</p> <p>MM-NV02 Construction noise criteria Application of noise management measures if construction noise is predicted to or exceeds the guideline noise levels</p>	Low	No additional mitigation measures identified.	Low
NV2	Pipeline Works	General construction works along the pipeline causes an increase in noise or vibration that affects the amenity at sensitive receptors.	<p>MM-NV01 Managing noise and vibration from construction activities</p> <p>MM-NV02 Construction noise criteria</p>	Medium	MM-NV04 Noise management measures Adopt at-receiver management measures when onsite mitigation measures cannot control emissions (e.g. works notification, individual briefings and/or respite)	Low
NV3	Gas Import Jetty Works and Pipeline Works	Construction of Pakenham Delivery Facility cause an increase in noise or vibration that affects the amenity at sensitive receptors.	<p>MM-NV01 Managing noise and vibration from construction activities</p> <p>MM-NV02 Construction noise criteria</p>	Low	No additional mitigation measures identified.	Low

Risk ID	Works area	Risk pathway	Initial mitigation measures	Initial risk rating	Additional mitigation measures	Residual risk rating
NV4	Pipeline Works	Out of hours night work causes an increase in noise that affects the amenity and causes sleep disturbance at sensitive receptors.	<p>MM-NV01 Managing noise and vibration from construction activities</p> <p>MM-NV02 Construction noise criteria</p>	High	<p>MM-NV05 HDD noise control Design site-specific acoustic treatment to reduce the noise transmission from HDD and boring works by at least 10dB in Hastings</p> <p>MM-NV04 Noise management measures MM-NV06 Noise and vibration monitoring Monitor noise during construction to confirm compliance</p>	Medium
NV5	Gas Import Jetty Works and Pipeline Works	Construction works for concurrent projects causes longer or higher levels of noise disturbance at sensitive receptors.	<p>MM-NV01 Managing noise and vibration from construction activities</p> <p>MM-NV02 Construction noise criteria</p>	Medium	MM-NV07 Managing cumulative noise impacts Consultation and collaboration with other projects to manage cumulative impacts where applicable	Low
NV6	Gas Import Jetty Works and Pipeline Works	Vibration from construction works causes human disturbance.	<p>MM-NV01 Managing noise and vibration from construction activities</p> <p>MM-NV03 Vibration safe working distances Adopt set back distances derived using BS6472-1:2008</p>	Low	MM-NV08 Managing impacts from ground vibration Equipment substitution to minimise vibration impacts Consultation with affected stakeholders to manage vibration impacts	Very low
NV7	Gas Import Jetty Works and Pipeline Works	Vibration from construction works cause structural damage to buildings and underground services.	<p>MM-NV01 Managing noise and vibration from construction activities</p> <p>MM-NV03 Vibration safe working distances Adopt set back distances derived using DIN 4150-3 criteria</p>	Low	<p>MM-NV08 Managing impacts from ground vibration</p> <p>MM-NV06 Noise and vibration monitoring Vibration monitoring of sensitive buildings/structures inside safe working distances</p> <p>MM-NV09 Condition surveys Condition survey of properties within safe working distances</p>	Very low

Risk ID	Works area	Risk pathway	Initial mitigation measures	Initial risk rating	Additional mitigation measures	Residual risk rating
Operation						
NV8	Gas Import Jetty Works	The 24-hour operation of the FSRU and Crib Point Receiving Facility causes an increase in noise affecting amenity at nearby sensitive receptors.	MM-NV10 Operational noise controls Noise mitigation included within Project design to achieve NIRV recommended levels	Low	No additional mitigation measures identified	Low
NV9	Gas Import Jetty Works	Noise generated by tugboats bringing liquefied natural gas (LNG) carriers in to moor at Crib Point Jetty cause an increase in noise affecting amenity at sensitive receptors.	No initial mitigation measures identified	Medium	MM-NV12 Notification for mooring LNG carriers Notification of nearby residents 24 hours before the arrival of LNG carriers at night MM-NV13 Post-commissioning measurements Noise produced by the Gas Import Facility will be measured within six months of the beginning of commercial operation to confirm compliance with the Recommended Maximum Levels. Mitigation to be provided if levels are exceeded.	Low
NV10	Gas Import Jetty Works	The combined noise from the operation of Berth 1 (United Petroleum) and Berth 2 (Project) at Crib Point Jetty causes disturbance at sensitive receptors.	MM-NV11 Operational noise cumulative controls Noise mitigation included within the Project design to achieve NIRV recommended levels.	Low	MM-NV07 Managing cumulative noise impacts Consultation with EPA Victoria and United Petroleum	Low
NV11	Pipeline Works	The 24-hour operation of the Pakenham Delivery Facility causes an increase in noise affecting amenity at nearby sensitive receptors.	MM-NV10 Operational noise controls Noise mitigation included within Project design to achieve NIRV recommended levels	Low	No additional mitigation measures identified	Low
NV12	Pipeline Works	The combined noise from the operation of the Project and Pakenham East rail depot at Pakenham causes disturbance at sensitive receptors.	MM-NV11 Operational noise cumulative controls Noise mitigation included within the Project design to achieve NIRV recommended levels.	Low	MM-NV07 Managing cumulative noise impacts Consultation with EPA Victoria and The Department of Transport	Low
NV13	Gas Import Jetty Works and Pipeline Works	Vibration at sensitive receptors generated by the operation of Project infrastructure causes human disturbance.	No initial mitigation measures identified	Very low	No additional mitigation measures identified	Very low

13.7 Construction impacts

The Gas Import Jetty Works construction activity hours would be from 6 am to 6 pm on weekdays and from 6 am to 3:30 pm on Saturdays. Construction activity hours for the Pipeline Works would generally be from 6 am to 6 pm, seven days per week, with some activities requiring 24-hour works.

EPA Victoria publication 1254: *Noise control guidelines* specifies a method for using background levels to derive construction noise criteria for different time periods. The measured average background levels for each of the land area categories have been adopted when deriving the residential evening, weekend and night noise criteria.

These guidelines do not provide objectives for the EPA Victoria normal working hours (Monday to Friday: 7 am to 6 pm and Sat: 7 am to 1 pm) or for non-residential occupancies. The NSW EPA guidelines provide noise management levels that have been used to develop the construction noise criteria for the Project.

The construction noise criteria adopted for the assessment are shown in **Table 13-4**.

Table 13-4: Construction noise criteria adopted for the assessment

Sensitive receptor	Time of day	Construction noise criteria, L_{Aeq} dB(A)
EPA Victoria normal working hours (day)		
Residential	Mon to Fri: 7 am – 6 pm	75
Commercial buildings	Sat: 7 am – 1 pm	70
Educational institutions		60
Parks and recreational areas		65
Outside EPA Victoria normal working hours		
Rural residential – evening and weekend (<18 months)	Mon to Fri: 6 pm – 10 pm	45
Hastings – evening and weekend (<18 months)	Sat: 1 pm – 10 pm	50
Pakenham/Nar Nar Goon residential – evening and weekend (<18 months)	Sun/public holiday: 7 am – 10 pm	57
Rural residential – night	Mon to Sun: 10 pm – 7 am	27
Hastings – night		29
Pakenham/Nar Nar Goon residential – night		38
Residential – unavoidable out of hours work (HDD drilling and hydrostatic testing)	Mon to Fri: 6 pm – 7 am Sat: 1 pm – 7 am Sun/public holiday	Application of all feasible and reasonable work practices to reduce unacceptable levels of noise

Construction scenarios have been developed using the above information to assess impacts when noise is expected to be greatest (i.e. worst-case). The noise impacts from the proposed construction activities have been calculated and compared to the construction noise criteria for the working hours shown in **Table 13-4**.

Initial mitigation measures for managing construction noise and vibration impacts includes the following general good practice techniques:

- using the lowest-noise work practices and equipment that meet the requirements of the job
- locating site buildings, access roads and positioning plant so that minimum disturbance occurs to the locality
- installing broadband reversing alarms on construction vehicles and machinery in preference to 'beeper' reversing alarms – the site would also be planned to minimise the need for reversing of vehicles
- turning off plant and vehicles when not being used
- taking care not to drop spoil and construction materials that cause peak noise events
- limiting works to the arrival of staff on site and toolbox meetings between 6 am and 7 am – the use of loud equipment, generation of unnecessary noise and the movement of vehicles on the construction footprint would be minimised where possible
- undertake all reasonable and feasible actions to comply with levels derived using the method described in **Table 13-4**.

