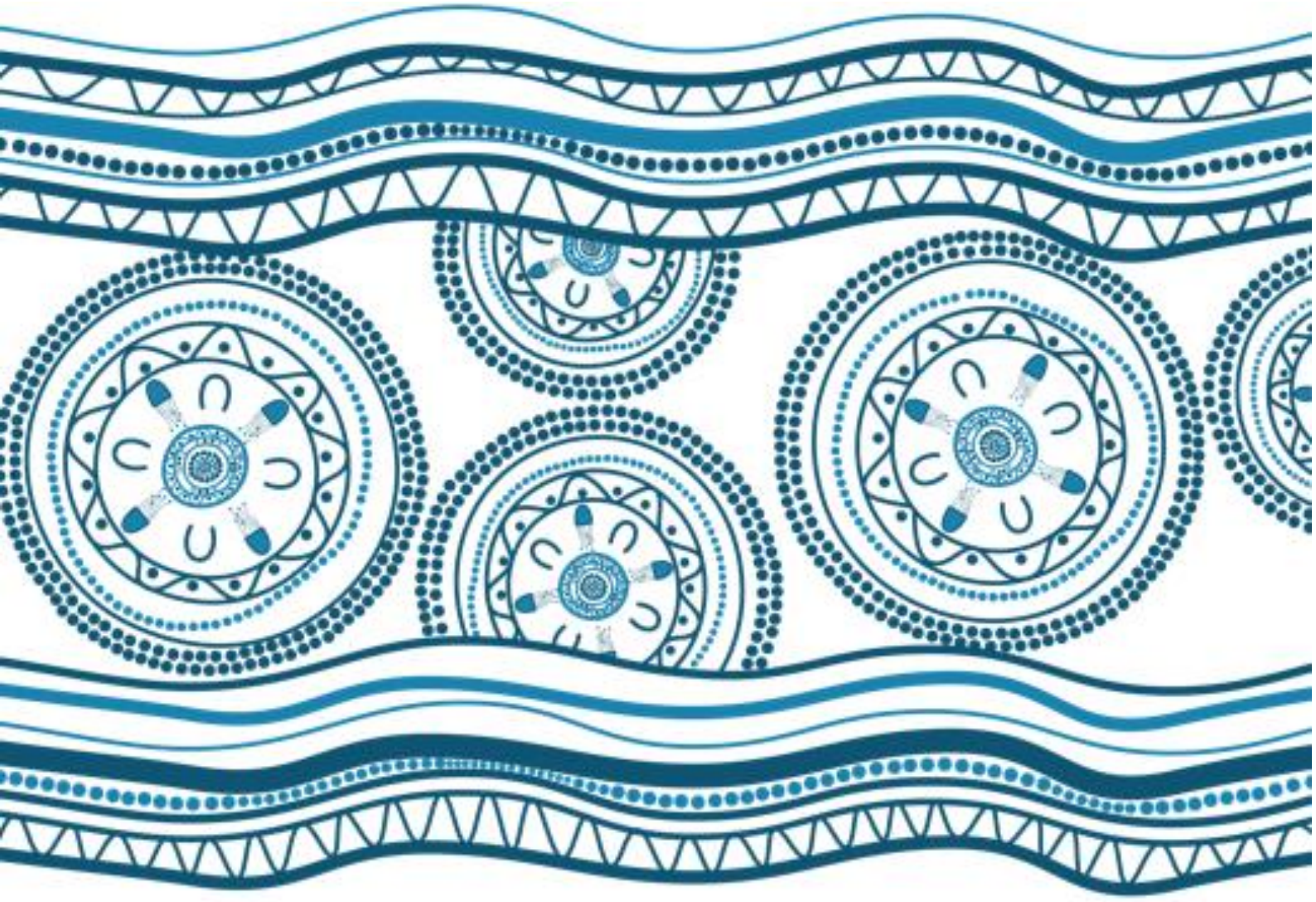
Appendix O

# Surface Noise and Vibration Impact Assessment Report



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Transport for NSW

# Kamay Ferry Wharves Project

## Surface Noise and Vibration Impact Assessment Report

KFW01-ARUP-BPW-NV-RPT-000054

Final | 10 June 2021



Job number 273023-00

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# Executive summary

This report assesses noise and vibration impacts associated with the construction and operation of the Kamay Ferry Wharves conducted in accordance with Secretary's Environmental Assessment Requirements (SEARS) and relevant noise and vibration policies and guidance documents.

The assessment has been based on information within the concept design reports, and where necessary supplemented by appropriate assumptions based on comparable projects to enable a robust assessment.

Background noise monitoring has been undertaken at the project site to establish the baseline noise environment for the derivation of construction and operational noise criteria.

The results from the construction noise assessment indicate that noise generated from the various stages of demolition and construction are predicted to exceed the noise management levels (NMLs) and for some receivers, in excess of the highly affected targets. Majority of the works will take place during standard hours, except for piling works which will be out of hours and assessed accordingly. It should be noted that in general, construction works are temporary in nature therefore any potential noise impact on the community and the surrounding environment will not be permanent. Notwithstanding, preliminary recommendations have been provided for the management of potential impacts, including development of a detailed management plan.

Regarding potential vibration impact from construction works, based on the identified nearest receiver locations, and proposed construction works, the likelihood of adverse vibration impacts is low due to the distances from vibration intensive equipment to the nearest sensitive receivers.

The results from the road traffic assessment from both construction works and ferry wharves operations indicate that any increase in the road traffic will have an insignificant effect on the ambient noise environment.

The operational noise from the wharves operations has been assessed against the NSW *Noise Policy for Industry* (NPfI). These include marine vessels arriving and departing, use of horns and PA systems during times of operation, it is understood that operating hours will only be from 7am to 7pm. This will need to be confirmed once an operator has been appointed. It should be noted that this assessment does not include the effects of underwater noise during operation. The predicted noise levels are well below daytime project noise trigger levels established in Section 3.3.3 except for the Gujaga MACS Childcare Centre where exceedances of up to 6 dB exceedance has been predicted with enhanced meteorological conditions assumed. The assessment is conservative as it has included a 10dB correction to account for two or more modifying factors as per NPfI. It is recommended that a confirmation of our assessment be undertaken once a ferry operator has been appointed and details of the ferry sound power levels are made available.

# Contents



## Appendices

# 1 Introduction

## 1.1 Project overview

Transport for New South Wales (TfNSW) is seeking approval to reinstate the ferry wharves at La Perouse and Kurnell in Botany Bay (the project) under Division 5.2 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) (see Figure 1) as State significant infrastructure. The project would allow for an alternative connection between La Perouse and Kurnell rather than by road. The primary purpose of this infrastructure would be to operate a public ferry service to service visitors to the area and by the local community for cultural and recreational purposes, as well as for commuting. It would also provide supplementary temporary mooring for tourism-related commercial vessels and recreational boating.

The project provides opportunities for significant cultural, health and economic benefits to the local Aboriginal community by providing improved access to culturally significant sites. It is also expected to deliver benefits and opportunities to wider communities on either side of Botany Bay such as investment opportunities in ferry service(s) and other new visitor/tourist experiences.

Key features of the project include:

- Two new wharves, one at La Perouse and one at Kurnell that would include:
  - Berth for ferries
  - Berth for recreational vessels
  - Facilities for recreational fishing
  - Sheltered waiting areas
  - Landside tie-in and landscaping
- Reconfiguration of existing car parking areas at La Perouse to increase the number of spaces
- Installation of utilities to service the wharves.

The total construction period is anticipated to take up to 13 months, starting in 2022. The construction would occur across both sites at the same time.

A concept design has been developed for the project, which forms the basis of this assessment. This noise and vibration assessment supports the Environmental Impact Statement (EIS) prepared for the project.

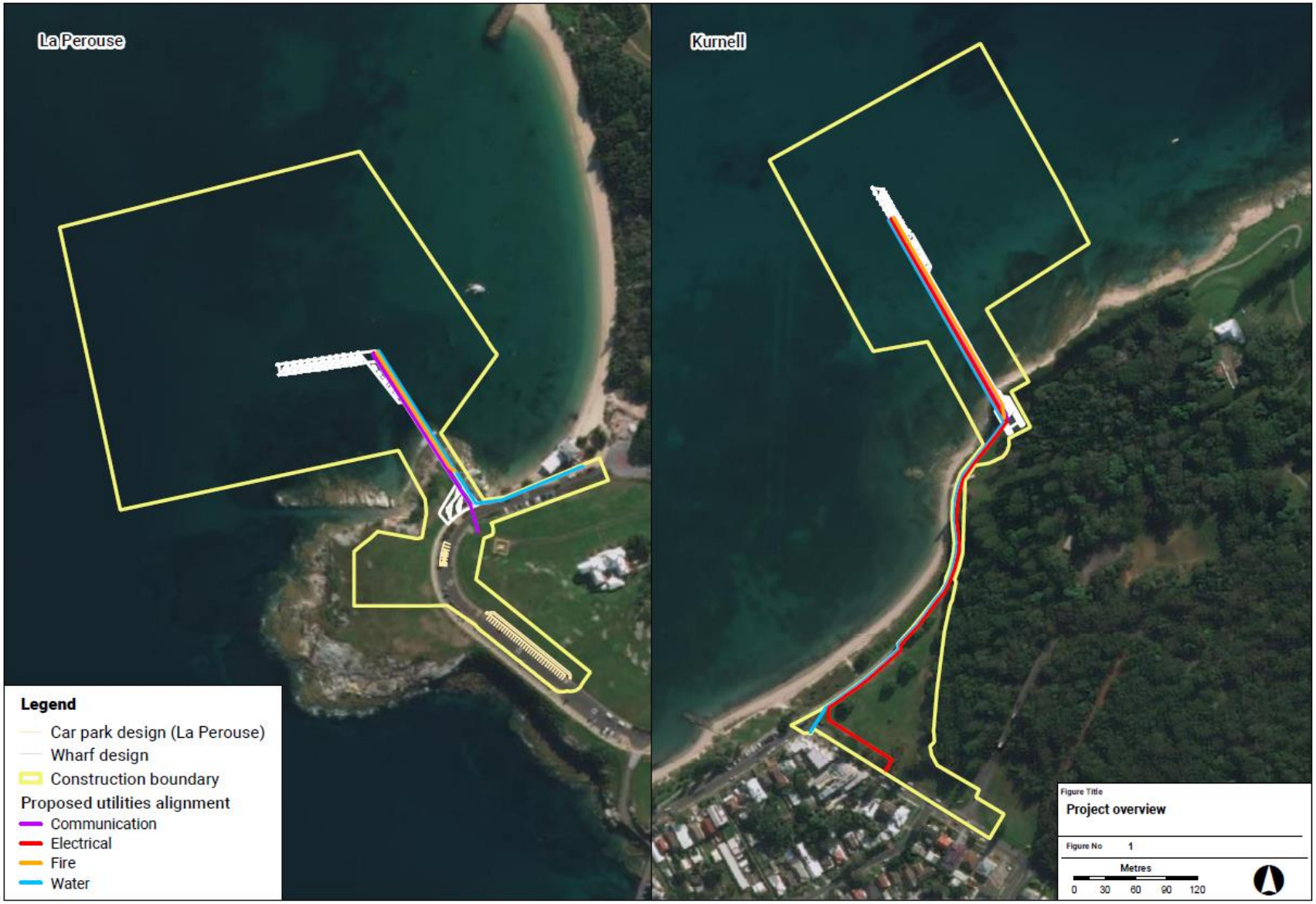


Figure 1: Project overview

## 1.2 Secretary's Environmental Assessment Requirements relevant to this report

Table 1 identifies the Secretary's Environmental Assessment Requirements (SEARs) which are relevant to this technical assessment.

Table 1: SEARs for noise and vibration

| SEARs relevant to this technical report | Where addressed in this technical report |
|---|---|
| For each key issue the Proponent must:<br>(a) describe the biophysical, social and economic environment, as far as it is relevant to that issue, including baseline data that is reflective of current guidelines where relevant;<br>(b) describe the legislative and policy context, as far as it is relevant to the issue;<br>(c) identify, describe and quantify (if possible) the impacts associated with the issue, including the likelihood and consequence (including worst case scenario) of the impact (comprehensive risk assessment), the impact (comprehensive risk assessment), the impacts of concurrent activities within the project and cumulative impacts;<br>(d) demonstrate how potential impacts have been avoided (through design, or construction or operation methodologies);<br>(e) detail how likely impacts that have not been avoided through design will be minimised, and the predicted effectiveness of these measures (against performance criteria where relevant); and detail how any residual impacts will be managed or offset, and the approach and effectiveness of these measures. | Section 2;<br>Section 3;<br>Section 5 and Section 6<br>Section 7<br>Section 7 |
| Where multiple reasonable and feasible options to avoid or minimise impacts are available, they must be identified and considered, and the proposed measure justified taking into account the public interest. | Section 7 |
| 6. Noise and Vibration<br>Construction noise and vibration (including airborne noise, ground-borne noise and blasting) are effectively managed to minimise adverse impacts on acoustic amenity.<br>Increases in noise emissions and vibration affecting nearby properties and other sensitive receivers during operation of the project are effectively managed to protect the amenity and well-being of the community. | Section 7 |
| 1. Land, water and under-water-based construction noise and vibration impacts of the project in accordance with relevant NSW noise and vibration guidelines. The assessment must include noise impacts of construction related traffic. | Section 3.1; Section 3.2; Section 3.4; Section 4.1; Section 5 |
| 2. Operational noise impacts on the amenity of sensitive receivers, employees and visitors to the Kamay Botany Bay National Park, vessels approaching, mooring and departing the infrastructure, and vehicular traffic. | Section 3.3; Section 3.4; Section 4.2; Section 6 |
| 3. Impacts to the structural integrity and heritage significance of items (including Aboriginal places, items of environmental heritage and maritime archaeology). | Section 4.3 |

| Agency comments | |
|---|---|
| Environment Protection Authority | |
| Land and water-based construction noise and vibration impacts of the project in accordance with relevant NSW noise and vibration guidelines, including construction related traffic. | Section 3.1; Section 3.2; Section 3.4; Section 4.1; Section 5 |
| Operational noise impacts on the amenity of local residents and other noise sensitive receivers, and visitors to the Kamay Botany Bay National Park from the use of the infrastructure, including vessels approaching, moored and departing the wharves and increased vehicular traffic. | Section 3.3; Section 3.4; Section 4.2; Section 6 |
| Impacts to the structural integrity and heritage significance of items (including Aboriginal places, items of environmental heritage and maritime archaeology). | Section 4.3 |
| Randwick City Council | |
| An acoustic report should be prepared in relation to the proposed construction activity. This is important some works may be sited close to residential properties and there may be reverberations and vibration from drilling, digging or excavation works. | Section 3.1; Section 3.2; Section 3.4; Section 4.1; Section 5 |

## 1.3 Purpose of this report

This report supports the EIS for the redevelopment of the ferry wharves at La Perouse and Kurnell in Botany Bay. This report assesses the noise and vibration which effect structures on land, this report does not assess noise and vibrations underwater refer to Underwater Noise Assessment for further details.

It is noted that the SEARs do not outline the specific policy for construction and operational noise, however consistent with other SSDAs, this report assesses construction and operational noise and vibration in Table 2.

Table 2: Construction and operational noise and vibration policies and guidelines

| Acoustic aspect | Policy or guideline | Report section |
|---|---|---|
| Construction noise and vibration | Interim Construction Noise Guideline (ICNG) (Department of Environment and Climate Change NSW, 2009) | Section 5 |
| | Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration (Australian and New Zealand Environment Council, 1990)[1] | |
| | German Standard DIN4150-3 (German Institute for Standardisation, 2016). | |
| | BS 7385:1993 (British Standard, 1993) | |
| | Assessing Vibration: A Technical Guideline (Department of Environment and Conservation (NSW), 2006) | |

| Acoustic aspect | Policy or guideline | Report section |
|---|---|---|
| Operational noise from site | NSW Noise Policy for Industry (Environment Protection Authority, 2017) | Section 6 |
| Construction and operational road traffic generated on local road network | Road Noise Policy (Department of Environment, Climate Change and Water NSW, 2011) | Section 5.4 and Section 6.3 |

1- SEARs makes reference to this guideline, but it has not been taken into account as there are no blasting works in this project

The following outlines the scope of assessment with respect to the above acoustic aspects and relevant policies and guidelines:

- Examine the proposed development to identify acoustic aspects of the construction and operation of the project
- Identify the noise sensitive structures surrounding the site, which are to be assessed regarding construction and operational activities.
- Conduct noise level monitoring to quantify the existing acoustic environment at relevant surrounding receiver locations to set project targets in accordance with relevant policy.
- Where appropriate, carry out a quantitative acoustic assessment of potential impacts and compare against the relevant noise and vibration targets.
- Identify in-principle mitigation or management methods for the control of noise and vibration where required.

A glossary of the acoustic terminology used in this document is presented in Appendix A.

# 2 Existing environment

Criteria for the assessment of construction and operational noise are usually derived from the existing noise environment of an area, excluding noise from the subject development.

Fact Sheet B of the NSW EPA *Noise Policy for Industry* (NPfI) outlines two methods for determining the background noise level of an area, being 'B1 – Determining background noise using long-term noise measurements' and 'B2 – Determining background noise using short-term noise measurements'. This assessment has used a combination of long-term and short-term noise monitoring.

## 2.1 Sensitive receivers

Sensitive receivers which may be affected by the project were identified for the La Perouse and Kurnell in accordance with the ICNG. The sensitive receivers assessed are the structures and key sensitive land uses closest to the site most likely affected by noise and vibration, these receivers are the representative sample of all structures in the project area. Assessment of residential and non-residential receivers presented in this report is isolated to the reasonably most-affected receivers.

An assessment for heritage structures and features has been carried and identified in the Aboriginal Cultural Heritage Assessment Report (refer to Appendix E of the EIS) and Statement of Heritage Impact Report (refer to Appendix F of the EIS). While the entire Kamay Botany Bay National Park and La Perouse Point are identified as heritage sites, the list focuses on significant items or structures.

### 2.1.1 La Perouse

Residential receivers with the potential to be impacted by the project at La Perouse are listed in Table 3. The reasonable most-affected non-residential sensitive receivers are listed in Table 4. All residential and non-residential receivers are also shown in Figure 2.

Table 3: Residential receivers at La Perouse

| Receiver ID | Address | No. of floors | Approximate distance to the project area [m] |
|---|---|---|---|
| RES1 | 51-52 Endeavour Avenue | 3 | 90 |
| RES2 | 27 Goorawahl Avenue | 5 | 60 |
| RES3 | 3/1599 Anzac Parade | 5 | 100 |
| RES4 | 31 Endeavour Avenue | 2 | 170 |

Table 4: Reasonably most-affected non-residential sensitive receivers in La Perouse

| Receiver ID | Name | Address | No. of floors | Approximate distance to the project area[m] |
|---|---|---|---|---|
| Commercial | | | | |
| COM1 | The Boatshed | 1609 Anzac Pde | 2 | 15 |
| Active Recreation Area | | | | |
| ARC1 | Frenchmans Bay Reserve Playground | 46-50 Endeavour Ave | n/a | 30 |
| ARC2 | Congwong Trail | Henry Head | n/a | 215 |
| Passive Recreation Area | | | | |
| PRC1 | Frenchmans Beach | Frenchmans Beach | n/a | 130 |
| Cultural | | | | |
| CUL1 | La Perouse Museum | 1542 Anzac Pde | 2 | 55 |
| CUL2 | Macquarie Watchtower | 1599-1601 Anzac Pde | 1 | 90 |
| Child Care | | | | |
| CHC1 | Gujaga MACS Childcare Centre | 1 Elaroo Ave | 1 | 420 |
| Community | | | | |
| CMU1 | La Perouse Local Aboriginal Land Council | 1 Elaroo Ave | 1 | 450 |

Non-Aboriginal, Aboriginal heritage receivers and potential archaeologically with the potential to be impacted by the project at La Perouse are listed in Table 5, Table 6 and Table 7 respectively. The sensitive heritage and potential archaeological receiver locations are provided in Figure 3, Figure 4 and Figure 5.

Table 5: Heritage - Non-Aboriginal at La Perouse

| Heritage | Address | No. of floors | Approximate distance to the project area [m] |
|---|---|---|---|
| Yarra Bay Beach and Reserve | 1 Elaroo Ave | n/a | 360 |
| Yarra Bay House | 1 Elaroo Ave | 1 | 350 |
| Kamay Botany Bay: Botanical collection sites | La Perouse Point | n/a | <5 |
| Kamay Botany Bay National Park and Towra Point Reserve | La Perouse Point | n/a | <5 |
| Botany Bay National Park | La Perouse Point | n/a | <5 |
| La Perouse Museum | La Perouse Point | 2 | 58 |
| Tomb of Pere le Receveur | La Perouse Point | n/a | 55 |
| Macquarie Watchtower | La Perouse Point | 1 | 93 |
| La Perouse Memorial | La Perouse Point | n/a | <5 |
| Bare Island Fort | Bare Island Rd | 1 | 400 |

Table 6: Heritage - Aboriginal at La Perouse

| Heritage | Address | Approximate distance to the project area [m] |
|---|---|---|
| 45-6-1144 - Engraving | La Perouse Point | [redacted] |
| 45-6-0653 – Engraving | La Perouse Point | |
| 45-6-0651 - Engraving | La Perouse Point | |
| 45-6-0649 - Engraving | La Perouse Point | |
| 45-6-0648- Engraving | La Perouse Point | |

Table 7: Potential archaeology receivers at La Perouse

| Heritage | Address | Approximate distance to the project area [m] |
|---|---|---|
| Cable Tanks | La Perouse Point | <5 |
| Gear House | La Perouse Point | <5 |
| Wharf Approach Road | La Perouse Point | <5 |
| Cable House | La Perouse Point | <5 |
| Tennis Court | La Perouse Point | <5 |
| Boat Shed | La Perouse Point | <5 |

### 2.1.2 Kurnell

Residential receivers with the potential to be impacted by the project at Kurnell are listed in Table 8. The reasonable most-affected non-residential sensitive receivers are listed in Table 9. All sensitive receivers are also shown in Figure 6 and heritage receivers are shown in Figure 7.

Table 8: Residential receivers for Kurnell works

| Receiver ID | Address | No. of floors | Approximate distance to the project area [m] |
|---|---|---|---|
| RES1 | 3/1 Captain Cook Drive | 2 | 15 |
| RES2 | Kamay Botany Bay National Park (Rangers House) | 1 | 155 |
| RES3 | 10 Prince Charles Parade | 1 | 50 |
| RES4 | 33 Captain Cook Drive | 1 | 20 |

Table 9: Reasonably most-affected non-residential sensitive receivers in Kurnell

| Receiver ID | Name | Address | No. of floors | Approximate distance to the project area [m] |
|---|---|---|---|---|
| Commercial | | | | |
| COM1 | Endeavour Coffee and Ice-cream | 2/4 Prince Charles Parade | 2 | 15 |

| Receiver ID | Name | Address | No. of floors | Approximate distance to the project area [m] |
|---|---|---|---|---|
| Educational Facilities | | | | |
| EDU1 | Kamay Botany Bay Environmental Education Centre | 21 Cape Colander Drive | 1 | 315 |
| Active Recreation Area | | | | |
| ACR1 | Marton Park | 96 Captain Cook Drive | n/a | 580 |
| ACR2 | Yena Walking Trail | Kamay Botany Bay National Park | n/a | 330 |
| Passive Recreation Area | | | | |
| PRC1 | Commemoration Flat | Kamay Botany Bay National Park | n/a | 400 |
| Child Care | | | | |
| CHC1 | Kurnell Preschool Kindergarten | 96 Captain Cook Drive | 1 | 640 |
| Place of Worship | | | | |
| POW1 | St John Fisher Catholic Church | 62 Prince Charles Parade | 2 | 325 |
| Industrial Area | | | | |
| IND1 | Caltex Kurnell Terminal | 2 Solander Street | 1 | 300 |

Non-Aboriginal, Aboriginal heritage and potential archaeologically with the potential to be impacted by the project at Kurnell are listed in Table 10, Table 11 and Table 12 respectively. The sensitive heritage and potential archaeological receiver locations are provided in Figure 7, Figure 8 and Figure 9.

Table 10: Heritage - Non-Aboriginal at Kurnell

| Receiver | Address | Approximate distance to the project area [m] |
|---|---|---|
| Landing Place Wharf Abutment | Kamay Botany Bay National Park | <5 |
| Captain Cook's Landing Site | Kamay Botany Bay National Park | 5 |
| Kurnell Peninsula Headland | Kamay Botany Bay National Park | <5 |
| Kamay Botany Bay: Botanical collection sites | Kamay Botany Bay National Park | <5 |
| Kamay Botany Bay National Park and Towra Point Reserve | Kamay Botany Bay National Park | <5 |
| Silver Beach and Roadway | Silver Beach Kurnell | 115 |
| Kurnell Monuments | Kamay Botany Bay National Park | <5 |
| Kurnell Historic site | Kamay Botany Bay National Park | <5 |

| Receiver | Address | Approximate distance to the project area [m] |
|---|---|---|
| Captain Cook Watering Well | Kamay Botany Bay National Park | <5 |
| Captain Cook Monument | Kamay Botany Bay National Park | <5 |
| Captain Cook Watering Hole | Kamay Botany Bay National Park | 40 |
| Banks Memorial | Kamay Botany Bay National Park | 100 |
| Alpha Farm site | Kamay Botany Bay National Park | 155 |
| Captain Cook's Landing Place | Kamay Botany Bay National Park | 45 |
| Flagpole | Kamay Botany Bay National Park | 300 |
| Solander Monument | Kamay Botany Bay National Park | 250 |
| Forby Sutherland Monument | Kamay Botany Bay National Park | 240 |

Table 11:Heritage - Aboriginal at Kurnell

| Receiver | Address | Approximate distance to the project area [m] |
|---|---|---|
| KMT ISO 01 - AHIMS Site | Kamay Botany Bay National Park | [redacted] |
| KMT ISO 02 – AHIMS Site | Kamay Botany Bay National Park | |
| Foreshore Midden | Kamay Botany Bay National Park | |

Table 12: Potential archaeology at Kurnell

| Receiver | Address | Approximate distance to the project area [m] |
|---|---|---|
| Former Sea Wall | Kamay Botany Bay National Park | <5 |
| Boat Shed | Kamay Botany Bay National Park | <5 |
| Cottage Number 2 | Kamay Botany Bay National Park | <5 |