Where the construction noise and/or vibration criteria were predicted to be exceeded at sensitive receptor locations, the following onsite measures would be implemented to minimise the impact to affected receptors:

- adopting engineering noise controls at the source (such as silencer, mufflers, enclosures) by all practical means using current technology – assumed reduction of 10 dB to 15 dB
- selection of quieter equipment – assumed reduction of up to 5 dB
- installation of onsite barriers such as hoardings or temporary screens to provide a noise barrier between any particularly noisy construction works and the residences – assumed reduction of 5 dB to 10 dB
- respite periods by restricting the hours the very noisy activities can occur.

Offsite noise management measures would be implemented if construction noise is predicted to or does exceed the noise management levels (see mitigation measure MM-NV04) after all reasonable and feasible onsite mitigation measures have been incorporated.

Noisy works would generally be undertaken during EPA Victoria normal working hours as defined within EPA Victoria publication 1254: *Noise control guidelines* (that is, Monday to Friday: 7 am to 6 pm and Saturday: 7 am to 1 pm). However, some construction activities would need to be carried out outside EPA Victoria normal working hours as discussed further in the next sections.

13.7.1 Gas Import Jetty Works construction

Jetty Infrastructure works would include installing gas piping from the Crib Point Jetty to the Crib Point Receiving Facility and installing auxiliary infrastructure at Berth 2. The Jetty Infrastructure at Crib Point Jetty would be installed using construction barges and cranes as described in **Chapter 4** Project description.

Construction of the Crib Point Receiving Facility would be undertaken by specialist crews, including earthworks and civil construction, mechanical installation, and electrical and instrumentation works. The Gas Import Jetty Works would occur between 6 am to 6 pm weekdays and 6 am to 3:30 pm on Saturdays.

Works between 6 am to 7 am (EPA night hours) would be limited to the arrival of staff to construction compounds, staff briefings and preparation. Works that are inherently quiet or unobtrusive may be undertaken outside of EPA normal working hours. These types of work are unlikely to have a noise impact (if undertaken in accordance with MM-NV01) and have not been assessed.

Noise from the construction of the Crib Point Receiving Facility and Jetty Infrastructure may reduce amenity at nearby sensitive receptors such as residential properties, community buildings such as the Victorian Maritime Centre, at outdoor recreational land as well as public open spaces such as Woolleys Beach Reserve (Risk ID NV1).

Noise modelling predictions indicate that construction of the Gas Import Jetty Works would not exceed the day noise criteria (75 dB(A)). The 45 dB(A) criteria may be exceeded during the evening at nearby residences and public open spaces. These exceedances may occur in extenuating circumstances if works cannot cease by 6 pm due to the type of work activity, such as concrete pours. This may disturb residents living nearest to the Gas Import Jetty Works.

While noise levels from construction works at the jetty are not expected to exceed the day noise criteria, the nearest residences (approximately 700 to 1,300 metres away) may hear construction activities when outdoors during peak work periods. This could result in a minor disturbance to residents for short periods.

The noise levels during the construction of the Gas Import Facility are predicted to comply with nominated construction noise criteria of 70 dB(A) at the Victorian Maritime Centre. There may be periods where construction works are approximately 10 dB above the existing outdoor ambient noise levels. Works at this level are likely to be audible in the areas outside the museum. This is unlikely to result in disturbance at the museum as noise sensitive activities would typically occur indoors between the normal opening hours on Saturdays and Sundays between 10 am and 3 pm.

The closest park and recreational area to the construction works is Woolleys Beach Reserve. The closest usable area of the park to the proposed construction works is over 200 metres from the reserve where the noise level (L_{eq}) is calculated to be up to 66 dB(A) during bulk earthworks. It is therefore expected there would be periods where the noise level is above the adopted noise criteria and over 20 dB above the existing ambient noise levels. This would mean that construction noise would be clearly audible over other sounds at Woolleys Beach Reserve and HMAS Otama Lookout Beach. Visitors to the reserve are likely to be disturbed for short periods during these works.

Observing the general good practice techniques included within mitigation measure MM-NV01 would be important during periods of noisy work. Onsite mitigation would likely be required during periods of noisy work at Crib Point that occur outside EPA Victoria normal working hours. This includes onsite noise barriers, managing noise onsite before 7 am and offering temporary respite periods. The community would also be provided information about the duration and intensity of works before each stage of noisy work starts (see mitigation measure MM-SE01 in **Chapter 18 Social**).

13.7.2 Pakenham Delivery Facility construction

The residents located on Oakview Lane are approximately 250 metres from the proposed Pakenham Delivery Facility. Construction noise at these residences are predicted to comply with the proposed criteria during EPA Victoria normal working hours. Noise levels of up to 65 dB(A) are predicted during this time although the dwellings in this area are currently exposed to similar levels of continuous traffic noise from the Princes Highway and Princes Freeway. Accordingly, reduced amenity is not expected during EPA Victoria normal working hours.

Works planned during EPA Victoria evening/weekend hours are predicted to exceed the proposed criteria during the noisiest periods of work. A combination of onsite mitigation such as enclosures or barriers, selection of quieter machinery and the installation of silencers or mufflers on the noisiest items of machinery would be adopted to achieve the construction noise criteria. Periods of respite would be implemented to manage construction noise where source or path controls are not feasible or are deemed ineffective.

13.7.3 Pipeline construction

Construction of the pipeline would involve a wide range of construction activities. The potential for noise impacts varies considerably based on the nature of the activity and the plant and equipment used. Pipeline construction works would generally occur during EPA Victoria normal working hours, and evening and weekend noise guideline levels would also apply where works need to be undertaken during these periods. Pipeline construction works would be completed progressively, with generally short periods of disturbance.

Unavoidable work outside EPA Victoria normal working hours would be required during stages of horizontal directional drilling (HDD), horizontal boring and hydrostatic testing that require continuous operation. Potential noise impacts from pipeline construction during and outside EPA Victoria normal working hours are discussed in the next sections.

Pipeline construction – EPA Victoria normal working hours

The pipeline would pass a variety of sensitive receptors that includes residential, community buildings, educational institutions, parks and recreational spaces. This section discusses the potential noise impacts from the pipeline's construction on these receptors.

Residential

Construction noise levels during EPA Victoria normal working hours in Hastings have a higher likelihood to be above the construction noise criteria. The potential noise impact from the pipeline's construction has an initial risk rating of medium (Risk ID NV2). Residences within 50 metres of construction activities (approximately 14 identified along the pipeline alignment) would likely experience noise levels above the 75 dB(A) daytime noise criteria during certain periods. This is expected to affect residents in Hastings and rural areas.

Residents exposed to noise above 75 dB(A) risk being highly noise affected¹ and having an adverse response to noise. Consequently, construction noise mitigation and management would be required to minimise the degree to which these noisy works affect residents that are predicted to be affected.

Highly noise affected receptors would be provided with works notifications (such as letter box drops), individual briefings with the community engagement team and offers of respite, (such as pre-purchased movie, restaurant vouchers) where modelled or measured noise is above the proposed construction noise management levels (see mitigation measure MM-NV04).

¹ The highly noise affected level represents the point above which there may be strong community reaction to noise (NSW ICNG)

Residents may also be exposed to noise levels more than 10 dB above the existing ambient levels up to 200 metres from the works. These receptors may be moderately affected by construction noise. Impacts at this distance are expected to be more prevalent in rural areas where the existing ambient levels are lower and there is usually less acoustic shielding being provided by the built environment.

Each pipeline facility (Pakenham Delivery Facility, mainline valves and the End of Line Scraper Station) would also have a construction laydown area within the site location. Works at these sites is planned to only occur during EPA Victoria normal working hours. The predicted impacts from these ancillary construction works would be adequately managed by the measures in EPA Victoria publication 1254: *Noise control guidelines*.

The nearest residences on French Island are located more than five kilometres from the Crib Point Jetty and the pipeline alignment and are not expected to be impacted by construction noise.

Community buildings and educational institutions

The pipeline alignment would pass within 240 metres of the Toogoolawa School and 220 metres of Hastings Primary School. Most of the open-cut works in Hastings are calculated to exceed the outdoor noise criteria of 60 dB(A) for classrooms in schools and other educational institutions.