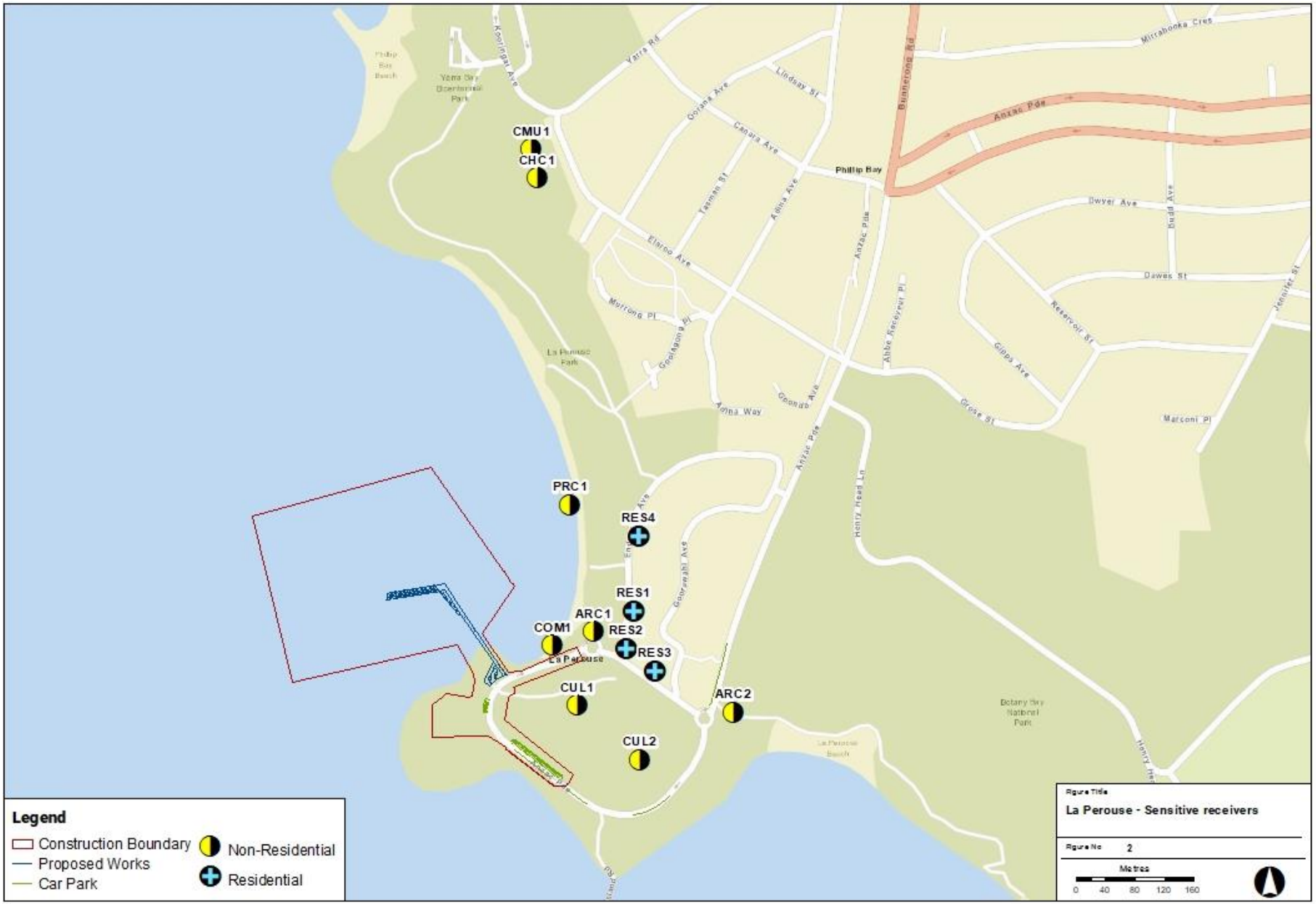


Figure 2: Site map showing La Perouse noise sensitive receivers


Figure 3: Non-Aboriginal heritage at La Perouse

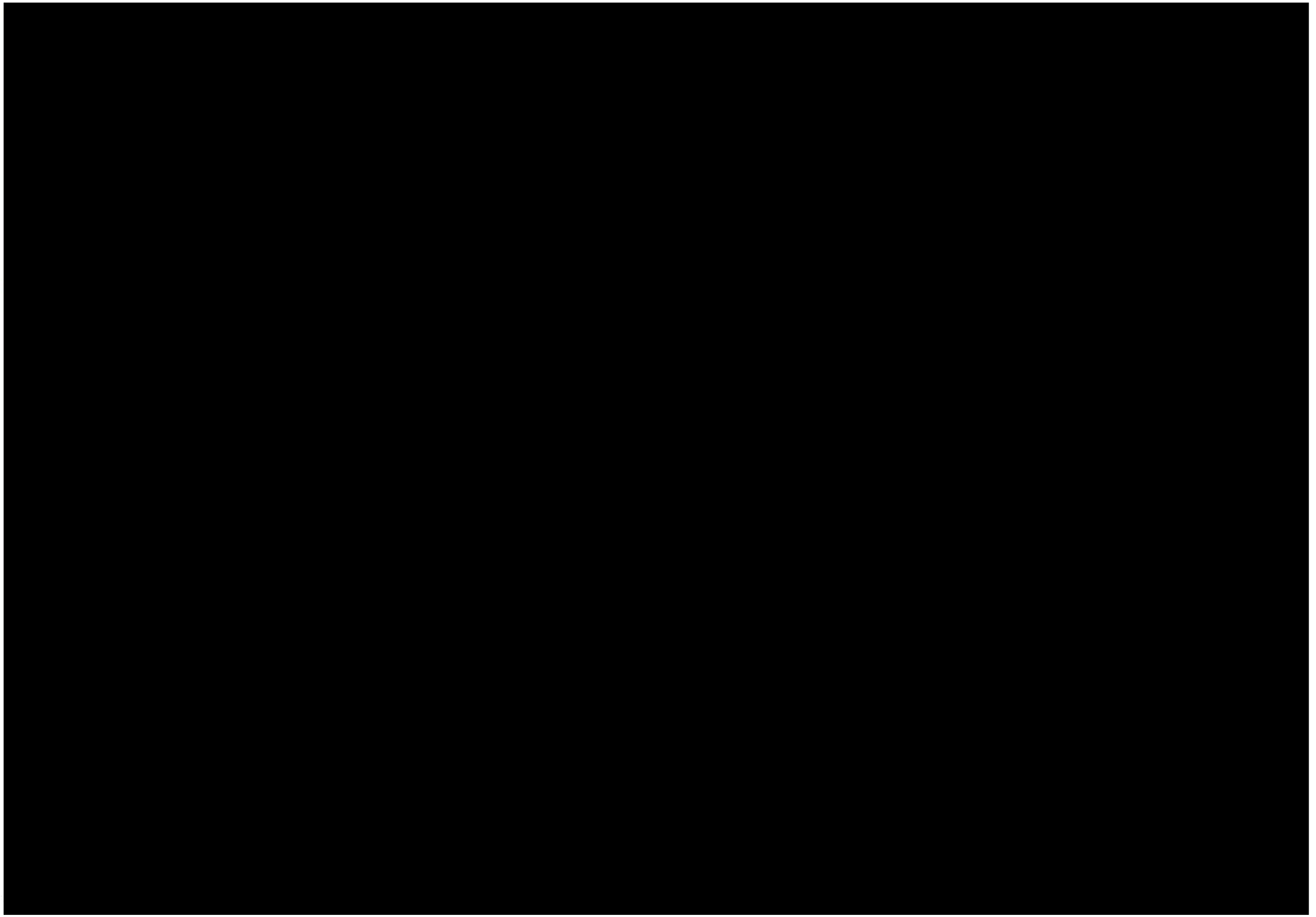

Figure 4: Aboriginal heritage at La Perouse

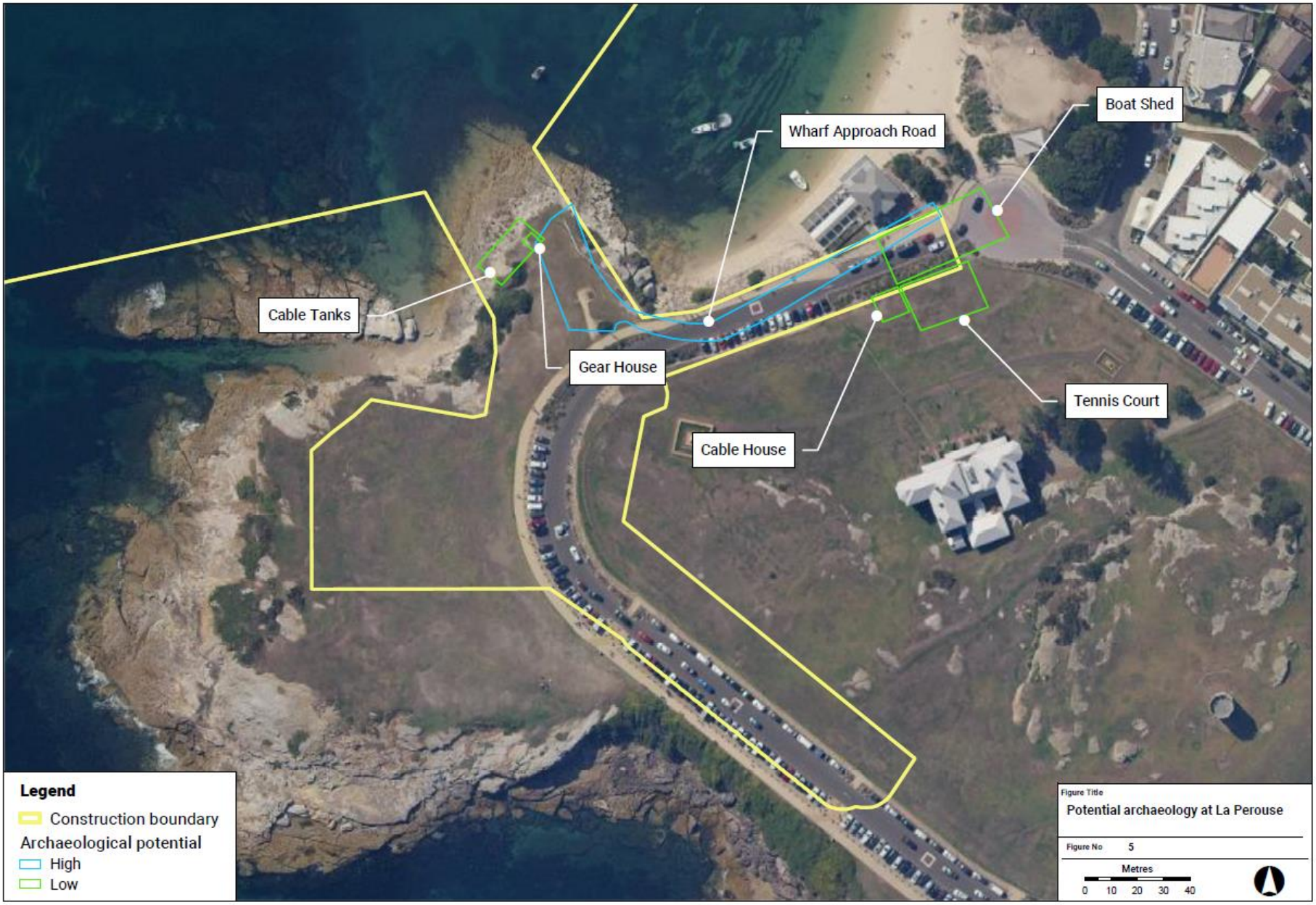


Figure 5: Potential archaeology at La Perouse


Figure 6: Site map showing Kurnell noise sensitive receivers


Figure 7: Non-Aboriginal heritage at Kurnell

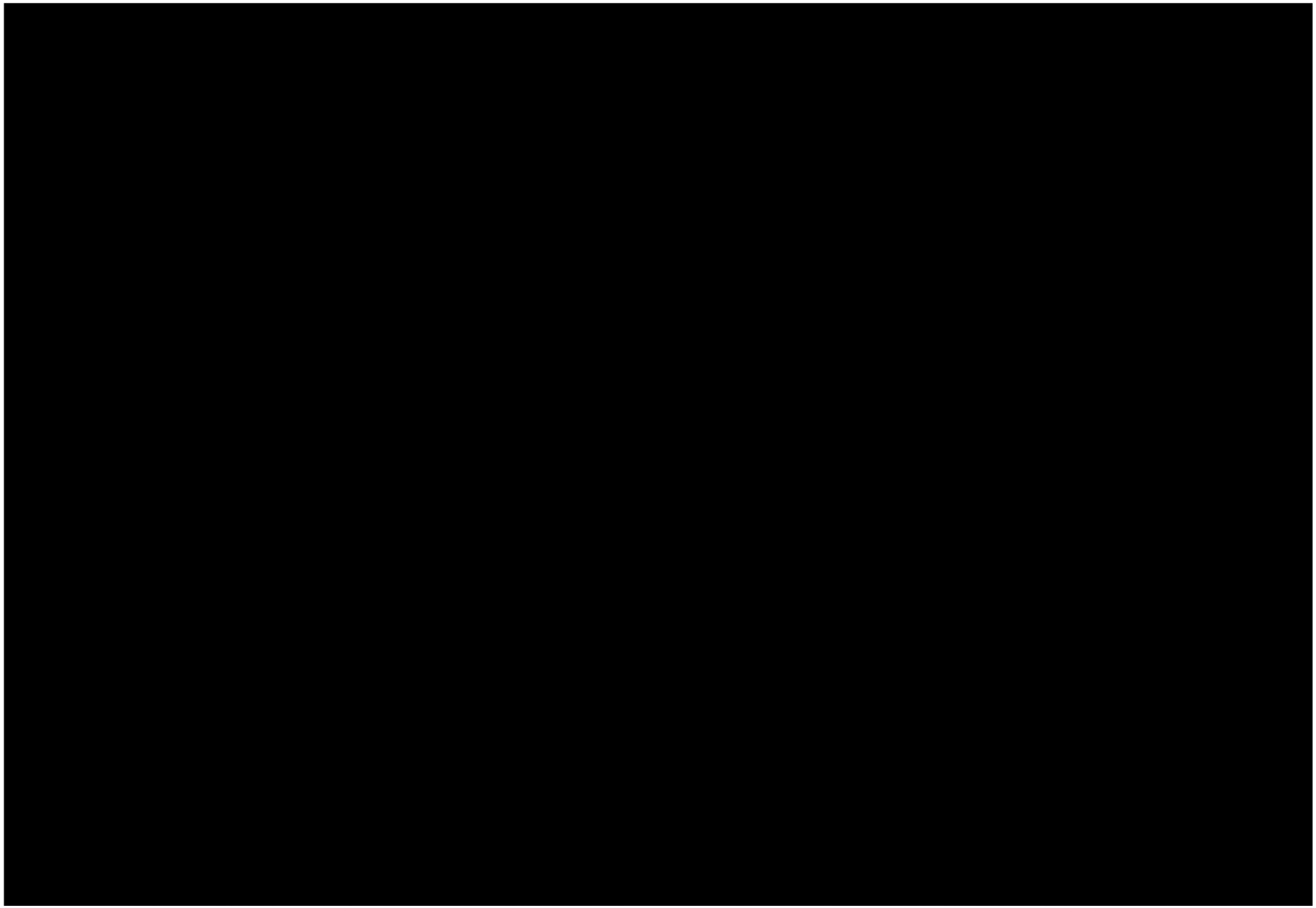

Figure 8: Aboriginal heritage at Kurnell


Figure 9: Potential archaeology at Kurnell

## 2.2 Noise monitoring locations

Noise measurements are ideally carried out at the nearest or most potentially affected locations surrounding a development. An alternative, representative location should be established in the case of access restrictions or a safe and secure location cannot be identified. Furthermore, representative locations may be established in the case of multiple receivers as it is usually impractical to carry out measurements at all locations surrounding a site.

Long-term and short-term noise monitoring was carried out using the equipment shown in Table 13 at locations shown in Figure 10 and Figure 11.

Table 13: Noise monitoring equipment

| Meas. Loc. | Equipment/model | Description of Equipment | Serial No. |
|---|---|---|---|
| La Perouse Logger - 51-52 Endeavour Avenue | Ngara | Environmental noise logger | 878060 |
| Kurnell Logger - 3/1 Captain Cook Drive | Ngara | Environmental noise logger | 878061 |
| Attended locations Kurnell | B&K 2250 | Sound level meter | 2445716 |
| Attended location La Perouse | B&K 2250 | Sound level meter | 2445716 |
| Note: All meters comply with AS IEC 61672.1 2019 “Electroacoustics - Sound Level Meters” designated either Class 1 and are suitable for field use. | | | |

The equipment was calibrated prior and subsequent to the measurement period using a Bruel & Kjaer Type 4231 calibrator. No significant drift in calibration was observed.

## 2.3 Baseline noise monitoring results

### 2.3.1 Long term unattended noise monitoring

Long-term noise monitoring was carried out from Friday 27 March to Thursday 2 April 2020. The long-term noise monitoring methodology and noise level-vs-time graphs of the data are included in Appendix B.

Table 14 presents the overall single Rating Background Levels (RBL) and representative ambient $L_{eq}$ noise levels for each assessment period, determined in accordance with the NPfI.

Table 14: Long-term noise monitoring results

| ID | Location | Time Period[1] | Ambient $dBL_{Aeq(period)}$ | Rating background level, $dBL_{A90(period)}$ |
|---|---|---|---|---|
| La Perouse | 51-52 Endeavour Avenue | Day | 64 | 43 |
| | | Evening | 60 | 41 |
| | | Night | 48 | 38 |

| | | | | |
|---|---|---|---|---|
| Kurnell | 3/1 Captain Cook Drive | Day | 58 | 43 |
| | | Evening | 54 | 40 |
| | | Night | 53 | 38 |
| Notes:<br>1 - The NPfI defines day, evening and night-time periods as:<br>Day: the period from 7am to 6pm Monday to Saturday; or 8am to 6pm on Sundays and Public Holidays.<br>Evening: the period from 6pm to 10pm.<br>Night: the remaining period. | | | | |

The noise levels display a typical trend with lower noise levels during the night-time than the daytime and evening periods. This is a characteristic of suburban areas where the ambient noise environment is primarily influenced by road traffic

### 2.3.2 Short term attended noise measurements

Short-term operator attended noise measurements were conducted on Monday 6th of April 2020 at each logger location. Noise measurements were conducted over a 15-minute period. Weather conditions were warm, still and clear during measurements.

Table 15 presents the measured $L_{eq}$ and $L_{90}$ noise levels for each measurement location, determined in accordance with the AS1055:2018. The measurements were taken more than one metre away from any building façade and at a height of 1.2 - 1.5 m above ground level.

Table 15: Short-term noise monitoring

| ID | Location | Date/Time | Description of Noise Environment | $dBL_{Aeq,15min}$ | $dBL_{A90,\ 15min}$ |
|---|---|---|---|---|---|
| La Perouse | | | | | |
| 1 | Opposite 16 Prince Charles Parade | 06/04/20 – 10:28am | Breeze present, dogs barking, waves, vehicles, constant distant saw noise on pier | 54 | 45 |
| 2 | 9 Silver Beach Road | 06/04/20 – 11:35am | Breeze, occasional vehicles, hand tools, human activity movement | 57 | 43 |
| 3 | 22 Captain Cook Drive | 06/04/20 – 10:57am | Breeze, traffic noise, aircraft noise | 62 | 38 |
| Kurnell | | | | | |
| 4 | Behind 11 Goolagong Place | 06/04/20 – 2:34pm | Music, breeze, aircraft noise | 52 | 43 |

| ID | Location | Date/Time | Description of Noise Environment | $dBL_{Aeq,15min}$ | $dBL_{A90,15min}$ |
|---|---|---|---|---|---|
| 5 | 8 Goorawahl Avenue | 06/04/20 – 1:46pm | Breeze, minimal vehicles, car idling | 48 | 35 |
| 6 | Cnr Elaroo Avenue, 7 Anzac Parade | 06/04/20 – 2:10pm | Predominantly traffic noise | 60 | 59 |

A full set of long term and short-term measurement details and results are presented in Appendix B.

### 2.3.3 Covid19 lockdown

The noise monitoring was carried out from Thursday 26 March to Monday 2 April 2020 just after the start of Covid19 restrictions lockdown. Although the results of the noise monitoring may have been affected by the lower road traffic and aircraft movements, the results have been compared against previous noise monitoring back in 2008 and the results have not significantly changed since then. It is a conservative approach given that the resulting impact criteria may be more stringent than what would have otherwise been determined.

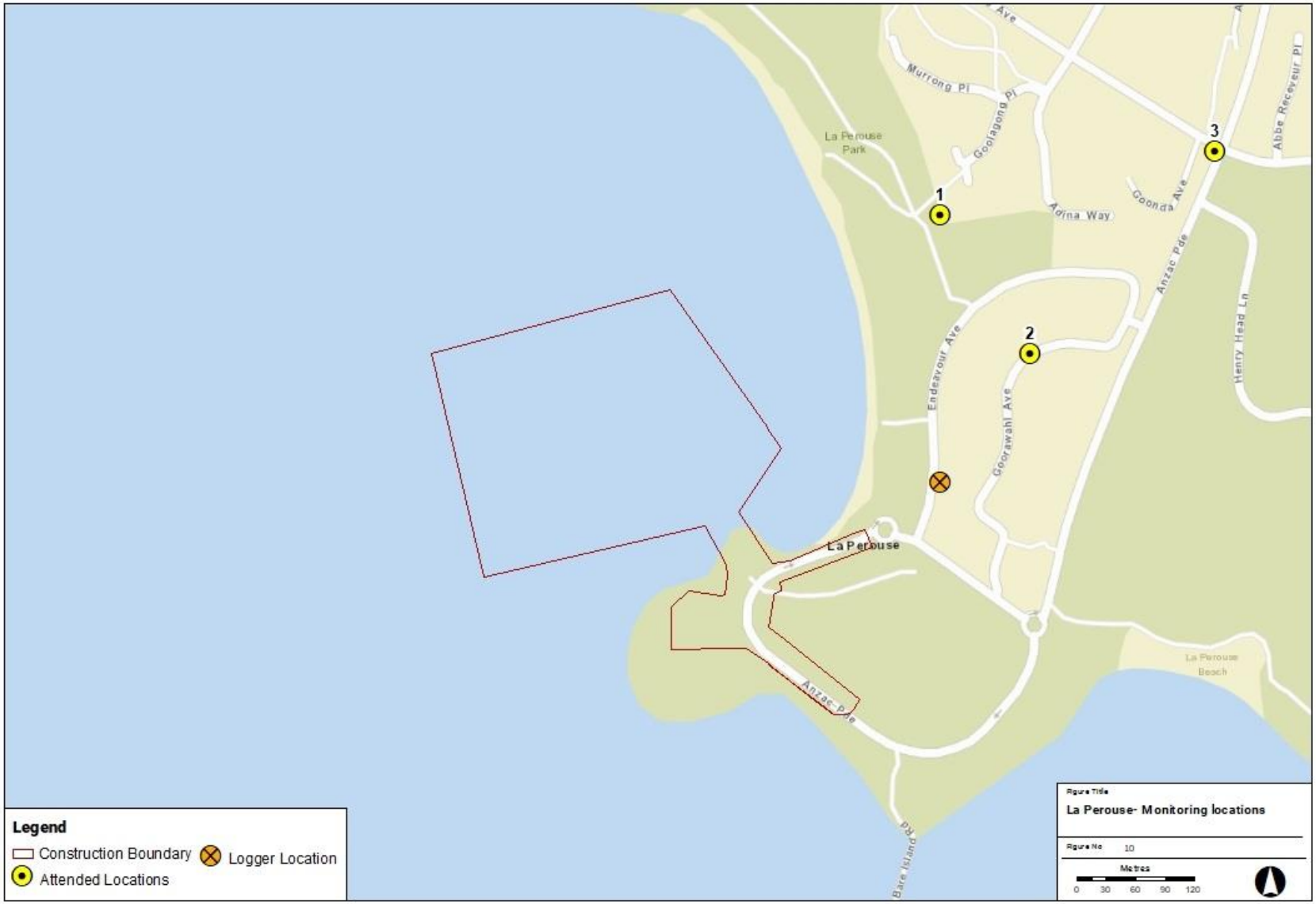


Figure 10: La Perouse monitoring locations

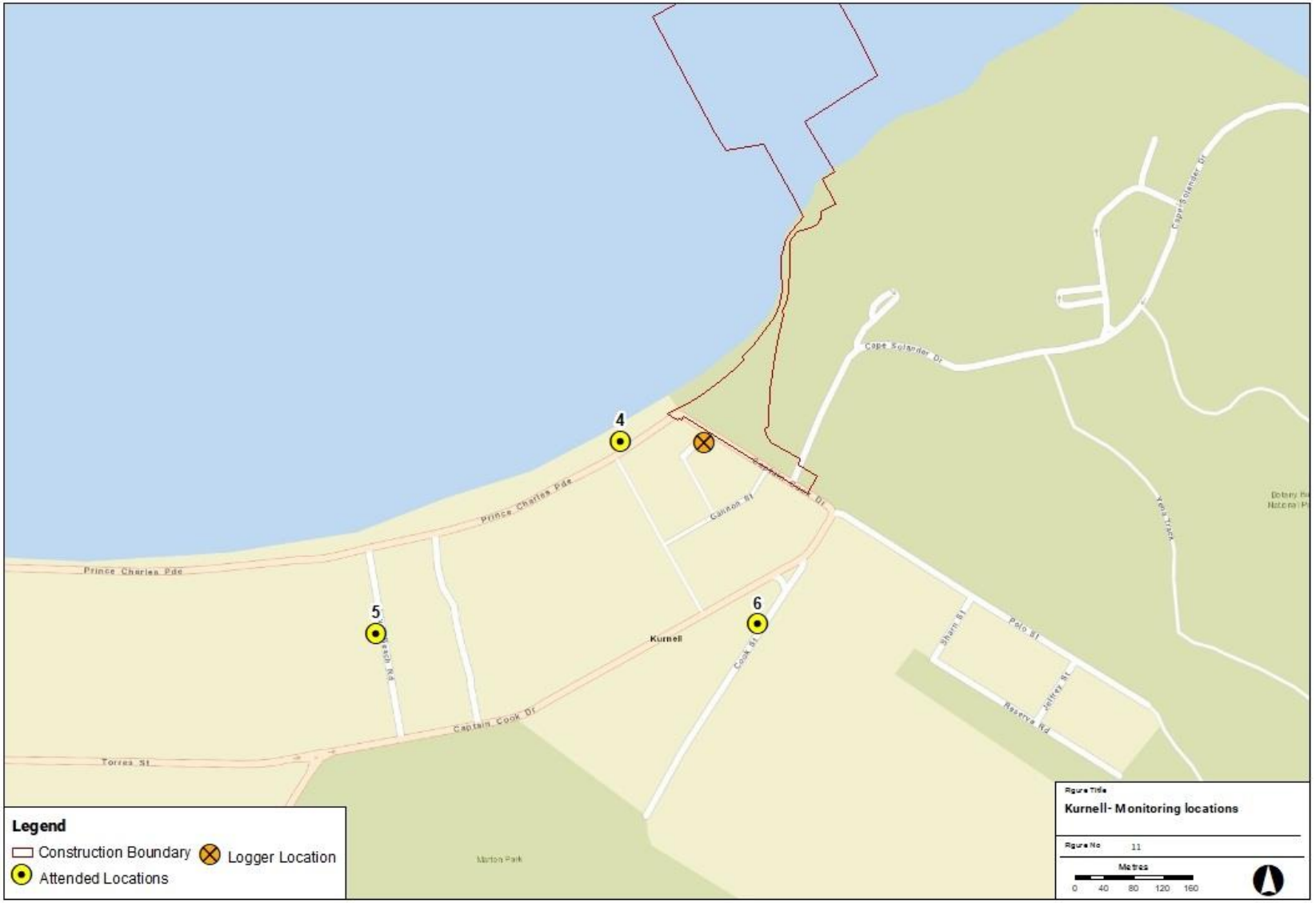


Figure 11: Kurnell monitoring locations

# 3 Guidelines and criteria

## 3.1 Construction noise criteria

The *Interim Construction Noise Guideline* (ICNG) (Department of Environment and Climate Change NSW, 2009) provides recommended noise levels for airborne construction noise at sensitive land uses. The guideline provides construction management noise levels above which all 'feasible and reasonable' work practices should be applied to minimise the construction noise impact. The ICNG works on the principle of a 'screening' criterion – if predicted or measured construction noise exceeds the ICNG levels then the construction activity must implement all 'feasible and reasonable' work practices to reduce noise levels.

The ICNG sets out management levels for noise at sensitive receivers and how they are to be applied. For residential receivers, the rating background level (RBL) is used when determining the management level. The management level for residential receivers is reproduced in Table 16. For other sensitive land uses, the management levels are reproduced in Table 17.

Table 16: Construction noise management levels at residential receivers

| Time of day | Management level [1]<br>$dBL_{Aeq\ (15\ min)}$ | How to apply |
|---|---|---|
| Recommended standard hours:<br>• Monday to Friday 7am to 6pm<br>• Saturday 8am to 1pm<br>• No work on Sundays or public holidays | Noise affected<br>RBL + 10dB | The noise affected level represents the point above which there may be some community reaction to noise.<br>Where the predicted or measured $L_{Aeq\ (15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level.<br>The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details. |
| | Highly noise affected<br>75 | The highly noise affected level represents the point above which there may be strong community reaction to noise.<br>Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account:<br>• times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences<br>• if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times. |

| Time of day | Management level [1] dBL$_{Aeq\ (15\ min)}$ | How to apply |
|---|---|---|
| Outside recommended standard hours | Noise affected RBL + 5dB | A strong justification would typically be required for works outside the recommended standard hours.<br>The proponent should apply all feasible and reasonable work practices to meet the noise affected level.<br>Where all feasible and reasonable practices have been applied and noise is more than 5dB above the noise affected level, the proponent should negotiate with the community.<br>For guidance on negotiating agreements see section 7.2.2 of the ICNG. |

Note:
[1] - Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Table 17: Construction noise management levels at other noise sensitive land uses

| Land use | Where objective applies | Management level [1] dBL$_{Aeq\ (15\ min)}$ |
|---|---|---|
| Passive recreation areas | External noise level | 60 |
| Active recreation areas | External noise level | 65 |
| Educational institutions | Internal noise level | 45 |
| Childcare premises | Internal noise level | 45[2] |
| Museums | Internal noise level | 45[2] |
| Community premises | Internal noise level | 45[2] |
| Commercial premises | External noise level | 70 |
| Place of Worship | Internal noise level | 45 |
| Industrial | External noise level | 75 |

Notes
1 – Noise management levels apply when properties are in use.
2 – Based on AS/NZS2107:2016 max design level for Public Buildings – Museums (exhibition space)

### 3.1.1 Sleep disturbance

Where construction works are planned to extend over more than two consecutive nights, the ICNG recommends that an assessment of sleep disturbance impacts should be undertaken.

The ICNG refers to the NSW *Environmental Criteria for Road Traffic Noise* (Environment Protection Authority, 1999) for assessing the potential impacts, which notes that to limit the level of sleep disturbance the $L_{AF1,(1\ minute)}$ level (equivalent to the $L_{Amax}$) of a noise event which should not exceed the ambient $L_{A90}$ noise level by more than 15 dB is not applied to traffic noise.

### 3.1.2 Project construction noise management levels

Noise criteria at residential receivers for construction works proposed at La Perouse and Kurnell were derived from noise monitoring data from the noise survey conducted by Arup in March 2020.

The rating background level (RBL) from a monitoring location in close proximity to the residential receivers was used to determine the noise management level (NML) for the Day, Evening and Night-time periods.

Table 18: Noise Management Levels for residential receivers

| Receiver ID | Address | Standard Hours[1] | Out of Hours[2] | Sleep disturbance |
|---|---|---|---|---|
| | | Day $dBL_{Aeq\ (15\ min)}$ | Night $dBL_{Aeq\ (15\ min)}$ | ($L_{90}$ + 15 dB) $dBL_{Amax}$ |
| La Perouse | | | | |
| RES1 | 51-53 Endeavour Avenue | 53 | 43 | 53 |
| RES2 | 27 Goorawahl Avenue | 53 | 43 | 53 |
| RES3 | 3/1599 Anzac Parade | 53 | 43 | 53 |
| RES4 | 31 Endeavour Avenue | 53 | 43 | 53 |
| Kurnell | | | | |
| RES1 | 3/1 Captain Cook Drive | 53 | 43 | 53 |
| RES2 | Ranger's house | 53 | 43 | 53 |
| RES3 | 33 Captain Cook Drive | 53 | 43 | 53 |
| RES4 | 10 Prince Charles Parade | 53 | 43 | 53 |
| Notes:<br>1 - Standard hours are Monday to Friday 7 am to 6 pm and Saturday from 8 am to 1 pm.<br>2 - Out of Hours during the different time periods:<br>Night-time hours are 10 pm to 7am. | | | | |

Table 19: Non-residential Noise Management Levels

| Usage | Receiver ID | Name | NML, $dBLA_{eq\ 15minute}$[1] |
|---|---|---|---|
| La Perouse | | | |
| Active recreation | ARC1 | Frenchmans bay reserve playground | 65 |
| | ARC2 | Congwong trail | 65 |
| Commercial premise | COM1 | The boatshed | 70 |
| Community premise | CMU1 | La Perouse local aboriginal land council | 45 (Internal) |
| Childcare premise | CHC1 | Gujaga MACS Childcare Centre | 45 (Internal) |
| Cultural premise | CUL1 | La Perouse museum | 45 (Internal) |

| Usage | Receiver ID | Name | NML, $dBLA_{eq\ 15minute}$[1] |
|---|---|---|---|
| | CUL2 | Macquarie watchtower | 45 (Internal) |
| Passive recreation area | PRC1 | Frenchmans beach | 60 |
| Kurnell | | | |
| Active recreation | ARC1 | Marton park | 65 |
| | ARC2 | Yena walking track | 65 |
| Commercial premise | COM1 | Endeavour coffee and ice-cream | 70 |
| Childcare premise | CHC1 | Kurnell preschool kindergarten | 45 (Internal) |
| Educational institution | EDU1 | Kamay botany bay environmental education centre | 45 (Internal) |
| Industrial premise | IND1 | Caltex Kurnell terminal | 75 |
| Passive recreation area | PRC1 | Commemoration flat | 60 |
| Place of worship | POW1 | St John Fisher catholic church | 45 (Internal) |

Note:
1 - When in use

## 3.2 Construction vibration criteria

Vibration criteria for construction works are established in the following sections.

### 3.2.1 Human comfort

The NSW EPA's *Assessing Vibration – A Technical Guideline* (Department of Environment and Conservation (NSW), 2006) provides vibration criteria for maintaining human comfort within different space uses. The guideline recommends 'preferred' and 'maximum' weighted vibration levels for both continuous vibration sources, such as steady road traffic and continuous construction activity, and for impulsive vibration sources. The weighting curves are obtained from BS 6472-1:2008 (British Standards, 2008).

For intermittent sources (e.g. passing heavy vehicles, impact pile driving, intermittent construction), the guideline uses the vibration dose value (VDV) metric to assess human comfort effects of vibration. VDV considers both the magnitude of vibration events and the number of instances of the vibration event. Intermittent events that occur less than 3 times in an assessment period (either day, 7 am to 10 pm, or night, 10 pm to 7 am) are counted as 'impulsive' sources for the purposes of assessment.

As noted in the Guideline, situations exist where vibration above the preferred values can be acceptable, particularly for temporary disturbances, such as a construction or excavation projects. Notwithstanding, the recommended vibration limits for maintaining human comfort in residences and other relevant receiver types are given for continuous/impulsive and intermittent vibration in Table 20 and Table 21 respectively.

Table 20: Preferred and maximum weighted root-mean-square (rms) values for continuous and impulsive vibration acceleration ($m/s^2$) 1-80 Hz

| Location | Period | Preferred Values | | Maximum Values | |
|---|---|---|---|---|---|
| | | z-axis | x- and y-axes | z-axis | x- and y-axes |
| Continuous Vibration | | | | | |
| Critical areas[1] | Day- or Night-time | 0.005 | 0.0036 | 0.01 | 0.0072 |
| Residences | Daytime 0700-2200h | 0.010 | 0.0071 | 0.020 | 0.014 |
| | Night-time 2200-0700h | 0.007 | 0.005 | 0.014 | 0.010 |
| Offices, schools, educational institutions and places of worship | Day- or Night-time | 0.020 | 0.014 | 0.040 | 0.028 |
| Impulsive Vibration | | | | | |
| Critical areas[1] | Day- or Night-time | 0.005 | 0.0036 | 0.01 | 0.0072 |
| Residences | Daytime 0700-2200h | 0.30 | 0.21 | 0.60 | 0.42 |
| | Night-time 2200-0700h | 0.10 | 0.071 | 0.20 | 0.14 |
| Offices, schools, educational institutions and places of worship | Day- or Night-time | 0.64 | 0.46 | 1.28 | 0.92 |
| 1 - Criteria for sensitive areas are only indicative, and have been provided as guidance to acceptable vibration levels for the use of sensitive equipment, eg. camera equipment at Fox Studios. | | | | | |

Table 21: Acceptable vibration dose values for intermittent vibration ($m/s^{1.75}$)

| Location | Daytime 0700-2200 h | | Night-time 2200-0700 h | |
|---|---|---|---|---|
| | Preferred Value | Maximum Value | Preferred Value | Maximum Value |
| Critical areas[1] | 0.10 | 0.20 | 0.10 | 0.20 |
| Residences | 0.20 | 0.40 | 0.13 | 0.26 |
| Offices, schools, educational institutions and places of worship | 0.40 | 0.80 | 0.40 | 0.80 |
| 1 - Criteria for sensitive areas are only indicative, and there may be a need to assess intermittent vibration against impulsive or continuous criteria. | | | | |

### 3.2.2 Building damage

Potential structural or cosmetic damage to buildings as a result of vibration is typically assessed in accordance with British Standard 7385 Part 2-1993 and/or German Standard DIN4150-3 (German Institute for Standardisation, 2016). British Standard 7385 Part 1: 1990 defines different levels of structural damage as:

- *Cosmetic - The formation of hairline cracks on drywall surfaces, or the growth of existing cracks in plaster or drywall surfaces; in addition, the formation of hairline cracks in mortar joints of brick/concrete block construction.*
- *Minor - The formation of large cracks or loosening of plaster or drywall surfaces, or cracks through bricks/concrete blocks.*
- *Major - Damage to structural elements of the building, cracks in supporting columns, loosening of joints, splaying of masonry cracks, etc.*

Table 1 of BS7385-2 sets limits for the protection against cosmetic damage, however the following guidance on minor and major damage is provided in Section 7.4.2 of the Standard:

> *7.4.2 Guide values for transient vibration relating to cosmetic damage*
>
> *Limits for transient vibration, above which cosmetic damage could occur are given numerically in Table 1 and graphically in Figure 1* [Not reproduced].
>
> *In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the guide values for the building types corresponding to line 2 are reduced. Below a frequency of 4 Hz, where a high displacement is associated with a relatively low peak component particle velocity value a maximum displacement of 0.6 mm (zero to peak) should be used.*
>
> *Minor damage is possible at vibration magnitudes which are greater than twice those given in Table 1, and major damage to a building structure may occur at values greater than four times the tabulated values.*

Within DIN4150-3 (German Institute for Standardisation, 2016), damage is defined as "any permanent effect of vibration that reduces the serviceability of a structure or one of its components" (p.2). The Standard also outlines:

> *"that for structures as in lines 2 and 3 of Table 1, the serviceability is considered to have been reduced if cracks form in plastered surfaces of walls; existing cracks in the building are enlarged; partitions become detached from loadbearing walls or floors.*
>
> *These effects are deemed 'minor damage."*

While the DIN Standard defines the above damage as 'minor', the description aligns with BS7385 cosmetic damage, rather than referring to structural failures.

**British Standard BS7385-2**

BS 7385-2:1993 (British Standards, 1993) is based on peak particle velocity and specifies damage criteria for frequencies within the range 4–250 Hz, and a maximum displacement value below 4 Hz is recommended. Table 22 sets out the BS7385 criteria for cosmetic, minor and major damage.

Regarding heritage buildings, British Standard 7385 Part 2 (1993, p.5) notes that "*a building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive*".

Table 22: BS 7385-2 structural damage criteria

| Group | Type of structure | Damage level | Peak component particle velocity, mm/s[1] | | |
|---|---|---|---|---|---|
| | | | 4 Hz to 15 Hz | 15 Hz to 40 Hz | 40 Hz and above |
| 1 | Reinforced or framed structures Industrial and heavy commercial buildings | Cosmetic | 50 | | |
| | | Minor[2] | 100 | | |
| | | Major[2] | 200 | | |
| 2 | Un-reinforced or light framed structures Residential or light commercial type buildings | Cosmetic | 15 to 20 | 20 to 50 | 50 |
| | | Minor[2] | 30 to 40 | 40 to 100 | 100 |
| | | Major[2] | 60 to 80 | 80 to 200 | 200 |
| 1 - Peak Component Particle Velocity is the maximum Peak particle velocity in any one direction (x, y, z) as measured by a tri-axial vibration transducer.<br>2 - Minor and major damage criteria established based on British Standard 7385 Part 2 (1993) Section 7.4.2 | | | | | |

All levels relate to transient vibrations in low-rise buildings. Continuous vibration can give rise to dynamic magnifications that may require levels to be reduced by up to 50%.

### German Standard DIN 4150-3

German Standard DIN 4150 - Part 3 'Structural vibration in buildings - Effects on Structure' (DIN 4150-3) are generally recognised to be conservative. DIN 4150-3 presents the recommended maximum limits over a range of frequencies (Hz), measured in any direction, and at the foundation or in the plane of the uppermost floor of a building or structure. The criteria are presented in Table 23.

Table 23: DIN 4150-3 structural damage criteria

| Group | Type of structure | Vibration velocity, mm/s | | | |
|---|---|---|---|---|---|
| | | At foundation at frequency of | | | Plane of floor uppermost storey |
| | | 1 Hz to 10 Hz | 10 Hz to 50 Hz | 50 Hz to 100 Hz | All frequencies |
| 1 | Buildings used for commercial purposes, industrial buildings and buildings of similar design | 20 | 20 to 40 | 40 to 50 | 40 |
| 2 | Dwellings and buildings of similar design and/or use | 5 | 5 to 15 | 15 to 20 | 15 |
| 3 | Structures that because of their particular sensitivity to vibration, do not correspond to those listed in | 3 | 3 to 8 | 8 to 10 | 8 |

| | | | | | |
|---|---|---|---|---|---|
| | Group 1 or 2 and have intrinsic value (eg buildings under a preservation order) | | | | |

### 3.2.3 Buried services

DIN 4150-3:2016 sets out guideline values for vibration effects on buried pipework and reproduced in Table 24 below.

Table 24: Guideline values for short-term vibration impacts on buried pipework

| Pipe material | Guideline values for vibration velocity measured on the pipe, mm/s |
|---|---|
| Steel (including welded pipes) | 100 |
| Clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange) | 80 |
| Masonry, plastic | 50 |
| Note:<br>For gas and water supply pipes within 2m of buildings, the levels given above should be applied. Consideration must also be given to pipe junctions with the building structure as potential significant changes in mechanical loads on the pipe must be considered. | |

In addition, specific limits for vibration affecting high-pressure gas pipelines is provided in the UK National Grid's Specification for Safe Working in the Vicinity of National Grid High Pressure Gas Pipelines and Associated Installations – Requirements for Third Parties (report T/SP/SSW/22, UK National Grid, Rev 10/06, October 2006). This specification states that no piling is allowed within 15 m of a pipeline without an assessment of the vibration levels at the pipeline. The PPV at the pipeline is limited to a maximum level of 75 mm/s, and where PPV is predicted to exceed 50 mm/sec the ground vibration is required to be monitored.

Other services that may be encountered include electrical cables and telecommunication services such as fibre optic cables. While these may sustain vibration velocity levels from between 50 mm/s and 100 mm/s, the connected services such as transformers and switchgear may not. Where encountered, site specific vibration assessment in consultation with the utility provider should be carried out.

## 3.3 Operational noise

There is no existing policy in NSW to assess noise impacts of marine based transport including ferry operations.

To provide a quantitative assessment of the project, reference has been to the *Noise Policy for Industry* (NPfI) (Environment Protection Authority, 2000), as while intended for industrial type activities, the policy has been applied to other fixed infrastructure such as rail stations and light rail stops. Accordingly, it has been used to assess noise emission from the ferry wharves.

The NPfI is primarily concerned with controlling intrusive noise impacts in the short-term for residences and maintaining long-term noise level amenity for residences and other land uses.

The NPfI sets out the procedure to determine the project noise trigger levels relevant to an industrial development. The project noise trigger level is a level that, if exceeded would indicate a potential noise impact on the community and so 'trigger' a management response.

### 3.3.1 Intrusive noise trigger level

The intrusiveness noise trigger level is applicable to residential premises only and is summarised as follows:

- $L_{Aeq,15minute} \leq$ Rating Background Level (RBL) plus 5 dB

(where $L_{Aeq,15minute}$ represent the equivalent continuous noise level of the source)

Note that as the Intrusive Noise Trigger Level is established from the prevailing background noise levels at the residential receiver location, the existing background noise level is to be measured.

### 3.3.2 Recommended and project amenity noise level

To limit continuing increases in noise levels from application of the intrusiveness level alone, the ambient noise level within an area from **all** industrial noise sources combined should remain below the recommended amenity noise levels specified in Table 25 of the NPfI where feasible and reasonable.

Table 25: NPfI Recommended Amenity Noise Levels (RANLs)

| Receiver | Noise amenity area | Time of Day[1] | Recommended amenity noise levels (RANLs) $dBL_{Aeq,period}$ |
|---|---|---|---|
| Residential | Rural | Day | 50 |
| | | Evening | 45 |
| | | Night | 40 |
| | Suburban | Day | 55 |
| | | Evening | 45 |
| | | Night | 40 |
| | Urban | Day | 60 |
| | | Evening | 50 |
| | | Night | 45 |
| School classroom - internal | All | Noisiest 1-hour period when in use | 35 (see notes for table) |

| Receiver | Noise amenity area | Time of Day[1] | Recommended amenity noise levels (RANLs) $dBL_{Aeq,period}$ |
|---|---|---|---|
| Place of worship – internal | All | When in use | 40 |
| Area specifically reserved for passive recreation (e.g. national park) | All | When in use | 50 |
| Active recreation area (e.g. school playground, gold course) | All | When in use | 55 |
| Commercial premises | All | When in use | 65 |
| Industrial premises | All | When in use | 70 |

Notes:

- The recommended amenity noise levels (RANLs) refer only to noise from industrial sources. However, they refer to noise from all such sources at the receiver location, and not only noise due to a specific project under consideration. The levels represent outdoor levels except where otherwise stated.

[1] - The NPfI defines day, evening and nighttime periods as:

- Day: the period from 7am to 6pm Monday to Saturday; or 8am to 6pm on Sundays and Public Holidays.
- Evening: the period from 6pm to 10pm.
- Night: the remaining period.

The recommended amenity noise levels (RANLs) represent the objective for **total** industrial noise at a receiver location, whereas the **project amenity noise level (PANL)** represents the objective for noise from a **single** industrial development at a receiver location.