Construction scheduling would limit the timing of works during school hours to reduce potential noise impacts on students and teachers, for example with works being undertaken outside school hours or during school holidays. Consultation with Toogoolawa School and Hastings Primary School would ensure staff members and families were adequately briefed on the duration and predicted noise levels before works commence.

Parks and recreational spaces

Users of public open spaces including Woolleys Beach Reserve, Warringine Park and HMAS Otama Lookout Beach are predicted to experience construction noise above the 65 dB(A) noise criteria due to these spaces proximity to the pipeline construction. Open trenching pipeline construction activities near these open spaces would typically be completed in a few days, meaning there may be a short-term change to the local acoustic environment that is annoying to the users of these spaces.

Pipeline construction – outside EPA Victoria normal working hours

Specific elements of the pipeline construction are required to be undertaken outside EPA Victoria normal working hours (6 pm to 7 am), such as HDD and horizontal boring. Much of the proposed pipeline alignment crosses through rural areas so any loud construction activities, particularly at night, would likely be audible at nearby residences (Risk ID NV4). This means there is a high risk that construction works at night would exceed the Project noise criteria and cause sleep disturbance for nearby residents. All unavoidable night work would require approval by an independent and qualified representative appointed to the Project (see mitigation measure MM-NV02).

General works from 6 am to 7 am (during EPA Victoria night hours) would likely include the arrival of staff to construction compounds, staff briefings and works preparation. The use of loud equipment, generation of unnecessary noise and the movement of vehicles on the construction footprint would be restricted during this time.

HDD and horizontal boring

Unavoidable works at night may occur during HDD and horizontal boring as these methods require continuous operation during the pullback phase to avoid borehole collapse. Construction works at these sites would generally last for six weeks, depending on ground and weather conditions, although night works would comprise a shorter period of this total timeframe (around one to two weeks depending on the location).

The 20 HDD and horizontal boring construction sites modelled for the assessment are shown in **Figure 13-3**.

An exterior noise level of $L_{Aeq(15-min)} 55\text{ dB(A)}$ was selected to help identify receptors likely to have their sleep disturbed by unavoidable night-time construction works. This level is approximately 20 to 25 dB above the existing background level. It is expected that receptors exposed to noise levels above this threshold would require offsite management measures in addition to onsite noise control.

At most of the modelled sites, less than five residential receptors would be exposed to an exterior noise level above $L_{Aeq(15-min)} 55\text{ dB(A)}$. At modelled HDD sites at Warringine Creek and Hastings, up to 30 residential receptors would be affected by construction noise above this level.

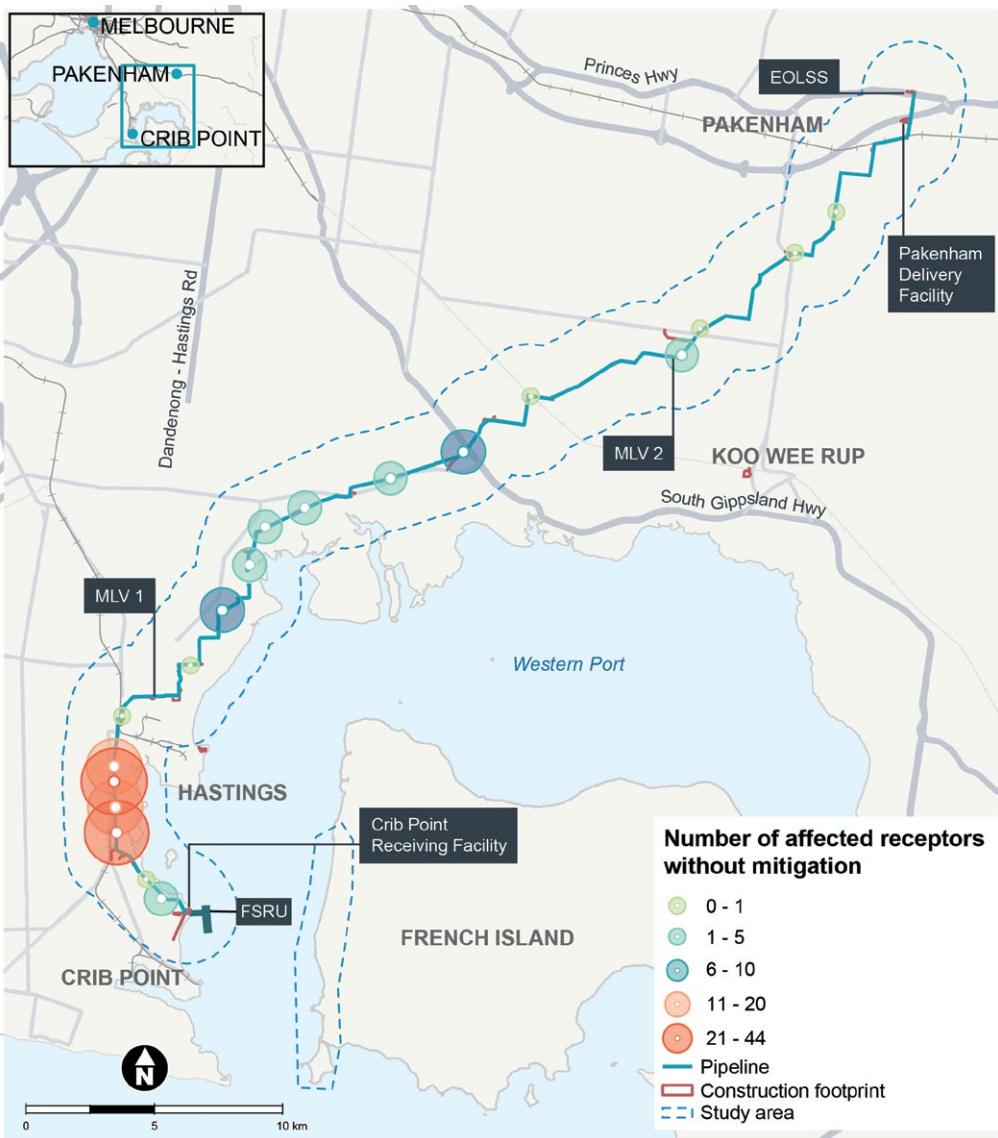


Figure 13-3: Modelled HDD sites showing number of affected residential receptors where night-time noise guideline levels would be exceeded without mitigation

To mitigate the effects of unavoidable night-time noise, site-specific acoustic treatment of noise intensive HDD activities have been factored into the construction planning. Temporary onsite mitigation such as acoustic screens or enclosures would be installed to achieve a minimum of 10 dB noise reduction at the following HDD sites (see mitigation measure MM-NV05):

- Warringine Park – northern work site
- along the railway corridor – southern end of Hastings
- along the railway corridor – northern end of Hastings
- beneath Kings Creek along the railway corridor.

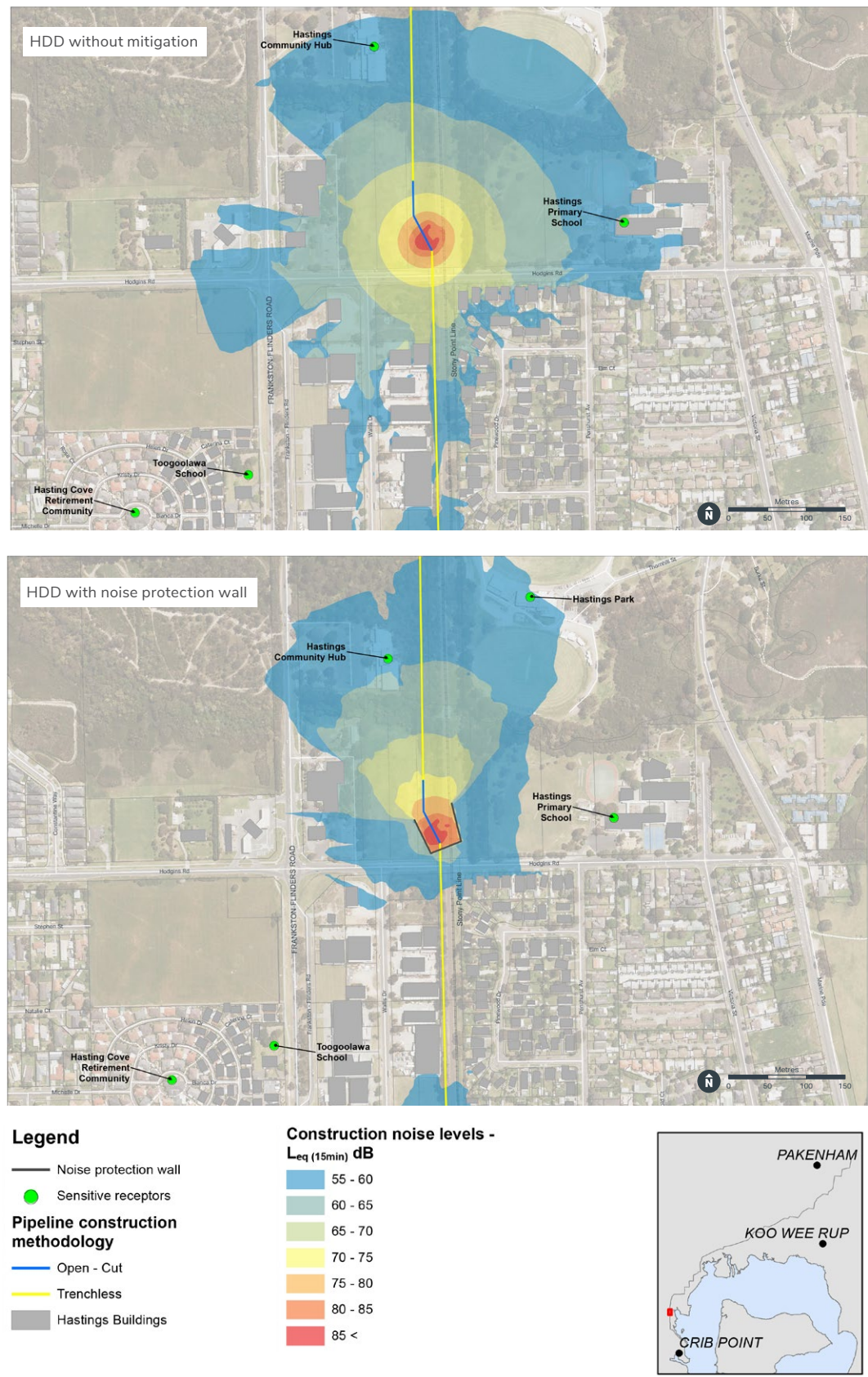
Stationary equipment such as generators and pumps would be stored within shipping containers or suitable acoustic enclosures at all sites. **Figure 13-4** shows an example of the effectiveness of reducing the noise extent with the use of acoustic treatments.

There is a risk that noise levels would remain at a level unacceptable to some residents. In these circumstances, offsite noise management measures at residential properties (see mitigation measure MM-NV04) are recommended where the measured or predicted levels exceed $L_{Aeq(15min)} > 55 \text{ dB(A)}$.

Further noise monitoring of unavoidable night-time construction works (HDD and horizontal boring) would be undertaken to confirm compliance with the noise management and modelling outputs (see mitigation measure MM-NV06) during the construction planning stage.

The application of the mitigation measures referred to above would reduce the risk of amenity loss from high to medium.

▼ **Figure 13-4:** Noise contours with and without mitigation measures, along the rail corridor at the northern end of Hastings



Hydrostatic testing

Hydrostatic testing, as part of the pipeline testing and commissioning phase, would include overnight works. While the testing takes approximately eight days for a single test section, most of this time is required to fill the test section with water using a pump, which is not a noisy activity.

Pressure testing is the loudest part of the hydrostatic testing and lasts for approximately four hours. Noise from pressure testing would only occur at the ends of the test section. Due to the noisy nature of pressure testing, this activity would only be performed during day-time hours and test end points would be located outside the Hastings main residential area.

Following pressure testing, the pipeline section would be subjected to leak testing, dewatering and drying. These works are considered unavoidable out-of-hours works. The testing must run continuously to meet the pipeline safety requirements. Dewatering and drying would be the noisiest night-time activity, requiring the operation of a water pump and compressor as well as a generator.

Residential receptors could be affected within 130 metres from hydrostatic testing at any location along the pipeline. Residents located in Hastings are at the highest risk of being impacted due to the higher population density and proximity to the testing.

The community would be provided information about the duration and intensity of works before works started and a complaints management system would be available so the Project team can be contacted if disturbance is unacceptable (see mitigation measures MM-SE01 and MM-SE02 in **Chapter 18 Social**).

Specific noise management measures (see mitigation measure MM-NV04) include providing residents with works notifications, individual briefings or offers of respite when the locations of hydrostatic testing sites are known.

13.7.4 Construction vibration

Construction activities have the possibility of causing vibration impacts to sensitive receptors within the study area (Risk ID NV6) and to affect structural integrity of buildings (Risk ID NV7). It is possible that vibration would be above perceptible levels at nearby receptors as there are approximately 100 sensitive buildings noted within 100 metres of the works. The risk of adverse vibration impacts on humans and structures is low because of the types of proposed construction activities and the likelihood that safe working distances could be maintained throughout a majority of the works (see mitigation measure MM-NV03).

Vibration impacts and management of the effects would be further mitigated through selection of equipment that would cause lower levels of vibration (see mitigation measure MM-NV08), vibration monitoring of sensitive properties/structures (see mitigation measure MM-NV06) and condition surveys of such properties (see mitigation measure MM-NV09).

This would include documenting and recording the condition of nearby sensitive structures, including photographs of any pre-existing cosmetic or structural damage to determine if rectification may be required. For example, a condition survey would be undertaken of the former BP Refinery Administration Building H1016, which is listed on the Victorian Heritage Register and considered a sensitive structure. Further discussion on this building is provided in **Chapter 22 Historic heritage**.

13.7.5 Cumulative construction noise impacts

Construction works occurring in the same area at the same time or sequentially may lead to an increased noise impact on sensitive receptors. This impact may be through increased noise levels from the construction activities themselves, an increase in construction traffic on local roads or construction fatigue which can occur after prolonged periods of exposure to construction noise and vibration (Risk ID NV5).

Construction of the Jetty Infrastructure and Crib Point Receiving Facility may be undertaken at the same time as planned upgrade works to the Crib Point Jetty, which the Port of Hastings Development Authority (PoHDA) would undertake under a separate set of approvals. Noise criteria and mitigation measures for this project are outlined in the *Crib Point Jetty Upgrade Port of Hastings Development Authority Environment Management Plan* (21 September 2019). The measures in the plan are similar to those outlined in mitigation measure MM-NV01.

Similarly, construction of the pipeline and Pakenham Delivery Facility may overlap with Healesville-Koo Wee Rup Road upgrades.

While the timing of these activities and how they may overlap with the Project construction works is not yet known, there is a medium risk of adverse impacts. A documented communication protocol between each Project component and the other construction projects in the area would be prepared in consultation with the EPA Victoria. Plans to manage the duration and intensity of construction noise impacts at the relevant receptor locations would be developed during construction planning (see mitigation measure MM-NV07).

13.8 Operation impacts

Noise generated by the Project's operation would include continuous noise from the Pakenham Delivery Facility, Crib Point Receiving Facility and the FSRU. The pipeline itself would not emit any audible noise or vibrate during operation due to the rigorous engineering requirements for pipelines in Victoria. Combined noise from the Project and other nearby industrial activities (not associated with the Project) could also result in a cumulative increase in noise.

EPA Victoria provides noise assessment procedures to protect people from industrial noise that may affect normal domestic and recreational activities, including sleep at night. The EPA publications aim to balance the needs of industry with the protection of sensitive uses, which is why different levels apply depending on the planning land use zoning and the amount of background noise in the area.

The approach to managing noise from commercial industrial or trade premises is different for metropolitan Melbourne and regional Victoria. NIRV provides the method for setting noise levels for industry operation in regional Victoria. The criteria used for assessing Project compliance are called the Recommended Maximum Levels.

Recommended Maximum Levels derived using NIRV for nearby residential locations are summarised in **Table 13-5** and **Table 13-6**. The lowest of the average background levels (LA90) have been used to calculate the Recommended Maximum Levels. These background levels are shown in Appendix B of the EES Technical Report H: Noise and vibration impact assessment.