To ensure that any new industrial source of noise is within the RANLs for an area, the PANL applies for each new source of industrial noise as follows:

*Project Amenity Noise Level (PANL) = Recommended Amenity Noise Level (RANL) minus 5 dB*

The area surrounding the project at both La Perouse and Kurnell can be categorised as Suburban under the NPfI.

Table 26 summarises the RANLs and the PANLs applicable for the project.

Table 26: NPfI RANLs and PANLs

| Receiver | Indicative Noise Amenity Area | Time of day[1] | Recommended Amenity Noise Level (RANL) $L_{Aeq(period)}$ | Project Amenity Noise Level (PANL) $L_{Aeq(period)}$ |
|---|---|---|---|---|
| La Perouse residential receivers | Suburban | Day | 55 | 50 |
| | | Evening | 45 | 40 |
| | | Night | 40 | 35 |

| | | | | |
|---|---|---|---|---|
| Kurnell residential receivers | Suburban | Day | 55 | 50 |
| | | Evening | 45 | 40 |
| | | Night | 40 | 35 |

Notes

[1] - The NPfI defines day, evening and night time periods as:

- Day: the period from 7 am to 6 pm Monday to Saturday; or 8 am to 6 pm on Sundays and Public Holidays.
- Evening: the period from 6 pm to 10 pm.
- Night: the remaining period.

### 3.3.3 NPfI Project specific noise levels

Based on the background and ambient noise monitoring, Table 26 summarises the derived project specific noise levels based on the NPfI.

Project Noise Trigger Levels (PNTLs) for residential receivers represent the lower of the intrusive criteria and the adjusted $L_{Aeq,15min}$ amenity criteria, shown in Table 28.

Table 27: NPfI Project specific noise levels for **residential receivers**

| Receiver | Time Period[1] | Project Specific Noise Levels | | Project Noise Trigger Levels, $dBL_{Aeq(15minute)}$ |
|---|---|---|---|---|
| | | Intrusive Noise Trigger Levels $L_{Aeq,15minute}$ | Project Amenity Noise Level (PANL) $(L_{Aeq,15minute})^2$ | |
| La Perouse residential receivers | Day | 48 | 53 | 48 |
| | Evening | 45 | 43 | 43 |
| | Night | 43 | 38 | 38 |
| Kurnell residential receivers | Day | 53 | 53 | 53 |
| | Evening | 46 | 43 | 43 |
| | Night | 43 | 38 | 38 |

Notes

[1] - The NPfI defines day, evening and night time periods as:

- Day: the period from 7 am to 6 pm Monday to Saturday; or 8 am to 6 pm on Sundays and Public Holidays.
- Evening: the period from 6 pm to 10 pm.
- Night: the remaining period.

[2] – The NPfI has simplified assessment for the amenity criteria, making a crude assumption regarding the relationship between the $L_{Aeq(15min)}$ and $L_{Aeq(period)}$, applying a +3 dB correction to adjust the Project Amenity Level $L_{Aeq(period)}$ to an $L_{Aeq(15min)}$.

Table 28: Project Noise Trigger Levels – **non-residential receivers**

| Usage | Receiver ID | Name | Project Noise Trigger Levels, $dBL_{Aeq(15minute)}$[2] |
|---|---|---|---|
| **La Perouse** | | | |
| Commercial premise | COM1 | The Boatshed | 63 |
| Community premise | CMU1 | La Perouse Local Aboriginal Land Council | 53[1] |
| Childcare premise | CHC1 | Gujaga MACS Childcare Centre | 40[1] |
| Cultural premise | CUL1 | La Perouse Museum | 63 |
| Cultural premise | CUL2 | Macquarie Watchtower | 63 |
| Passive recreation area | PRC1 | Frenchmans Beach | 48 |
| Active recreation | ARC1 | Frenchmans Bay Reserve Playground | 53 |
| Active recreation | ARC2 | Congwong Trail | 53 |
| **Kurnell** | | | |
| Commercial premise | COM1 | Endeavour Coffee and Ice-cream | 63 |
| Childcare premise | CHC1 | Kurnell Preschool Kindergarten | 40[1] |
| Educational institution | EDU1 | Kamay Botany Bay Environmental Education Centre | 40[1] |
| Industrial premise | IND1 | Caltex Kurnell Terminal | 68 |
| Place of worship | POW1 | St John Fisher Catholic Church | 48 |
| Passive recreation area | PRC1 | Commemoration Flat | 48 |
| Active recreation | ARC1 | Marton Park | 53 |
| Active recreation | ARC2 | Yena Walking Track | 53 |

Notes:
1 - External noise levels have been determined by assuming a 10 dB reduction through an open window.
2- The project noise trigger levels apply only when in use.

## 3.4 Road traffic noise criteria

Increased traffic generated on the surrounding road network due to the construction activities or by the operation of the ferry wharves in La Perouse and Kurnell is assessed in accordance with the NSW *Road Noise Policy* (RNP) (Department of Environment, Climate Change and Water NSW, 2011).

Table 3 of the RNP which sets out the assessment criteria for types of project, road category and land use, shown in Table 29. It should be noted that although commercial

receivers may be impacted by increases of road traffic due to the construction works or ferry wharve operations, the RNP does not stipulate any criteria for commercial land uses.

Table 29: Road traffic criteria for traffic generating development - residential receivers

| Road category | Type of project / land use | Assessment criteria – dB$L_{Aeq}$ | |
|---|---|---|---|
| | | **Day (7:00am-10:00pm)** | **Night (10:00pm-7:00am)** |
| **Local roads** | Existing residences affected by additional traffic on existing local roads generated by land use developments | $L_{Aeq,(1\ hour)}$ 55 (external) | $L_{Aeq,(1\ hour)}$ 50 (external) |
| Note: These criteria are for assessment against façade corrected noise levels when measured in front of a building façade. | | | |

Regarding the application of the assessment, the RNP states:

> *In assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.*

# 4 Assessment of potential construction impacts

## 4.1 Basis of assessment

### 4.1.1 Hours of work

Construction would take place between standard working hours:

- Monday to Friday 7 am to 6 pm; and
- Saturday 8 am to 1 pm.

There would be no construction work on Sundays or public holidays.

**Out of Hours work**

However, being within a marine environment, the project would require several activities to be undertaken outside standard working hours for safety reasons. These activities would need to take place at night when the water is calm and still and the harbour is least busy. These activities would include:

- Relocating the jack-up barge depending on the tides to maintain enough clearance distance between the vessel and the sea floor
- Completing safety critical activities and movements of vessels prior to forecast weather events
- Setting up of the construction pump for in-situ concrete placing works to ensure concrete can set before warmer temperature rise during the day in the summer months
- Most of the drilling or piling activities would be undertaken during standard working hours, however if required some drilling and piling activities may have to be undertaken outside of these standard hours. Night-time piling activities would adopt the following work schedule:

Table 30: OOHW schedule for night-time piling

| Activity | Timing |
|---|---|
| Drilling of Piles | Setup: 11pm to 12am<br>Drilling: 12am to 6am<br>Pack up: generally, 6am to 7am. |
| Hammering of Piles | Setup: 4am to 5am<br>Hammering: 5am to 7am. |

Pile drilling or hammering would take place intermittently during the above periods. On average, a pile would be drilled or hammered for about 10 minutes followed by a relatively quiet period for the next 30 minutes or more before the next stage is progressed.

### 4.1.2 Activities

The total construction period is anticipated to take up to 13 months, starting in early 2022. The construction of the two wharves are likely to occur at the same time. The construction would involve the stages outlined in Table 31.

Table 31: Construction stages

| Stage | Activities |
|---|---|
| Stage 1: Early works and site establishment | Security and fencing<br>Setting up site offices and access<br>Demolishing of the existing Kurnell viewing platform |
| Stage 2: Main construction | Establishing temporary causeway at Kurnell<br>Piling<br>Wharf construction<br>Car parking reconfiguration at La Perouse<br>Earthworks for footpaths and landscaping<br>Installation of wharf furniture<br>Earthworks and installation of utilities<br>Final landscaping |
| Stage 3: Site demobilisation | Removal of temporary work areas |

Proposed construction equipment and activities to be used have been provided by TLM Project Services and are summarised in Table 32 and Table 33.

Equipment sound power levels have been determined by reference to AS2436 (Standards Australia, 2010), BS 5228-1:2009 (British Standards, 2009) and Arup's measurement database. The equipment below has been assumed to operate concurrently and continuously over a full 15-minute period (a typical worst-case assumption).

The locations of equipment have been based the on the construction works areas in and around La Perouse and Kurnell as shown in Figure 12 and Figure 13.

Table 32: Construction equipment and associated sound power levels at La Perouse site

| Item / Description | Quantity | Operating duration in 15min period (min) | Sound Power Level, $L_w$ | |
|---|---|---|---|---|
| | | | $dBL_{Aeq\ (15min)1}$ | $dBL_{Amax2}$ |
| STAGE 1 - ENABLING WORKS & SITE ESTABLISHMENT | | | | |
| Security and Fencing | | | | |
| Construction area[3]: L1A, L1B | | | | |
| Hand Tools (Electric) | 2 | 0.75 | 100 | - |
| Light Vehicle - 4WD | 4 | 1.5 | 99 | - |
| Truck | 2 | 1.5 | 100 | - |

| Item / Description | Quantity | Operating duration in 15min period (min) | Sound Power Level, $L_w$ | |
|---|---|---|---|---|
| | | | $dBL_{Aeq\ (15min)1}$ | $dBL_{Amax2}$ |
| Setting up site offices and access | | | | |
| Construction area[3]: L1A | | | | |
| Hand Tools (Electric) | 4 | 3 | 109 | - |
| Light Vehicle - 4WD | 4 | 1.5 | 99 | - |
| Truck | 2 | 1.5 | 100 | - |
| Generator (diesel) | 2 | 7.5 | 113 | |
| STAGE 2 – MAIN CONSTRUCTION | | | | |
| Piling | | | | |
| Construction area[3]: L1A, L1B | | | | |
| Road Lorry (Empty) | 2 | 1.5 | 104 | 112 |
| Piling | | | | |
| Construction area[3]: L2A | | | | |
| Piling (Vibratory) | 1 | 7.5 | 118 | 126 |
| Hand Tools (Electric) | 1 | 1.5 | 100 | 108 |
| Crane (200t) | 1 | 7.5 | 100 | 108 |
| Crane (Mobile 50t) | 1 | 7.5 | 95 | 103 |
| Crane (150t) | 1 | 7.5 | 100 | 108 |
| Barge Crane | 1 | 7.5 | 101 | 109 |
| Barge (unpowered) | 2 | 0.75 | 90 | 98 |
| Piling | | | | |
| Construction area[3]: L2B | | | | |
| Hand Tools (Pneumatic) | 2 | 1.5 | 110 | 118 |
| Crane (200t) | 1 | 7.5 | 100 | 108 |
| Crane (Mobile 50t) | 1 | 7.5 | 95 | 103 |
| Crane (150t) | 1 | 7.5 | 100 | 108 |
| Barge Crane | 1 | 7.5 | 101 | 109 |
| Barge (unpowered) | 1 | 3.75 | 100 | 108 |
| Drill Rig | 2 | 0.75 | 90 | 98 |
| Piling | | | | |
| Construction area[3]: L2C | | | | |
| Piling (Bored) | 1 | 11.25 | 110 | 118 |
| Hand Tools (Pneumatic) | 2 | 1.5 | 110 | 118 |
| Crane (200t) | 1 | 7.5 | 100 | 108 |

| Item / Description | Quantity | Operating duration in 15min period (min) | Sound Power Level, $L_w$ | |
|---|---|---|---|---|
| | | | $dBL_{Aeq\ (15min)1}$ | $dBL_{Amax2}$ |
| Crane (Mobile 50t) | 1 | 7.5 | 95 | 103 |
| Crane (150t) | 1 | 7.5 | 100 | 108 |
| Barge Crane | 1 | 7.5 | 101 | 109 |
| Barge (unpowered) | 1 | 3.75 | 100 | 108 |
| Wharf Construction | | | | |
| Construction area[3]: L2A | | | | |
| Hand Tools (Electric) | 6 | 1.5 | 108 | - |
| Concrete Pump Truck | 1 | 15 | 113 | - |
| Truck | 4 | 0.75 | 100 | - |
| Light Vehicle - 4WD | 2 | 0.75 | 101 | - |
| Carparking Reconfiguration | | | | |
| Construction area[3]: L1A, L1B | | | | |
| Hand Tools (Pneumatic) | 2 | 1.5 | 110 | - |
| Truck | 2 | 0.75 | 97 | - |
| Light Vehicle - 4WD | 2 | 0.75 | 101 | - |
| Earthworks for Footpaths and Landscaping | | | | |
| Construction area[3]: L1A, L1B | | | | |
| Hand Tools (Pneumatic) | 2 | 1.5 | 110 | - |
| Truck | 2 | 0.75 | 97 | - |
| Light Vehicle - 4WD | 2 | 0.75 | 101 | - |
| Excavator | 1 | 11.25 | 116 | - |
| Compactor Whacker Plate | 2 | 1.5 | 101 | - |
| Installation of Wharf Furniture | | | | |
| Construction area[3]: L2A | | | | |
| Hand Tools (Electric) | 2 | 3.75 | 107 | - |
| Truck | 1 | 0.75 | 94 | - |
| Light Vehicle - 4WD | 1 | 1.5 | 101 | - |
| Installation of Utilities | | | | |
| Construction area[3]: L1A, L1B | | | | |
| Hand Tools (Pneumatic | 2 | 1.5 | 110 | - |
| Truck | 1 | 0.75 | 94 | - |
| Light Vehicle - 4WD | 2 | 1.5 | 104 | - |
| Excavator | 1 | 3.75 | 111 | - |

| Item / Description | Quantity | Operating duration in 15min period (min) | Sound Power Level, $L_w$ | |
|---|---|---|---|---|
| | | | $dBL_{Aeq\ (15min)1}$ | $dBL_{Amax2}$ |
| Landscaping | | | | |
| Construction area[3]: L1A, L1B | | | | |
| Hand Tools (Pneumatic) | 2 | 0.75 | 107 | - |
| Truck | 1 | 1.5 | 97 | - |
| STAGE 3 – SITE DEMOBILISATION | | | | |
| Removal of Temporary Work Areas | | | | |
| Construction area[3]: L1A, L1B, L2A, L2B, L2C | | | | |
| Truck & Dog | 2 | 1.5 | 101 | - |
| Truck | 2 | 1.5 | 100 | - |
| Light Vehicle - 4WD | 2 | 1.5 | 104 | - |
| Crane (200t) | 1 | 7.5 | 93 | - |
| Barge Crane | 1 | 1.5 | 101 | - |
| Barge | 2 | 1.5 | 93 | - |

1 – Sound power level of the equipment with number of sources and time corrections

2 – $L_{AMax}$ is 8 dB above the $L_{Aeq}$ value, except for impact piling which is 21 dB (exact level is dependent on a number of factors, so a conservative estimate has been utilised based on maximum levels)

3 – To view construction areas refer to Figure 8

Table 33: Construction equipment and associated sound power levels at the Kurnell site

| Item / Description | Quantity | Operating duration in 15min period (min) | Sound Power Level, $L_w$ | |
|---|---|---|---|---|
| | | | $dBL_{Aeq\ (15min)1}$ | $dBL_{Amax2}$ |
| STAGE 1 - ENABLING WORKS & SITE ESTABLISHMENT | | | | |
| **Security and Fencing** | | | | |
| Construction area[3]: K1A, K1B | | | | |
| Hand Tools (Electric) | 2 | 0.75 | 100 | - |
| Light Vehicle - 4WD | 4 | 1.5 | 99 | - |
| Truck | 2 | 1.5 | 100 | - |
| **Setting up Site offices and Access – K1B** | | | | |
| Construction area[3]: K1B | | | | |
| Hand Tools (Electric) | 4 | 3 | 109 | - |
| Light Vehicle - 4WD | 4 | 1.5 | 99 | - |
| Truck | 2 | 1.5 | 100 | - |
| Generator (diesel) | 2 | 7.5 | 113 | - |

| Item / Description | Quantity | Operating duration in 15min period (min) | Sound Power Level, $L_w$ | |
|---|---|---|---|---|
| | | | $dBL_{Aeq\ (15min)1}$ | $dBL_{Amax2}$ |
| **Demolition of existing Kurnell Viewing Platform – K1A, K2B** | | | | |
| Construction area[3]: K1A, K2B | | | | |
| Light Vehicle - 4WD | 2 | 1.5 | 96 | - |
| Truck | 1 | 1.5 | 97 | - |
| Excavator | 1 | 11.25 | 116 | - |
| Chainsaw | 1 | 3 | 107 | - |
| Crane (Tower) | 1 | 1.5 | 95 | - |
| Transport Float | 1 | 2.25 | 103 | - |
| Hand Tools (Electric) | 2 | 1.5 | 103 | - |
| STAGE 2 – MAIN CONSTRUCTION | | | | |
| **Establishing Temporary Causeway at Kurnell** | | | | |
| Construction area[3]: K1A, K2B | | | | |
| Excavator | 2 | 13.5 | 120 | - |
| Truck | 2 | 7.5 | 107 | - |
| Truck (Dump) | 2 | 13.5 | 120 | - |
| Light Vehicle - 4WD | 1 | 1.5 | 101 | - |
| **Piling** | | | | |
| Construction area[3]: K1A, K1B | | | | |
| Road Lorry (Empty) | 2 | 1.5 | 104 | 112 |
| **Piling** | | | | |
| Construction area[3]: K2A | | | | |
| Piling (Vibratory) | 1 | 7.5 | 118 | 126 |
| Hand Tools (Pneumatic) | 2 | 1.5 | 110 | 118 |
| Crane (200t) | 1 | 7.5 | 100 | 108 |
| Crane (Mobile 50t) | 1 | 7.5 | 95 | 103 |
| Crane (150t) | 1 | 7.5 | 100 | 108 |
| Barge Crane | 1 | 7.5 | 101 | 109 |
| Barge (unpowered) | 2 | 0.75 | 90 | 98 |
| **Piling** | | | | |
| Construction area3: K2B | | | | |
| Hand Tools (Pneumatic) | 2 | 1.5 | 110 | 118 |
| Crane (200t) | 1 | 7.5 | 100 | 108 |
| Crane (Mobile 50t) | 1 | 7.5 | 95 | 103 |

| Item / Description | Quantity | Operating duration in 15min period (min) | Sound Power Level, $L_w$ | |
|---|---|---|---|---|
| | | | $dBL_{Aeq\ (15min)1}$ | $dBL_{Amax2}$ |
| Crane (150t) | 1 | 7.5 | 100 | 108 |
| Barge Crane | 1 | 7.5 | 101 | 109 |
| Barge (unpowered) | 1 | 3.75 | 100 | 108 |
| Drill Rig | 2 | 0.75 | 90 | 98 |
| **Wharf Construction** | | | | |
| Construction area3: K1A, K2A, K2B | | | | |
| Hand Tools (Electric) | 6 | 1.5 | 108 | - |
| Concrete Pump Truck | 1 | 15 | 113 | - |
| Truck | 4 | 0.75 | 100 | - |
| Light Vehicle - 4WD | 2 | 0.75 | 101 | - |
| **Earthworks for Footpaths and Landscaping** | | | | |
| Construction area[3]: K1A, K1B, K1C | | | | |
| Hand Tools (Pneumatic) | 2 | 1.5 | 110 | - |
| Truck | 2 | 0.75 | 97 | - |
| Light Vehicle - 4WD | 2 | 0.75 | 101 | - |
| Excavator | 1 | 11.25 | 116 | - |
| Compactor Whacker Plate | 2 | 1.5 | 101 | - |
| **Installation of Wharf Furniture** | | | | |
| Construction area[3]: K1A, K1B, K2A, K2B | | | | |
| Hand Tools (Electric) | 2 | 3.75 | 107 | - |
| Truck | 1 | 0.75 | 94 | - |
| Light Vehicle - 4WD | 1 | 1.5 | 101 | - |
| **Installation of Utilities** | | | | |
| Construction area[3]: K1A, K1B, K1C | | | | |
| Hand Tools (Pneumatic | 2 | 1.5 | 110 | - |
| Truck | 1 | 0.75 | 94 | - |
| Light Vehicle - 4WD | 2 | 1.5 | 104 | - |
| Excavator | 1 | 3.75 | 111 | - |
| Landscaping | | | | |
| Construction area[3]: K1A, K1B, K1C | | | | |
| Hand Tools (Pneumatic) | 2 | 0.75 | 107 | - |
| Truck | 1 | 1.5 | 97 | - |

| Item / Description | Quantity | Operating duration in 15min period (min) | Sound Power Level, $L_w$ | |
|---|---|---|---|---|
| | | | $dBL_{Aeq\ (15min)1}$ | $dBL_{Amax2}$ |
| STAGE 3 – LANDSCAPING AND SITE DEMOBILISATION | | | | |
| **Removal of Temporary Work Areas – K1A, K1B, K1C, K2A, K2B** | | | | |
| Construction area[3]: K1A, K1B, K1C, K2A, K2B | | | | |
| Truck & Dog | 2 | 1.5 | 101 | - |
| Truck | 2 | 1.5 | 100 | - |
| Light Vehicle - 4WD | 2 | 1.5 | 104 | - |
| Crane (200t) | 1 | 7.5 | 93 | - |
| Barge Crane | 1 | 1.5 | 101 | - |
| Barge | 2 | 1.5 | 93 | - |

1 – Sound power level of equipment with number of sources and time corrections

2 – LMax is 8 dB above the LAeq value, except for impact piling which is 21 dB (exact level is dependent on a number of factors, so a conservative estimate has been utilised based on maximum levels)

3 – To view construction areas refer to Figure 9


Figure 12: Construction work areas in the La Perouse site

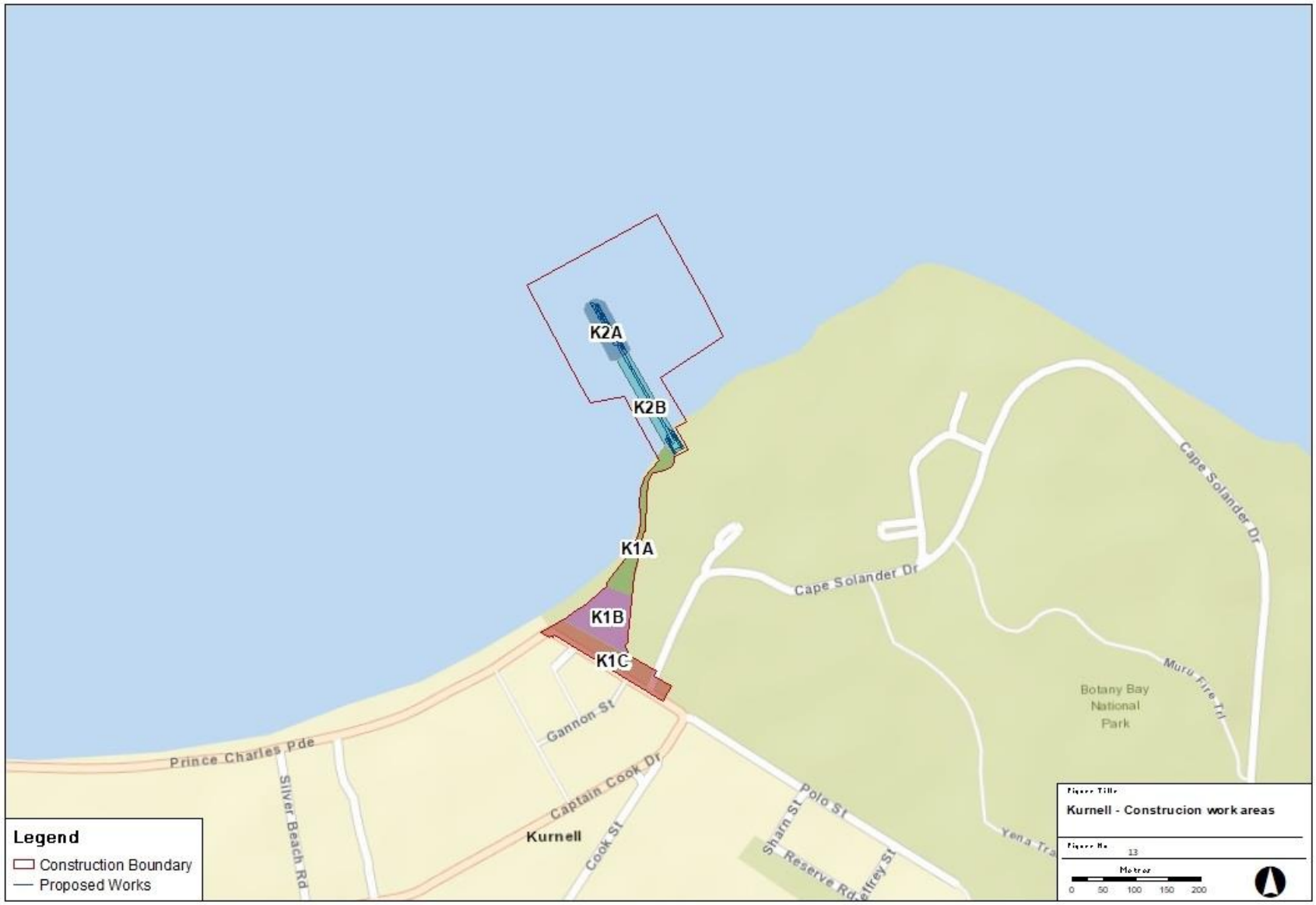


Figure 13: Construction work areas in the Kurnell site

### 4.1.3 Construction traffic

All land side traffic would be expected to access the construction sites using existing roads. At La Perouse, this would be via Anzac Parade, and at Kurnell this would be via Captain Cook Drive.

The key haulage routes are shown on Figure 14 and Figure 15.

Over the construction period at La Perouse, around 12 vehicles would arrive and leave the site every day on average. The highest number of vehicles arriving and leaving the site would be around 40 vehicles per day during the early works period.

Over the construction period at Kurnell, around 20 vehicles would arrive and leave the side every day on average. The highest number of vehicles arriving and leaving the site would be around 50 vehicles per day during the early works period.

The above estimates account for construction worker vehicle movements. It is anticipated construction workers would travel to site on public transport, by car or by construction vehicles.


Figure 14: Haulage route at La Perouse


Figure 15: Haulage route at Kurnell

## 4.2 Construction noise assessment

Construction noise has been assessed in accordance with the ICNG. Predicted construction noise levels during and outside standard construction hours are provided in Table 34 and Table 35 for La Perouse, and in Table 36 and Table 37 for Kurnell.

The noise assessment aims to provide a 'realistic worst-case' noise impact assessment based on construction works in a 15-minute period. The scenarios assessed are considered representative of the noisiest construction activities likely to occur across the project.

The predictions assume activities are located at the closest point of the works zone to the nearest sensitive receivers. In reality, the potential construction noise impacts at any particular location will vary depending on factors including:

- The position of the works within the site and distance to the nearest sensitive receiver
- The overall duration of the works
- The cumulative operation of works

An analysis of potential cumulative impacts due to works being undertaken concurrently within the project has not been included. As the predictions are based on worst-case nearest distances, the influence of cumulative works is not expected to be significantly higher than the levels predicted.

Noise levels have been compared to the receiver's Noise Management Level. It should be noted that in general, construction works are temporary in nature therefore any potential noise impact on the community and the surrounding environment will not be permanent. However, where possible the impacts due to construction noise should be minimised.

Where the predicted noise level is greater than the noise management levels all feasible and reasonable work practices should be applied, however it is unlikely mitigation measures would reduce the received noise levels below the noise management levels, this is further discussed in Section 6. Where activity is predicted to exceed the 'highly noise affected' levels of 75 $dBL_{Aeq(15minute)}$, it is recommended that respite periods should be considered during these phases.

Table 34: La Perouse residential construction predicted results

| ID | Period | | NML | Stage 1 | | Stage 2 | | | | | | | Stage 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Security and fencing | Setting up Site Offices and access | Piling | Wharf Construction | Carpark Reconfiguration | Earthworks for footpaths & landscape | Installation of wharf furniture | Installation of utilities | Landscaping | Removal of site compound |
| RES1<br>51-53 Endeavour Ave, La Perouse | Standard Hours | Day | 53 | 49 | 55 | 61 | 50 | 56 | 62 | 51 | 62 | 52 | 57 |
| | OOHW | Night | 43 | - | - | 61 | - | - | - | - | - | - | - |
| RES2<br>27 Goorawahl Ave, La Perouse | Standard Hours | Day | 53 | 51 | 57 | 60 | 50 | 58 | 64 | 51 | 64 | 54 | 59 |
| | OOHW | Night | 43 | - | - | 60 | - | - | - | - | - | - | - |
| RES3<br>3/1599 Anzac Pde, La Perouse | Standard Hours | Day | 53 | 49 | 55 | 58 | 48 | 56 | 62 | 48 | 62 | 52 | 56 |
| | OOHW | Night | 43 | - | - | 58 | - | - | - | - | - | - | - |
| RES4<br>31 Endeavour Ave, La Perouse | Standard Hours | Day | 53 | 46 | 55 | 60 | 49 | 53 | 59 | 49 | 59 | 49 | 56 |
| | OOHW | Night | 43 | - | - | 60 | - | - | - | - | - | - | - |

Note:
1 – The results are highlighted according to the level of exceedance above the NML according to ICNG criteria

| Standard hours: | Out of Hours Works (OOHW): |
|---|---|
| Clearly audible – above NML | Clearly audible – above NML |
| Highly intrusive - >75dB | Highly intrusive - >75dB |

Results in Table 34 indicate some exceedances are predicted during various stages of construction. The highest predicted noise levels are during Stage 2, specifically during both phases of earthworks, where noise levels of up to 64 dBA are predicted, and during piling up to 61 $dBL_{Aeq(15minute)}$ for the representative residential receivers. Smaller exceedances are predicted during the setting up of site offices, car park reconfiguration, landscaping phases and removal of site compounds phases. Noise levels from security and fencing, wharf construction and installation of wharf furniture phases are predicted to comply with established NMLs.

Table 35: La Perouse construction other sensitive receiver predicted results

| ID[2] | NML | Stage 1 | | Stage 2 | | | | | | | Stage 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Security and fencing | Setting up Site Offices and access | Piling | Wharf Construction | Carpark Reconfiguration | Earthworks for footpaths & landscape | Installation of wharf furniture | Installation of utilities | Landscaping | Removal of site compound |
| ARC1- Frenchmans Bay Reserve Playground | 65 | 51 | 52 | 60 | 49 | 58 | 64 | 49 | 64 | 54 | 58 |
| ARC2 - Congwong Trail | 65 | 40 | 45 | 37 | 36 | 47 | 53 | 35 | 53 | 43 | 47 |
| PRC1 - Frenchmans Beach | 60 | 43 | 52 | 57 | 46 | 50 | 56 | 47 | 56 | 46 | 53 |
| CHC1 - Gujaga MACS Childcare Centre | 55 | 38 | 46 | 55 | 43 | 45 | 51 | 43 | 51 | 41 | 48 |
| COM1 - The Boatshed | 70 | 53 | 62 | 65 | 54 | 60 | 66 | 56 | 66 | 56 | 64 |
| CUL1 - La Perouse Museum | 55 | 55 | 61 | 61 | 50 | 62 | 68 | 52 | 68 | 58 | 62 |
| CUL2 - Macquarie Watchtower | 55 | 49 | 54 | 41 | 35 | 56 | 62 | 36 | 62 | 52 | 53 |
| CMU1 - La Perouse Local Aboriginal Land Council | 55 | 37 | 46 | 53 | 43 | 44 | 50 | 42 | 50 | 40 | 48 |

Notes:
1 – The results are highlighted according to the level of exceedance above the NML according to ICNG criteria
2 – These receivers have been assessed to standard hours only.

Standard hours:
Clearly audible – above NML
Highly intrusive – < 75 dB

Results in Table 35 indicate some exceedances are predicted during various stages of construction. The La Perouse Museum and Macquarie Watchtower are the two representative locations that are most affected, with the La Perouse Museum having the highest predicted noise levels during Stage 2, specifically during both phases of earthworks, where noise levels of up to 68 dBA are predicted.

Smaller exceedances are predicted to reach Macquarie Watchtower for both earthworks and carpark reconfiguration phases. Noise levels from all other non-residential representative receivers at La Perouse are predicted to comply with established NMLs.

Table 36: Kurnell residential construction predicted results

| ID | Period | | NML | Stage 1 | Stage 2 | | | | | | | | | Stage 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Security & fencing | Setting up site offices and access | Demolition of existing Kurnell viewing platform | Establishing temporary causeway | Piling | Wharf construction | Earthworks for footpaths and landscape | Installation of wharf furniture | Installation of utilities | Landscaping | Removal of work site compound |
| RES1<br>3/1 Captain Cook Dr, Kurnell | Standard Hours | Day | 53 | 63 | 62 | 61 | 59 | 56 | 59 | 76 | 55 | 63 | 63 | 67 |
| | OOHW | Night | 43 | - | - | - | - | 56 | - | - | - | - | - | - |
| RES2<br>Rangers House | Standard Hours | Day | 53 | 44 | 44 | 52 | 62 | 57 | 50 | 57 | 50 | 52 | 52 | 52 |
| | OOHW | Night | 43 | - | - | - | - | 57 | - | - | - | - | - | - |
| RES3<br>33 Captain Cook Dr, Kurnell | Standard Hours | Day | 53 | 46 | 39 | 53 | 57 | 55 | 51 | 59 | 48 | 53 | 53 | 52 |
| | OOHW | Night | 43 | - | - | - | - | 55 | - | - | - | - | - | - |
| RES4<br>10 Prince Charles Pde, Kurnell | Standard Hours | Day | 53 | 58 | 55 | 58 | 57 | 54 | 56 | 71 | 48 | 65 | 65 | 62 |
| | OOHW | Night | 43 | - | - | - | - | 54 | - | - | - | - | - | - |
| 1 – The results are highlighted according to the level of exceedance above the NML according to ICNG criteria | | | | | | | | | | | | | | |
| Standard hours:<br>Clearly audible – above NML<br>Highly intrusive - >75dB | | | | | | | | Out of Hours Works (OOHW):<br>Clearly audible – above NML<br>Highly intrusive - >75dB | | | | | | |

Results in Table 36 show exceedances for representative residential receivers in Kurnell. Residential receivers 1 and 4 are the closest in proximity to the works and are therefore affected for almost all stages of the construction period. The highest predicted noise levels are during Stage 2, specifically during the earthworks for footpaths and landscape phase, where noise levels reach up to 76 dBA are predicted. The piling phase has exceedances for all representative receivers at both standard hours and out of hours.

Establishing temporary causeway phase also have exceedances for all receivers.

Table 37: Kurnell other sensitive receiver construction predicted results

| ID[2] | NML | Stage 1 | | | Stage 2 | | | | | | | Stage 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Security & fencing | Setting up site offices and access | Demolition of existing Kurnell viewing platform | Establishing temporary causeway | Piling | Wharf construction | Earthworks for footpaths and landscape | Installation of wharf furniture | Installation of utilities | Landscaping | Removal of work site compound |
| EDU1 - Kamay Botany Bay Environmental Education Centre | 55 | 41 | 39 | 43 | 57 | 54 | 41 | 54 | 46 | 54 | 48 | 49 |
| POW1 - St John Fisher Catholic Church | 55 | 43 | 45 | 51 | 53 | 51 | 51 | 56 | 45 | 55 | 46 | 49 |
| ARC1 - Marton Park | 65 | 30 | 27 | 36 | 36 | 40 | 34 | 43 | 32 | 43 | 36 | 36 |
| ARC2 - Yena Walking Trail | 65 | 31 | 31 | 35 | 47 | 37 | 33 | 44 | 31 | 44 | 37 | 40 |
| PRC1 - Commemoration Flat | 60 | 41 | 41 | 42 | 53 | 51 | 40 | 54 | 43 | 54 | 46 | 46 |
| CHC1 - Kurnell Preschool Kindergarten | 55 | 34 | 32 | 45 | 47 | 47 | 43 | 47 | 40 | 46 | 39 | 42 |
| COM1 - Endeavour Coffee and Ice cream | 70 | 62 | 61 | 61 | 59 | 58 | 59 | 75 | 65 | 75 | 62 | 66 |
| IND1 - Caltex Kurnell Terminal | 75 | 40 | 40 | 47 | 46 | 48 | 45 | 53 | 39 | 52 | 44 | 45 |
| Notes:<br>1 – The results are highlighted according to the level of exceedance above the NML according to CNVG criteria<br>2 – These non-residential sensitive receivers have been assessed to standard hours. | | | | | | | | | | | | |
| Standard hours:<br>Clearly audible – above NML<br>Highly intrusive - >75dB | | | | | | | | | | | | |

Results in Table 37 indicate some exceedances are predicted during various stages of construction for non-residential receivers in Kurnell . The highest predicted noise levels are during piling and both earthwork phases, where noise levels of up to 75 dBA are predicted, and during

earthworks up to 75 dBA for Endeavour Coffee and Ice cream. As these levels are predicted to be above the highly affected noise level 75 dBA, mitigation will need to be considered such as respite periods during these phases.