Table 13-5: Recommended Maximum Levels – Gas Import Facility

Noise-sensitive receptor	NIRV Recommended Maximum Levels $L_{Aeq,30min}$ dB		
	Day	Evening	Night
103 The Esplanade	45	42	35
43 Disney Street	48	43	36
132 The Esplanade	47	42	35
French Island residential locations	45	37	32

Table 13-6: Recommended Maximum Levels – Pakenham Delivery Facility

Noise-sensitive receptor	NIRV Recommended Maximum Levels $L_{Aeq,30min}$ dB		
	Day	Evening	Night
220 Oakview Lane	55	51	49
240 Oakview Lane	55	51	49
90 Mt Ararat S Road	53	53	41

Initial mitigation measures have been incorporated into the Project design to manage these risks and meet the intentions of the EPA Victoria NIRV guidelines (see mitigation measures MM-NV10 and MM-NV11).

In addition, the potential cumulative impacts of these modelled scenarios with the operation of the United Petroleum vessel offloading products at Berth 1 of Crib Point Jetty were also considered (Risk ID NV10).

The risk of human disturbance due to ground vibration generated by the Project's operation is considered negligible as the plant and pipeline would be constructed in accordance with relevant engineering requirements.

13.8.1 Operational noise at Crib Point Jetty

Five scenarios were modelled to predict 'worst-case' noise propagation for the operation of the Gas Import Jetty Works. These scenarios take into consideration the FSRU, LNG carriers arriving and departing from the Crib Point Jetty and nitrogen injection into the gas pipeline at the Crib Point Receiving Facility.

The preferred operating regasification mode of the FSRU is open loop. However, closed loop operation has been adopted for the majority of the worst-case noise modelling scenarios due the additional noise produced by the boilers to heat the water inside FSRU. The purpose of doing this is to present a conservative assessment of potential operational noise impacts from the FSRU.

The modelled scenarios comprise:

- Scenario 1 (with LNG carrier berthing – closed loop) (Risk ID NV9):
 - FSRU regasification in closed loop mode with three regasification trains operating (peak operation)
 - the arrival or departure of LNG carriers at Crib Point Jetty requiring the use of up to four tugboats operated by PoHDA to bring the LNG carrier in to moor safely next to the FSRU – the assessment assumes that LNG carriers may arrive during the night
 - nitrogen injection at the Crib Point Receiving Facility.
- Scenario 2 (LNG carrier berthed – closed loop) (Risk ID NV8):
 - FSRU regasification in closed loop mode with three regasification trains operating (peak operation)
 - LNG carrier berthed adjacent to the FSRU
 - nitrogen injection at the Crib Point Receiving Facility.
- Scenario 3 (FSRU operation – closed loop) (Risk ID NV8):
 - FSRU regasification in closed loop mode with two regasification trains operating (typical operation)
 - nitrogen injection at the Crib Point Receiving Facility.
- Scenario 4 (LNG carrier berthed – open loop) (Risk ID NV8):
 - FSRU regasification in open loop mode with three regasification trains operating (peak operation)
 - LNG carrier berthed adjacent to the FSRU
 - nitrogen injection at the Crib Point Receiving Facility.
- Scenario 5 (FSRU operation and nitrogen offloading – closed loop) (Risk ID NV8):
 - FSRU regasification in closed loop mode with two regasification trains operating (typical operation)
 - nitrogen injection at the Crib Point Receiving Facility
 - Nitrogen unloading at the Crib Point Receiving Facility (planned activity for daytime and evenings only).

The noise modelling assumptions used to forecast noise emissions for the Project were based on design requirements, manufacturers data and measurements of similar operations in other parts of the world.

The modelling results show that operating noise levels would comply with the day or evening Recommended Maximum Levels for the modelled scenarios without mitigation at the nearest sensitive receptors to the Crib Point Jetty.

All modelled scenarios are predicted to comply with the Recommended Maximum Levels. Typical operation (approximately 300 days per year) is predicted to achieve compliance for the open and closed loop scenarios. Nitrogen offloading at the Crib Point Receiving Facility would occur during the day and evening. Accordingly, noise levels caused by nitrogen offloading have not been considered in the assessment of night-time impacts.

Changes in ambient noise level are expected to be noticeable at Woolleys Beach Reserve and at the Victorian Maritime Centre. Both of these receptors are located closer to the Project infrastructure than nearby residential locations.

With initial mitigation measures (engineering controls including the selection of quiet equipment, enclosures and exhaust silencers) applied to achieve the Recommended Maximum Levels and the intent of NIRV (see mitigation measure MM-NV10), the risk of causing an increase in noise affecting amenity at nearby sensitive receptors is low. Recommended Maximum Levels and noise modelling results at noise sensitive receptors near the Gas Import Jetty Works for each modelled scenario with initial mitigation measures applied are summarised in **Table 13-7**.

Table 13-7: Recommended Maximum Levels and modelling results for Gas Import Jetty Works operation with noise mitigation – most affected receptors (within 10 metres of the building)

Address	Recommended Maximum Levels [$L_{Aeq,30min}$ dB(A)]			Modelled Project contribution for each scenario [$L_{Aeq,30min}$ dB(A)]				
	Day	Evening	Night	1: with LNG carrier mooring	2: LNG carrier berthed	3: FSRU operation	4: LNG carrier berthed	5: LNG carrier berthed and nitrogen unloading
				Closed loop	Closed loop	Closed loop	Open Loop	Closed loop
132 The Esplanade	47	42	35	35	34	30	33	38
43 Disney Street	48	43	36	31	30	29	29	32
103 The Esplanade	45	42	35	35	35	34	34	35
French Island	45	37	32	22	<20	<20	<20	22
Victorian Maritime Centre	No criteria applicable			48	48	48	46	52
Woolleys Beach Reserve				46	46	46	45	52
HMAS Otama Lookout Beach				44	44	44	43	49
Jacks Beach Reserve				26	26	26	24	27

Figure 13-5 shows the noise contours for the operation of the Gas Import Jetty Works with an LNG carrier mooring (Scenario 1) with mitigation applied.

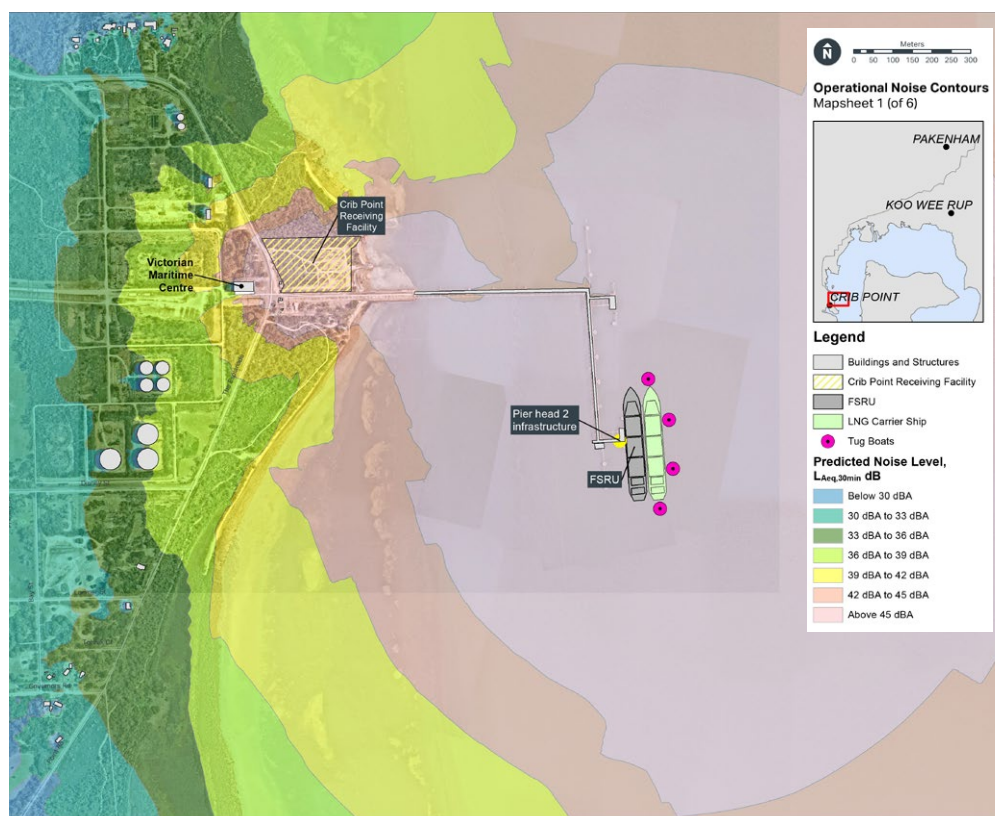


Figure 13-5: Noise contours with mitigation measures applied – Scenario 1 operation of FSRU, Crib Point Receiving Facility, LNG carrier and assisted mooring

Although compliance with the Recommended Maximum Levels is predicted, there is some uncertainty regarding the potential variability in noise impacts when the LNG carrier is being moored and when gas is being offloaded. Mooring could occur anytime throughout the day, however, the likelihood of a night arrival of an LNG carrier and peak FSRU regasification occurring at the same time is low.