Smaller exceedances are predicted during the establishing temporary causeway works, although this exceedance is minimal. Noise levels from security and fencing, setting up site offices and access, demolition of existing Kurnell viewing platform, wharf construction, installation of wharf furniture, landscaping and removal of work site compounds are predicted to comply with established NMLs.

## 4.3 Construction vibration assessment

As a guide, the recommended minimum working distances for vibration intensive plant to be used in the project is presented in Table 38. This table provides an indication of the possibility of impact due to vibration generating plant and equipment onto nearby receivers.

The minimum working distances presented are indicative and will vary depending on the particular item of plant and local geotechnical conditions. They apply to cosmetic damage of typical buildings under typical geotechnical conditions.

These are based on international standards and guidance.

Table 38: Recommended minimum working distances for vibration intensive plant

| Plant Item | Rating/Description | Minimum working distance (m) | | |
|---|---|---|---|---|
| | | Cosmetic damage | | **Human response (OH&E Vibration Guideline) – Disturbance to building occupants** |
| | | BS 7385 (Screening criterion of 25 mm/s) | DIN 4150 (Screening criterion of 3 mm/s) | |
| Vibratory pile driver | Sheet piles | 2 m to 20 m | 44 m | 20 m |
| Pile boring | ≤ 800 mm | 2 m (nominal) | 5 m | 10 m (nominal) |

The nearest sensitive receivers and their distance to the piling works is given in Table 39 below.

Table 39: Distance from sensitive receivers to piling works

| Receiver ID | Name | Approximate distance to the piling works[m] |
|---|---|---|
| La Perouse | | |
| RES2 | 27 Goorawahl Avenue | 310 m |
| COM1 | The Boatshed | 15 m |
| Heritage | La Perouse Memorial | 40m |
| | 45-6-1144 – Engraving | 9m |
| | Cable Tanks | <5m |
| Kurnell | | |
| RES1 | 3/1 Captain Cook Drive | 360 m |
| COM1 | Endeavour Coffee and Ice-cream | 448 m |
| Heritage | Landing Place Wharf Abutment | <5m |
| | Foreshore Midden | <5m |
| | Former Sea Wall | <5m |

Residential receivers for both La Perouse and Kurnell are not expected to be adversely affected by vibration impact, either in terms of cosmetic damage or human comfort, due to their distance from the subject works.

For the Boatshed at La Perouse, mitigation will need to be considered as it is located closer to the construction work zone than these minimum working distances. It is noted that focus is on mitigating cosmetic damage to the receiver.

The [redacted]at La Perouse could potentially be impacted by piling works if not managed appropriately. Mitigation will be needed as it is located within the minimum working distance. It is recommended that a vibration specialist would assess the minimum safe distance between the Aboriginal heritage site to the piling activities prior to construction.

The potential archaeology associated with the cable tanks at La Perouse may potentially be affected due to its proximity to piling works. This can be minimised through use of smaller equipment with lower vibration impact and vibration monitoring.

The non-Aboriginal heritage items are not expected to be impacted by vibration intensive construction works in La Perouse due to their separation distance from vibration intensive activities.

The heritage and potential archaeological items in Kurnell listed in Table 39 may be affected by the piling works. Mitigation may be required to minimise impacts to these items. It is recommended that a vibration specialist be engaged prior to construction to assess the minimum safe distance from the works to the items.

The contractor will be required to manage vibration as well as noise and make use of best practice in the management of vibration using simple and practicable techniques such equipment selection and as avoiding dropping heavy items. Vibration monitoring at the nearest potential affected building should be considered, where real-time alerts can be generated when measured vibration levels exceed criteria. Following the implementation of the proposed mitigation strategies, no impact to the site is expected. It should be noted that there is difficulty to provide certainty that there are no further vibration risks as potential archaeological structures can still be discovered.

Known and potential underwater heritage is outlined in Appendix G Underwater Cultural Heritage. For this assessment underwater heritage is considered to be anything below the mean high water mark. There would be less ground vibration at a given distance from a piling source used underwater than there would be from the same source in air (because more of the energy escapes into the water column). Conservatively, minimum safe working distances are considered the best approach to avoid vibration impacts. Any underwater heritage which is within safe working distances from piling activities could be impacted by vibration. Based on the assessment in Appendix G, it is likely that any vibration impacts from piling works would impact heritage features that are already likely to be physically impacted by piling construction. Therefore, any vibration impacts are considered to be negligible on underwater heritage including unidentified Aboriginal and non-Aboriginal heritage that is buried if present.

## 4.4 Construction traffic assessment

Road traffic noise levels including both existing and construction generated traffic, have been predicted using the Calculation of Road Traffic Noise (CoRTN) (Department of Transport Welsh Office, 1988) algorithm at the nearest residential receivers. The predicted external noise levels due to construction generated traffic is presented in Table 40 against RNP that considers residential receivers only.

Table 40: Traffic predicted results

| Area | Traffic Route | Nearest receiver | Existing hourly traffic volumes[1] | Daily construction movements[2] | Predicted results | Assessment criteria – $dBL_{Aeq}$ |
|---|---|---|---|---|---|---|
| La Perouse | Anzac Parade between Endeavour Ave and Goorawahl Avenue | RES2 and RES3 | 50 | 40 | 47$dBL_{Aeq}$ | 55$dBL_{Aeq,(1hour)}$ (external) |
| Kurnell | Captain Cook Drive | RES1 and RES4 | 58 | 50 | 48$dBL_{Aeq}$ | 55$dBL_{Aeq,(1hour)}$ (external) |
| Notes:<br>1 – Based on traffic data provided by SkyHigh and CfeIT<br>2 – Based on construction traffic data provided by TLM Consulting. | | | | | | |

Based on the assessment additional noise from construction traffic may be noticeable, given the comparative increase above the baseline traffic, however noise levels are predicted to comply with the RNP criteria.

# 5 Assessment of potential operational impacts

## 5.1 Basis of assessment

### 5.1.1 Ferry operations

The wharves would provide berthing access for both ferry vessels and commercial and recreational vessels.

Each wharf would be capable of accommodating up to three vessels per hour and enable a turnaround time of around 15 minutes from berthing to departing. This would result in approximately 36 peak vessel movements a day. The actual vessel movements would depend on the operating model. It is anticipated that vessels movements would be higher on weekends than on weekdays.

The operator for the Proposal has not been confirmed. It should be noted that operating hours are currently envisaged to be 7am – 7pm.

As the ferry types have not been confirmed and no specific sound power level data were provided for the operations, the sound power levels used in the ferry operations have been taken from the SLR Technical Paper, '*Barangaroo Ferry Hub Construction and Operation al Noise and Vibration Impact Assessment*' (SLR, 2014) and "*Noise Assessment of Small Vessels for Action Planning in Canal Cities*" (Bernadini, et al., 2019). The sound power levels are summarised in Table 41.

Table 41: Operational marine vessel activity sound power levels

| Activity | Time operating in a 15-minute period | Sound Power Level, $L_w$ **dBL$_{Aeq\ (15min)}$** |
|---|---|---|
| Ferry accelerating | 2 minutes | 98 |
| Ferry reverse thrust | 1 minute | 93 |
| Ferry idling | 5 minutes | 92 |
| Ferry horn | 5 seconds | 118 |
| Ferry PA system | 5 minutes | 73 |
| Ferry passenger noise | 10 minutes | 89 |
| Rec Vessel Accelerating (High)[1] | 2 minutes | 84 |
| Rec Vessel Idling[2] | 5 minutes | 98 |

Notes:

1 – The recreational vessel assumed is CAT 1 (i.e. small motorboats or sailing boats) **(Bernadini, et al., 2019)**.

2 – Assumed to be 5 dB less than the accelerating sound power level based on the difference of the Ferry accelerating and idling sound power levels.

The ferry routes have been assumed and are shown in Figure 16 and Figure 17.

### 5.1.2 Operational road traffic

Based on the Arup Traffic and Transport Assessment (refer to Appendix K), the projected traffic volumes generated by the wharf on opening year is provided in Table 42.

Table 42: Project traffic volumes generated by the wharf on opening year

| Area | Day of the week | Time | | | | | |
|---|---|---|---|---|---|---|---|
| | | **11:00am** | **12:00pm** | **1:00pm** | **2:00pm** | **15:00pm** | **16:00pm** |
| La Perouse | Weekday | 7 | 9 | 12 | 9 | 10 | 8 |
| | Weekend | 5 | 7 | 11 | 7 | 9 | 7 |
| Kurnell | Weekday | 41 | 49 | 49 | 39 | 41 | 35 |
| | Weekend | 35 | 42 | 39 | 32 | 33 | 28 |

A heavy vehicle percentage of 10% has been assumed for both existing traffic and generated traffic which is conservative.

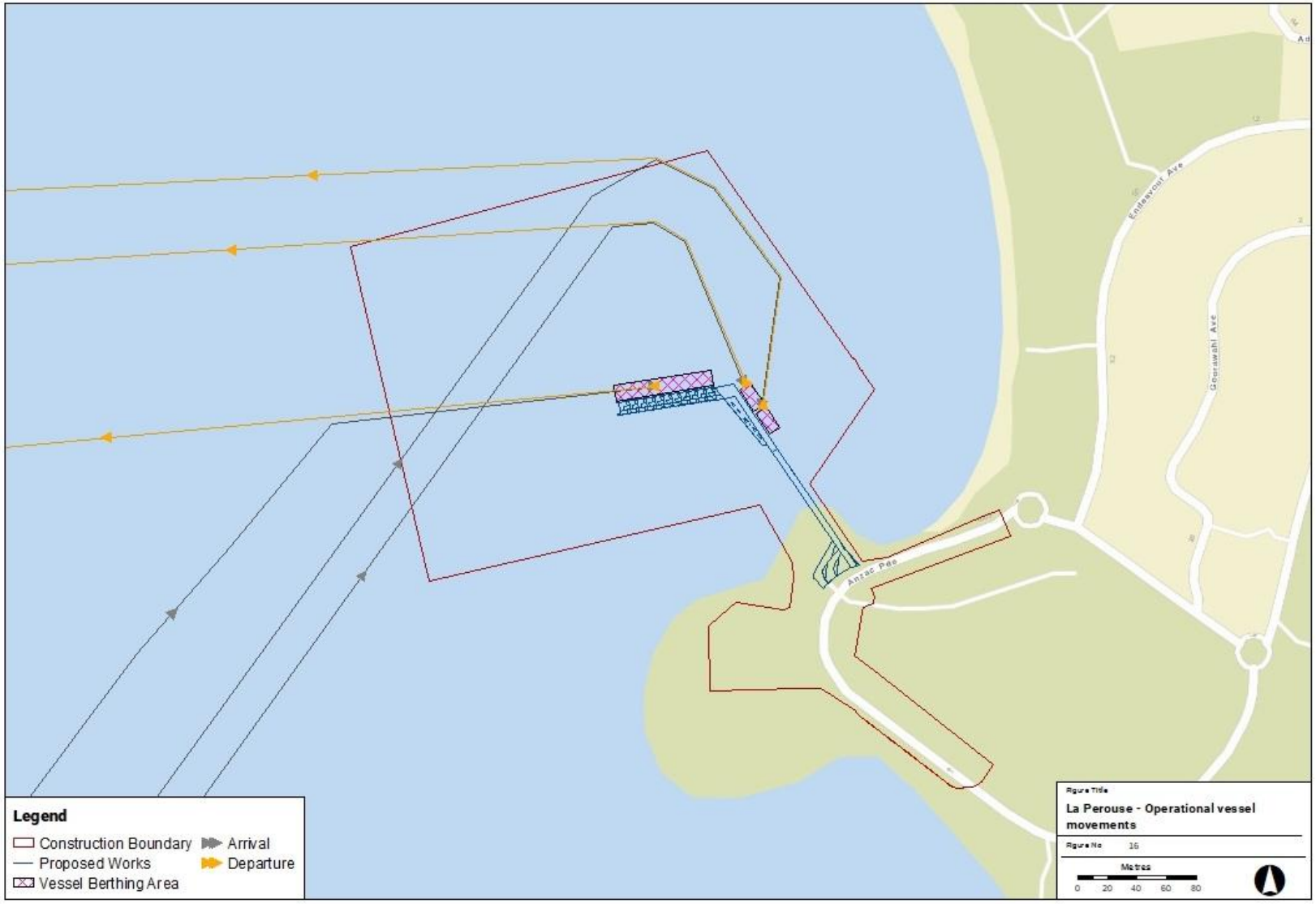


Figure 16: La Perouse operational vessel movements

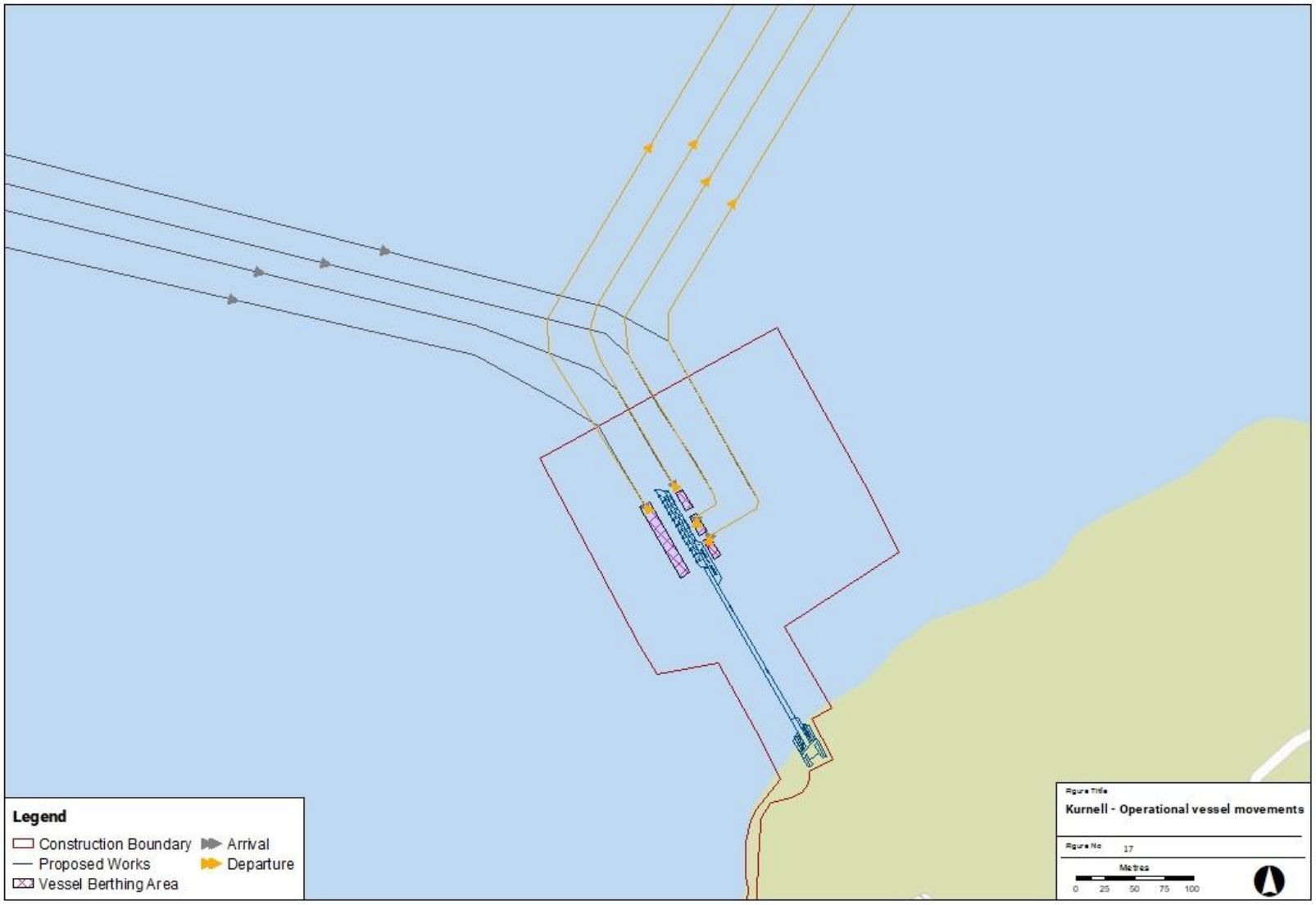


Figure 17: Kurnell operational vessel movements

## 5.2 Ferry operations assessment

Operational noise levels have been predicted at the nearest noise sensitive receivers using the SoundPLAN 8.1 noise modelling software in accordance with the Concawe (CONCAWE, 1981) algorithm.

The Concawe algorithm has been used which is considered appropriate for receivers more than 100 m away. The following meteorological conditions were adopted for this assessment for all receivers in accordance with the NPfI (Environment Protection Authority, 2017):

- Standard meteorological conditions - Stability Category D with no wind; and
- Enhanced meteorological conditions - Stability Category F with source-to receiver 3 m/s wind.

As details for the vessels and operations are not available during the time of this assessment, a conservative approach has been taken for the assessment of the ferry operations. The predictions include a 10 dB correction to account for the worst – case scenario wherein two or more modifying factors in accordance with NPfI applies.

The following scenario have been modelled as it considers the worst-case situation (i.e. full capacity) for each wharf for a 15minute period:

- One (1) public ferry is berthing and departing at each location
- Three (3) recreational vessels are berthing and departing at Kurnell
- Two (2) recreational vessels are berthing and departing at La Perouse

The predicted noise levels at each sensitive receiver are shown in Table 43 and Table 44.