Residents within 1.5 kilometres of the FSRU would be notified at least 24 hours before the planned arrival of an LNG carrier between 10 pm and 7 am (see mitigation measure MM-NV12). These notifications would be undertaken until measured noise levels post-commissioning of the gas import facility demonstrate compliance with the Recommended Maximum Levels (MM-NV13).

Accordingly, noise produced by the gas import facility would be measured within six months of the beginning of commercial operation to confirm compliance with the Recommended Maximum Levels and to account for potential variability in the noise generated by arriving LNG carriers.

Noise measurements would be undertaken in accordance with current EPA Victoria requirements, with mitigation actions taken as soon as practicable in the event the Recommended Maximum Levels have been exceeded.

Cumulative noise from other operations at the jetty mean that there is a risk that the Recommended Maximum Levels could be exceeded when the landside pump is offloading petroleum from a ship docked at Berth 1 (United Petroleum operations).

The Project has incorporated mitigation measures that are predicted to achieve noise levels that are three decibels below the Recommended Maximum Levels during normal operation (Scenario 3) at all locations except 103 The Esplanade, Crib Point (one decibel below criteria). However, there are likely to be times when receptors located on the Esplanade are exposed to noise impacts above the Recommended Maximum Levels if operations at Berth 1 of the Crib Point Jetty associated with United Petroleum were operating at the same noise level or higher than the gas import facility.

AGL would engage with the EPA to plan and implement a future compliance plan to achieve the Recommended Maximum Levels when the Project is operating at the same time as United Petroleum (see mitigation measure MM-NV11). Where required, the Proponent will also engage with other infrastructure operators on the jetty and surrounds to offset noise sources contributing to potential cumulative impacts. This would occur during the detailed design and operational phase of the Project (MM-NV07).

13.8.2 Operational noise at Pakenham Delivery Facility

The Pakenham Delivery Facility would operate 24 hours per day, 7 days per week, which has the potential to increase noise impacts on nearby sensitive receptors (Risk ID NV11). All site operations, including three filters, three control valves, three gas heaters and pipework were modelled as operating simultaneously.

The modelling indicates that several sensitive receptors near the Pakenham Delivery Facility may experience noise levels higher than the evening and night-time Recommended Maximum Levels. The gas heaters contribute most to the total level at affected sensitive receptors.

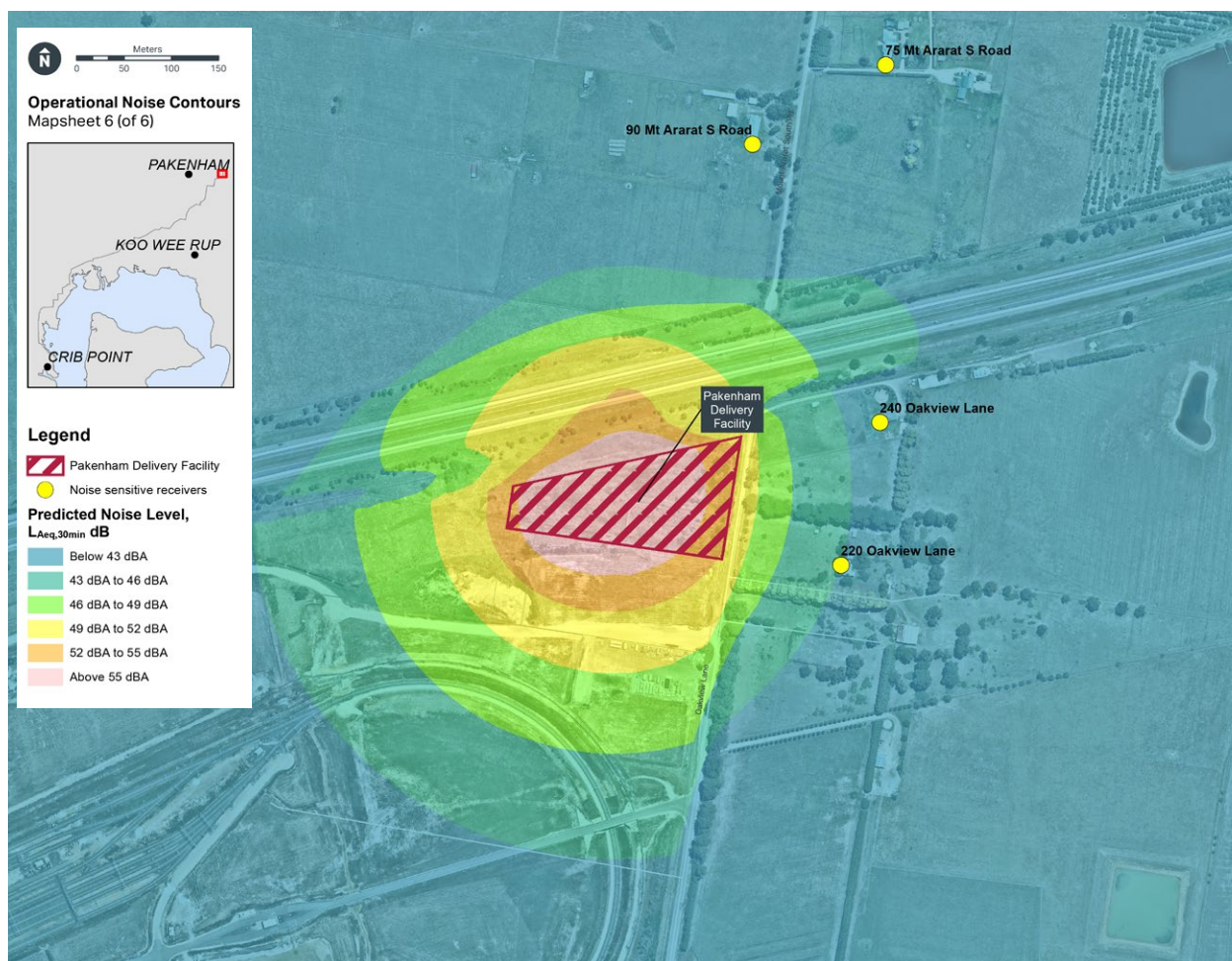
Engineering controls (mufflers, and enclosure, noise walls or quieter equipment) would be incorporated into the design to reduce the noise from each gas heater by 8 dB. With initial mitigation measures applied to achieve the Recommended Maximum Levels, the risk of impacting acoustic amenity at nearby sensitive receptors would be low.

Recommended Maximum Levels and noise modelling results at residential receptors near the Pakenham Delivery Facility with initial mitigation measures applied are provided in **Table 13-8**. The noise contours for the operation of the Pakenham Delivery Facility with mitigation applied are shown in **Figure 13-6**.

Table 13-8: Recommended Maximum Levels and modelling results with mitigation
– most affected receptors near the Pakenham Delivery Facility

Noise-sensitive receptor	Recommended Maximum Levels ($L_{Aeq,30min}$), dB(A)			Predicted level ($L_{Aeq,30min}$), dB(A)
	Day	Evening	Night	
220 Oakview Lane	55	51	49	46
240 Oakview Lane	55	51	49	45
90 Mt Ararat S Road	56	55	45	39
75 Mt Ararat S Road	58	57	47	34
155 Oakview Lane	55	51	49	36

▼ **Figure 13-6:** Predicted operational noise levels for the Pakenham Delivery Facility after mitigation



There is also a low risk the combined noise from the Pakenham Delivery Facility and the adjacent Pakenham East rail depot may result in non-compliance with the Recommended Maximum Levels applied to cumulative noise (Risk ID NV12) even if each facility individually complies with their operational noise requirements.

To ensure the Pakenham Delivery Facility meets the Recommended Maximum Levels even with cumulative industry noise, noise controls for the facility would be designed and implemented to achieve the guideline recommendations of EPA Victoria publication 1413 – Applying NIRV to proposed and existing industry.

Additional cumulative impact management strategies would be developed in consultation with the EPA Victoria if required (see mitigation measure MM-NV11).

13.9 Mitigation measures

Table 13-9 sets out the mitigation measures developed for the noise and vibration impact assessment.

Table 13-9: Mitigation measures – noise and vibration

Mitigation measure ID	Mitigation measures	Works area	Project phase
MM-NV01	<p>Managing noise and vibration from construction activities</p> <p>Construction noise and vibration will be managed with reference to Section 2 (Construction and Demolition Site Noise) of EPA Publication 1254 Noise Control Guidelines and Section 5 (Noise and vibration) of EPA Publication 480 Environmental Guidelines for Major Construction Sites. This includes the development of a plan to manage noise and vibration during construction in consultation with the EPA Victoria.</p> <p>The plan will include the following general good practice measures:</p> <ul style="list-style-type: none"> • using the lowest-noise work practices and equipment that meet the requirements of the job • locating site buildings, access roads and positioning plant such that the minimum disturbance occurs to the locality • installing broadband reversing alarms on construction vehicles and machinery in preference to 'beeper' reversing alarms – the site will also be planned to minimise the need for reversing of vehicles • turning off plant and vehicles when not being used • taking care not to drop spoil and construction materials that cause peak noise events • limiting works to the arrival of staff on site and toolbox meetings between 6am and 7am – the use of loud equipment, generation of unnecessary noise and the movement of vehicles on the construction footprint will be minimised where possible • undertaking all reasonable and feasible actions to comply the construction noise criteria derived using the method described in MM-NV02. <p>Where the construction noise levels are predicted or measured to be exceeded at sensitive receptor locations, all reasonable and feasible mitigation measures will be implemented to minimise the impact on the receptors, including the following onsite mitigation measures where required:</p> <ul style="list-style-type: none"> • adopting engineering noise controls at the source (e.g. silencer, mufflers, enclosures) by all practical means using current technology – assumed reduction of 10 dB to 15 dB • selection of quieter equipment – assumed reduction of up to 5 dB • installation of onsite barriers such as hoardings or temporary screens to provide a noise barrier between any particularly noisy construction works and the residences - assumed reduction of 5 dB to 10 dB • respite periods by restricting the hours that the very noisy activities can occur. 	Gas Import Jetty Works and Pipeline Works	Construction

Mitigation measure ID	Mitigation measures	Works area	Project phase			
MM-NV02	Construction noise criteria Onsite noise mitigation measures will be implemented if construction noise is predicted to or does exceed the following construction noise criteria.	Gas Import Jetty Works and Pipeline Works	Construction			
	<table><tr><th>Target area</th><th>Time of day</th><th>Construction noise criteria [L_{Aeq(15-min)} dB]</th></tr></table>			Target area	Time of day	Construction noise criteria [L _{Aeq(15-min)} dB]
	Target area			Time of day	Construction noise criteria [L _{Aeq(15-min)} dB]	
	EPA normal working hours					
	Residential			Mon-Fri: 7 am – 6 pm	75	
	Educational institutions			Sat: 7 am – 1 pm	60	
	Parks and recreational areas				65	
	Community and commercial buildings				70	
	Outside of EPA normal working hours					
	Residential - Evening and weekend			Mon-Fri: 6 pm – 10 pm Sat: 1pm – 10 pm Sun/Public Holiday: 7 am – 10 pm	Noise level at any residential premises not to exceed background (LA90, dB) noise by: <ul style="list-style-type: none">10 dB(A) or more for up to 18 months after Project commencement	
Residential – Night	Mon-Sun: 10 pm – 7 am	Noise inaudible within a habitable room of any residential premises Noise level at any residential premises not to exceed background (LA90, dB) noise by 0 dB.				
Residential – Unavoidable night works	Mon-Sun: 10 pm – 7 am	Application of all feasible and reasonable work practices to reduce unacceptable levels of noise				
An independent and qualified Project representative will be appointed to review and approve unavoidable night work (10 pm to 7 am) applications.						
MM-NV03	Vibration safe working distances Additional management measures will be required where occupancies, structures and assets are within the safe working distances derived using the values in the following standards: <ul style="list-style-type: none">British Standard BS 6472-1:2008 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting – Table 1 Vibration dose value ranges which might result in various probabilities of adverse comment within residential buildingsGerman Standard DIN4150-3:2016-12: Table 1 – Guideline values for vibration velocity for evaluating the effects of short-term vibration on structuresGerman Standard DIN4150-3:2016-12: Table 3 – Guideline values for vibration velocity for evaluating the effects of short-term vibration on buried pipeworkAn asset owner's utility standards.	Gas Import Jetty Works and Pipeline Works	Construction			

Mitigation measure ID	Mitigation measures	Works area	Project phase																																							
MM-NV04	<p>Offsite noise management measures</p> <p>Offsite management measures will be considered where measured or predicted construction noise exceeds noise management levels for an extended period of time.</p> <p>Levels in the following table are not noise limits but represents an action to minimise the noise impact at the receptor after all reasonable and feasible measures have been implemented to manage construction noise impacts onsite.</p> <table><tr><th>Time period</th><th>Noise management levels</th><th>Management measures</th></tr><tr><td colspan="3">$L_{Aeq(15\text{ min})}$</td></tr><tr><td colspan="3">EPA normal working hours</td></tr><tr><td>Mon-Fri: 7am - 6pm</td><td>External construction noise level: $L_{Aeq(15min)} > 75dB(A)$</td><td>Works notification</td></tr><tr><td>Sat: 7am - 1pm</td><td></td><td></td></tr><tr><td colspan="3">EPA evening/weekend hours and public holidays</td></tr><tr><td>Mon-Fri: 6pm - 10pm</td><td>External construction noise level: $L_{Aeq(15min)} > LA90$,</td><td><ul style="list-style-type: none">• Works notification• Individual briefings• Specific notification• Respite offer</td></tr><tr><td>Sat: 1pm - 10pm</td><td>Evening + 10 dB</td><td></td></tr><tr><td>Sun/Public Holiday: 7am - 10pm</td><td></td><td></td></tr><tr><td colspan="3">EPA night hours</td></tr><tr><td>Mon-Sun: 10pm - 7am</td><td>External construction noise level: $L_{Aeq(15min)} > LA90$, night + 5 dB</td><td><ul style="list-style-type: none">• Works notification• Individual briefings• Specific notification• Respite offer</td></tr><tr><td colspan="3">EPA unavoidable works at night</td></tr><tr><td>Mon-Sun: 10pm - 7am</td><td>External construction noise level: $LAeq(15min) > 55\text{ dB}$ Noise will be predicted or measured above 55 dB(A) for two or more nights to justify the application of management measures. Residents with special requirements will be consulted with on a case-by-case basis.</td><td>Targeted engagement with impacted residents to discuss individual mitigation options. Options include:<ul style="list-style-type: none">• Provision of ear plugs or noise cancelling headphones• Offer of respite• Offer of relocation in accordance with a Project relocation policy.</td></tr></table>	Time period	Noise management levels	Management measures	$L_{Aeq(15\text{ min})}$			EPA normal working hours			Mon-Fri: 7am - 6pm	External construction noise level: $L_{Aeq(15min)} > 75dB(A)$	Works notification	Sat: 7am - 1pm			EPA evening/weekend hours and public holidays			Mon-Fri: 6pm - 10pm	External construction noise level: $L_{Aeq(15min)} > LA90$,	<ul style="list-style-type: none">• Works notification• Individual briefings• Specific notification• Respite offer	Sat: 1pm - 10pm	Evening + 10 dB		Sun/Public Holiday: 7am - 10pm			EPA night hours			Mon-Sun: 10pm - 7am	External construction noise level: $L_{Aeq(15min)} > LA90$, night + 5 dB	<ul style="list-style-type: none">• Works notification• Individual briefings• Specific notification• Respite offer	EPA unavoidable works at night			Mon-Sun: 10pm - 7am	External construction noise level: $LAeq(15min) > 55\text{ dB}$ Noise will be predicted or measured above 55 dB(A) for two or more nights to justify the application of management measures. Residents with special requirements will be consulted with on a case-by-case basis.	Targeted engagement with impacted residents to discuss individual mitigation options. Options include: <ul style="list-style-type: none">• Provision of ear plugs or noise cancelling headphones• Offer of respite• Offer of relocation in accordance with a Project relocation policy.	Gas Import Jetty Works and Pipeline Works	Construction
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Mitigation measure ID	Mitigation measures	Works area	Project phase
MM-NV05	<p>HDD noise control</p> <p>A minimum of 10 dB noise reduction will be installed adjacent to the following HDD sites:</p> <ul style="list-style-type: none"> • HDD Location 4: Warringine Park (northern work site) • HDD Location 5: Along the railway corridor, southern end of Hastings • HDD Location 6: Along the railway corridor, northern end of Hastings • HDD Location 7: Beneath Kings Creek along the railway corridor. <p>Stationary equipment such as generators and pumps will be stored within shipping containers or suitable acoustic enclosures at all HDD locations. The impacts and the design of site-specific mitigation will be determined prior to construction works via acoustic modelling and confirmed during construction via onsite monitoring.</p>	Pipeline Works	Design and Construction
MM-NV06	<p>Noise and vibration monitoring</p> <p>Noise and vibration monitoring will be undertaken during construction at:</p> <ul style="list-style-type: none"> • the nearest noise sensitive residential property or properties impacted by out-of-hours works to confirm compliance with the construction noise criteria and to confirm modelling outputs • the nearest building or assets that are within derived set back distances for structural damage • where an asset owner's utility standards are at risk of being exceeded. <p>A response plan will be developed to manage potential impacts if nominated criteria are exceeded, including:</p> <ul style="list-style-type: none"> • actions taken to rectify the exceedance • actions to minimise risk of reoccurrence • name of person(s) responsible for undertaking the required actions. <p>The duration of the monitoring will be determined by a suitably qualified acoustic consultant.</p>	Gas Import Jetty Works and Pipeline Works	Construction
MM-NV07	<p>Managing cumulative noise impacts</p> <p>The EPA will be consulted during detailed design and the construction planning phase for the purpose of managing cumulative noise impacts associated with the following projects:</p> <ul style="list-style-type: none"> • Pakenham East rail depot construction and operation (Department of Transport) • Healesville-Koo Wee Rup Road upgrade construction (Major Road Projects Victoria and the principal contractor) • Crib Point Jetty upgrade construction works (Port of Hasting Development Authority) • Crib Point Jetty operation (United Petroleum). <p>The Project will (construction only):</p> <ul style="list-style-type: none"> • avoid overlap of sensitive works at night and other periods where excessive noise and vibration is likely • incorporate a requirement within the Stakeholder Engagement Management Strategy to notify residents of any unavoidable project overlaps and the potential impact to the community. 	Gas Import Jetty Works and Pipeline Works	Design, construction and operation
MM-NV08	<p>Managing impacts from ground vibration</p> <p>The following management measures will be applied when the setback distances derived using MM-NV03 are encroached:</p> <ul style="list-style-type: none"> • substitution of high vibration producing rock breakers, rollers or compactors for models that produce lower levels of vibration (applicable between Reid Parade and Graydens Road Hastings) • consultation with above and below ground utility asset owners to establish construction vibration limits to maintain asset integrity • vibration monitoring of sensitive buildings / structures inside safe working distances • condition survey of properties within safe working distances. 	Gas Import Jetty Works and Pipeline Works	Construction
MM-NV09	<p>Condition surveys</p> <p>Condition surveys will be undertaken for sensitive buildings and assets that are within the derived set back distances for structural damage.</p>	Gas Import Jetty Works and Pipeline Works	Construction

Mitigation measure ID	Mitigation measures	Works area	Project phase
MM-NV10	Operational noise controls The Gas Import Jetty Works and Pakenham Delivery Facility will identify and specify practical measures for minimising noise to achieve the intent of EPA Publication 1411 - <i>Noise from Industry in Regional Victoria</i> in consultation with EPA.	Gas Import Jetty Works and Pipeline Works	Operation
MM-NV11	Operational noise cumulative controls Noise from the Project when operating near existing industry will be managed in accordance with Section 5 - Managing Noise from Multiple Premises within the EPA Publication 1413 - <i>Applying NIRV to Proposed and Existing Industry</i> where relevant. Where required, other infrastructure operators on the jetty and Project surrounds will be engaged to offset noise sources contributing to potential cumulative impacts. Additional cumulative impact management strategies will be developed in consultation with EPA, if required.	Gas Import Jetty Works and Pipeline Works	Operation
MM-NV12	Notification for mooring LNG carriers If the verification noise monitoring demonstrates that the night time Recommended Maximum Levels have not yet been met, residents within 1.5 kilometres of the FSRU will be notified at least 24 hours before the planned arrival of an LNG carrier between 10 pm and 7 am. Project communications resources such as the Project website will include a link to the Port of Hastings Development Authority Weekly Shipping List. This list provides a forecast for the ships that are expected to be in Port each week.	Gas Import Jetty Works	Operation
MM-NV13	Post-commissioning measurements Noise produced by the Gas Import Facility will be measured within six months of the beginning of commercial operation to confirm compliance with the Recommended Maximum Levels. Noise measurements will be undertaken in accordance with current Victorian EPA requirements to verify compliance with the Recommended Maximum Levels applied at 132 The Esplanade Crib Point, 43 Disney Street Crib Point and 103 The Esplanade Crib Point. Onsite noise mitigation (administrative, operating or engineering controls) will be taken as soon as practicable if the measured noise levels demonstrate that the Recommended Maximum Levels are exceeded. Offsite noise mitigation (noise screening, offers of respite during noisy periods of work or architectural acoustic treatment to the exterior of rooms used for sleeping) will be considered where onsite noise mitigation cannot be feasibly constructed to reduce external noise to below the Recommended Maximum Levels.	Gas Import Jetty Works	Operation

13.10 Conclusion

Sensitive receptors that could be affected by construction and operation noise were identified throughout the study area.

Noise monitoring of the existing noise environment throughout the study area was used to establish background noise levels and develop the construction noise criteria and the Recommended Maximum Levels for operation of the Project.

Noise and vibration during the pipeline's construction would reduce amenity in some circumstances, although disruption to receptors would generally be for a short timeframe due to the linear progression of the pipeline construction. Construction works would generally be conducted during EPA Victoria normal working hours and managed in the first instance through adherence with the good practice construction techniques included within EPA publication 1254 – *Noise control guidelines* and EPA Victoria publication 480 – *Best practice environmental management – Environmental guidelines for major construction sites*.

Out of hours work would require onsite mitigation measures (see mitigation measure MM-NV01) during periods of noisy work to achieve the construction noise criteria (see mitigation measure MM-NV02). Offsite management measures have been recommended where the construction noise criteria cannot be achieved using all reasonable and feasible onsite mitigation measures (see mitigation measure MM-NV04).

Where construction works such as HDD, horizontal boring and hydrostatic testing are required to be undertaken during night hours, these works would need to be approved by an independent representative appointed to the Project as this work has a high risk of causing disruption to nearby residents. Noise control measures would be put in place for HDD locations within highly populated areas such as Hastings to lower this risk. When onsite mitigation measures cannot control noise emissions, offsite management measures would be implemented in consultation with affected residents.

Operational facilities would be designed to meet the Recommended Maximum Levels as per EPA Victoria publication 1411 – *Noise from industry in regional Victoria* and EPA Victoria publication 1413 – *Applying NIRV to proposed and existing industry*. Initial mitigation measures have been incorporated into the design to achieve the intent of the NIRV including cumulative noise impacts from nearby industry. Additional cumulative impact management strategies will be developed in consultation with EPA, if required.

Operational noise at Crib Point is predicted to be closest to the Recommended Maximum Levels at night when the PoHDA tugboats are assisting with mooring of LNG carriers. Mooring could occur anytime throughout the day although the likelihood that a night arrival of an LNG carrier at the same time as peak FSRU regasification is low. To mitigate noise disturbance to residents on these occasions, residents within 1.5 kilometres of the FSRU would be notified at least 24 hours before the planned arrival of an LNG carrier at night until compliance is confirmed during post-commissioning noise monitoring. This monitoring would be undertaken by a qualified acoustic consultant within six months of commissioning to demonstrate compliance with the Project criteria.

No vibration impacts were noted for the operation stage if the Project.

With implementation of the identified mitigation measures, potential impacts due to noise and vibration would be manageable during construction and operation.

In response to the social, economic, amenity and land use draft evaluation objective, noise and vibration impacts associated with the Project have been assessed and mitigation measures have been identified to reduce or minimise these impacts.