Table 43: Ferry operations noise predictions – Residential receivers

| ID | Period | Project Noise Trigger Level $L_{Aeq,15minute}$ | Standard meteorological conditions | Enhanced meteorological conditions |
|---|---|---|---|---|
| | | | **Predicted Noise Level $L_{Aeq,15minute}$[1]** | **Predicted Noise Level $L_{Aeq,15minute}$[1]** |
| **La Perouse** | | | | |
| RES1 - 51-53 Endeavour Avenue, La Perouse | Day | 53 | 46 | 50 |
| RES2 - 27 Goorawahl Avenue, La Perouse | Day | 53 | 46 | 51 |
| RES3 - 3/1599 Anzac Parade, La Perouse | Day | 53 | 44 | 48 |
| RES4 - 31 Endeavour Avenue, La Perouse | Day | 53 | 45 | 50 |

| | | | | |
|---|---|---|---|---|
| **Kurnell** | | | | |
| RES1 - 3/1 Captain Cook Dr, Kurnell | Day | 48 | 41 | 47 |
| RES2 - Rangers House | Day | 48 | 45 | 40 |
| RES3 - 33 Captain Cook Dr, Kurnell | Day | 48 | 42 | 47 |
| RES4 - 10 Prince Charles Pde, Kurnell | Day | 48 | 39 | 44 |
| 1- 10dB correction is added to these results to account for modifying factors, in accordance with NPfI | | | | |

Table 44: Ferry operations noise predictions - Other sensitive receivers

| ID | Period | Project Noise Trigger Level $L_{Aeq,15minute}$ | Standard meteorological conditions<br>Predicted Noise Level $L_{Aeq,15minute}$[1] | Enhanced meteorological conditions<br>Predicted Noise Level $L_{Aeq,15minute}$[1] |
|---|---|---|---|---|
| **La Perouse** | | | | |
| ARC1 - Frenchmans Bay Reserve Playground | When in use | 53 | 48 | 52 |
| ARC2 - Congwong Trail | When in use | 53 | 39 | 44 |
| PRC1 -Frenchmans Beach | When in use | 48 | 47 | 52 |
| CHC1 - Gujaga MACS Childcare Centre | When in use | 40 | 41 | 46 |
| COM1 - The Boatshed | When in use | 63 | 50 | 54 |
| CUL1 - La Perouse Museum | When in use | 63 | 46 | 50 |
| CUL2 - Macquarie Watchtower | When in use | 63 | 42 | 46 |
| CMU1 - La Perouse Local Aboriginal Land Council | When in use | 53 | 40 | 45 |
| **Kurnell** | | | | |
| EDU1 - Kamay Botany Bay Environmental Education Centre | When in use | 40 | 40 | 45 |
| PoW1 - St John Fisher Catholic Church | When in use | 48 | 39 | 44 |
| ARC1 - Marton Park | When in use | 53 | 27 | 32 |
| ARC2 - Yena Walking Trail | When in use | 53 | 39 | 44 |
| PRC1 - Commemoration Flat | When in use | 48 | 38 | 43 |

| ID | Period | Project Noise Trigger Level $L_{Aeq,15minute}$ | Standard meteorological conditions<br>Predicted Noise Level $L_{Aeq,15minute}$[1] | Enhanced meteorological conditions<br>Predicted Noise Level $L_{Aeq,15minute}$[1] |
|---|---|---|---|---|
| CHC1 -Kurnell Preschool Kindergarten | When in use | 40 | 28 | 33 |
| COM1 - Endeavour Coffee and Ice cream | When in use | 63 | 45 | 50 |
| IND1 - Caltex Kurnell Terminal | When in use | 68 | 33 | 38 |
| 1- The maximum 10dB correction is applied to the above predictions to account for the worst – case scenario wherein two or more modifying factors in accordance with NPfI has been assumed. | | | | |

Operational noise prediction levels in Table 43 and Table 44 which exceed criteria are highlighted in amber. The predicted results show exceedances for Gujaga MACS Childcare Centre - 1 dB with standard meteorological conditions and 6 dB with exceedance for enhanced meteorological conditions. The assessment is conservative as it has included a 10dB correction to account for two or more modifying factors as per NPfI.

All other receivers including employees and visitors to the Kamay Botany Bay National Park are expected to not be negatively affected by the ferry operational noise as they are below the project noise trigger levels. It is recommended that a confirmation of our assessment be undertaken once a ferry operator has been appointed and details of the ferry sound power levels are made available.

## 5.3 Operational traffic noise assessment

Increased traffic generated on the surrounding road network due to the operation of the Kamay Ferry Wharves development is assessed in accordance with the NSW *Road Noise Policy* (RNP).

From the projected traffic volumes during Opening year (2024) in Table 42, the busiest period is at 1pm for La Perouse and 12pm at Kurnell on both weekdays and weekends. These were adjusted to project the Opening and Design year volumes using a seasonality adjustment and a growth rate 1.32% provided by in the Landside Traffic and Transport Assessment (refer to Appendix K of the EIS).

A heavy vehicle percentage of 10% has been assumed for both existing traffic and generated traffic which is considered to be conservative.

Table 45: Assessment of the road traffic generated by Kamay ferry wharves

| | Existing Traffic 2014[1] | Opening Year 2024 | Design Year 2036 |
|---|---|---|---|
| **La Perouse - Anzac Parade** | | | |
| Peak vehicle movement volume for the site at 1pm | 186 | 289[2] | 338[2] |
| Traffic generated by wharf at 1pm | - | 12 | *198* |
| increase in noise level | | **0.2** | ***2.0*** |
| **Kurnell - Captain Cook Drive** | | | |
| Peak vehicle movement volume for the site at 12pm | 140 | 229[2] | 268[2] |
| Traffic generated by wharf at 12pm | - | 49 | *157* |
| increase in noise level | | **0.8** | ***2.0*** |
| Note:<br>1 – Based on traffic data provided by SkyHigh and CfeIT<br>2 – Adjusted traffic volumes using a seasonality adjustment and growth rate of 1.32% from Arup Transport | | | |

Based on the existing traffic numbers along Anzac Parade and Captain Cook Drive, the additional traffic created by wharves operations is predicted to increase the $L_{Aeq(15\ hour)}$ noise levels by 0.2 dB at Anzac Parade and 0.8 dB at Captain Cook Drive.

This is less than the 2 dB ‘minor impact’ criteria, and therefore represents an insignificant effect on the ambient noise environment.

For the Design Year 2046, as long as the generated traffic is not higher than 198 vehicles along Anzac Parade and 157 vehicles along Captain Cook Drive, which is unlikely, it is anticipated that the 2dB minor impact criteria will be satisfied.

# 6 Environmental management measures

A summary of recommended mitigation measures is presented in Table 46.

Table 46: Environmental management measures for noise and vibration impacts

| Impacts | Mitigation | Responsibility | Timing |
|---|---|---|---|
| **Noise and vibration risks during construction** | Noise and Vibration Management Plan<br>A Noise and Vibration Management Plan will be prepared and implemented as part of the CEMP. The Plan will generally follow the approach in OEH's Interim Construction Noise Guideline (ICNG) and identify:<br>All potential significant noise and vibration generating activities associated with the activity<br>Measures to be implemented during construction to minimise noise and vibration impacts, such as restrictions on working hours, staging, placement and operation of work compounds, parking and storage areas, temporary noise barriers, haul road maintenance, and controlling the location and use of vibration generating equipment<br>Feasible and reasonable mitigation measures to be implemented, taking into account the RMS Beyond the Pavement urban design policy, process and principles.<br>A monitoring program to assess performance against relevant noise and vibration criteria<br>Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures<br>Contingency measures to be implemented in the event of non-compliance with noise and vibration criteria.<br>Note that ICNG does not provide firm guidance around the management of works outside standard hours, the Construction Noise and Vibration Strategy (CNVS) provides greater clarity in the implementation of OOHW mitigation measures. | Contractor | Pre-construction / Construction |

| Impacts | Mitigation | Responsibility | Timing |
|---|---|---|---|
| **Equipment selection** | Equipment shall be selected to have Sound Power Levels (Lw) to be the same or quieter as the levels used in this assessment.<br>Where possible stationary equipment should be located behind structures such as demountable buildings or stockpiles to maximise shielding to receivers.<br>Consider using electric / hydraulic equipment where possible.<br>Use only the necessary size and power equipment<br>All plant and equipment used on site must be:<br>• maintained in a proper and efficient condition; and<br>• operated in a proper and efficient manner.<br>Turn off all vehicles, plant and equipment when not in use.<br>Ensuring that the Responsible Person checks the conditions of the powered equipment used on site daily to ensure plant is properly maintained and that noise is kept as low as practicable.<br>If rental equipment are to be used, the noise levels of plant and equipment items are to be considered in rental decisions. | Contractor | Construction |
| **Risks to local sensitive receivers** | Standard construction hours<br>• Monday to Friday 7.00 am to 6.00 pm<br>• Saturdays 8.00 am to 1.00 pm<br>• No construction on Sundays or Public Holidays. | Contractor | Construction |
| **Community notification** | Local community notification - sensitive receivers<br>All sensitive receivers (eg. schools, local councils) likely to be affected will be notified at least {30 days} prior to commencement of any works associated with the activity that may have an adverse noise or vibration impact. The notification will include details of: the project; construction period and construction hours; contact information for project management staff; complaint and incident reporting; and how to obtain further information. | Transport for NSW | Pre-construction / Construction |

| Impacts | Mitigation | Responsibility | Timing |
|---|---|---|---|
| **Location of plant** | The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers. Only have necessary equipment on site.<br>Plan truck movements to avoid residential streets where possible. | Contractor | Construction |
| **Out of Hours work** | Restrict the number of nights per week and/or the number of nights per calendar month that the works are undertaken, in consultation with residences and businesses most affected. | Contractor | Construction |
| **Piling vibration impacts** | Vibration specialist to assess the minimum safe distances between the identified sensitive heritage sites to the vibration generating activities | Vibration specialist | Pre construction |

# 7 Conclusion

An assessment of noise and vibration impacts associated with the construction and operation of the Kamay Ferry Wharves has been conducted in accordance with Secretary's Environmental Assessment Requirements and relevant noise policies and guidance documents.

## 7.1 Construction noise and vibration

Noise generated from the various stages of demolition and construction have been predicted at surrounding noise sensitive receivers.

Based on the results of the assessment, impact piling works are predicted to generate the most significant noise impacts at both La Perouse and Kurnell. Earthworks for footpaths and landscaping are also predicted to exceed project NMLs, where the use of equipment such as the excavator and compactor whacker plates, are the highest contributors to noise emissions. Some residential and commercial receivers along Captain Cook Drive may experiencing noise levels in excess of $L_{eq(15min)}$ 70dBA, however, these periods are likely to be limited in duration and frequency.

Based on the identified nearest receiver locations, and proposed construction works, vibration from the piling work will likely affect heritage and potential arachnological items closest to the site. This is recommended to be mitigated through vibration specialist guidance.

High level recommendations are given for the control of construction noise for the periods where exceedances are predicted of relevant Noise Management Levels. The construction contractor is required to prepare a detailed Construction Noise and Vibration Management Plan which reviews the modelled construction details and noise and vibration impacts.

## 7.2 Operational noise

Operation noise criteria have been established for noise emissions, which include traffic generated by operation of the site and ferry operations at the La Perouse and Kurnell wharves.

Impacts due to the operational road traffic have been assessed against the RNP. From the assessment, the generated road traffic from the operation of the ferry wharves will generate a less than 2 dB increase in noise level during Opening Year, and therefore represents an insignificant effect on the ambient noise environment.

The operational noise from the wharves have been assessed against the NPfI policy. The predicted noise levels are well below project noise trigger levels for all receivers except for Gujaga MACS Childcare Centre where exceedances of up to 6 dB with for enhanced meteorological conditions were calculated. However, the assessment is conservative as it has included a 10dB correction to account for two or more modifying factors as per NPfI.

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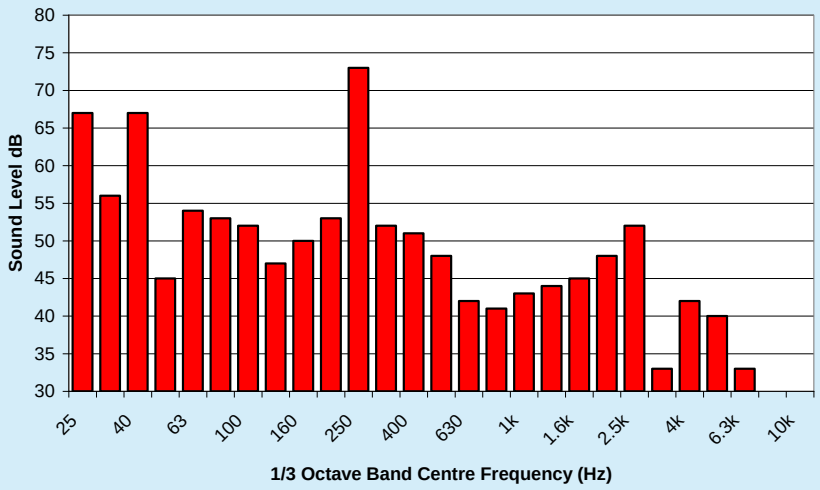
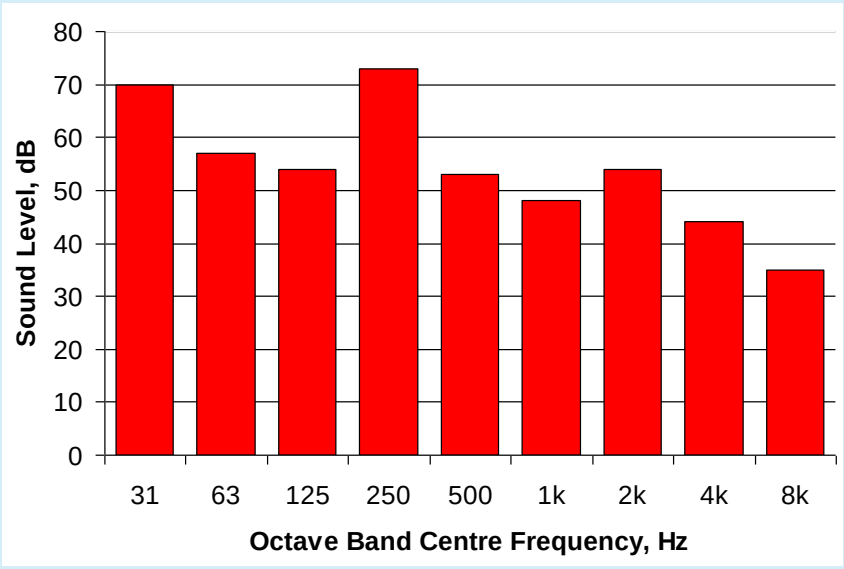
# Appendix A

Acoustic Terminology

<table>
<tr><th>Term</th><th>Definition</th></tr>
<tr><td>Ambient Noise Level</td><td>The ambient noise level is the overall noise level measured at a location from multiple noise sources. When assessing noise from a particular development, the ambient noise level is defined as the remaining noise level in the absence of the specific noise source being investigated. For example, if a fan located on a city building is being investigated, the ambient noise level is the noise level from all other sources without the fan running. This would include sources such as traffic, birds, people talking and other nearby fans on other buildings.</td></tr>
<tr><td>Background Noise Level</td><td>The background noise level is the noise level that is generally present at a location at all or most times. Although the background noise may change over the course of a day, over shorter time periods (e.g. 15 minutes) the background noise is almost-constant. Examples of background noise sources include steady traffic (e.g. motorways or arterial roads), constant mechanical or electrical plant and some natural noise sources such as wind, foliage, water and insects.<br>Assessment Background Level (ABL)<br>A single-number figure used to characterise the background noise levels from a single day of a noise survey. ABL is derived from the measured noise levels for the day, evening or night time period of a single day of background measurements. The ABL is calculated to be the tenth percentile of the background LA90 noise levels – i.e. the measured background noise is above the ABL 90% of the time.<br>Rating Background Level (RBL / min $L_{A90,1hour}$)<br>A single-number figure used to characterise the background noise levels from a complete noise survey. The RBL for a day, evening or night time period for the overall survey is calculated from the individual Assessment Background Levels (ABL) for each day of the measurement period, and is numerically equal to the median (middle value) of the ABL values for the days in the noise survey. This parameter is denoted RBL in NSW, and min $L_{A90,1hour}$ in QLD.</td></tr>
<tr><td>Decibel</td><td>The decibel scale is a logarithmic scale which is used to measure sound and vibration levels. Human hearing is not linear and involves hearing over a large range of sound pressure levels, which would be unwieldy if presented on a linear scale. Therefore, a logarithmic scale, the decibel (dB) scale, is used to describe sound levels.<br>An increase of approximately 10 dB corresponds to a subjective doubling of the loudness of a noise. The minimum increase or decrease in noise level that can be noticed is typically 2 to 3 dB.</td></tr>
<tr><td>dBA</td><td>dBA denotes a single-number sound pressure level that includes a frequency weighting (“A-weighting”) to reflect the subjective loudness of the sound level.<br>The frequency of a sound affects its perceived loudness. Human hearing is less sensitive at low and very high frequencies, and so the A-weighting is used to account for this effect. An A-weighted decibel level is written as dBA.</td></tr>
<tr><td></td><td>Some typical dBA levels are shown below.
<table>
<tr><th>Sound Pressure Level dBA</th><th>Example</th></tr>
<tr><td>130</td><td>Human threshold of pain</td></tr>
<tr><td>120</td><td>Jet aircraft take-off at 100 m</td></tr>
<tr><td>110</td><td>Chain saw at 1 m</td></tr>
<tr><td>100</td><td>Inside nightclub</td></tr>
</table></td></tr>
</table>

| Term | Definition | | |
|---|---|---|---|
| | | 90 | Heavy trucks at 5 m |
| | | 80 | Kerbside of busy street |
| | | 70 | Loud stereo in living room |
| | | 60 | Office or restaurant with people present |
| | | 50 | Domestic fan heater at 1m |
| | | 40 | Living room (without TV, stereo, etc.) |
| | | 30 | Background noise in a theatre |
| | | 20 | Remote rural area on still night |
| | | 10 | Acoustic laboratory test chamber |
| | | 0 | Threshold of hearing |
| **$L_1$** | The $L_1$ statistical level is often used to represent the maximum level of a sound level that varies with time.<br>Mathematically, the $L_1$ level is the sound level exceeded for 1% of the measurement duration. As an example, 87 dB $L_{A1,15min}$ is a sound level of 87 dBA or higher for 1% of the 15 minute measurement period. | | |
| **$L_{10}$** | The $L_{10}$ statistical level is often used as the "average maximum" level of a sound level that varies with time.<br>Mathematically, the $L_{10}$ level is the sound level exceeded for 10% of the measurement duration. $L_{10}$ is often used for road traffic noise assessment. As an example, 63 dB $L_{A10,18hr}$ is a sound level of 63 dBA or higher for 10% of the 18 hour measurement period. | | |
| **$L_{90}$** | The $L_{90}$ statistical level is often used as the "average minimum" or "background" level of a sound level that varies with time.<br>Mathematically, $L_{90}$ is the sound level exceeded for 90% of the measurement duration. As an example, 45 dB $L_{A90,15min}$ is a sound level of 45 dBA or higher for 90% of the 15 minute measurement period. | | |
| **$L_{eq}$** | The 'equivalent continuous sound level', Leq, is used to describe the level of a time-varying sound or vibration measurement.<br>Leq is often used as the "average" level for a measurement where the level is fluctuating over time. Mathematically, it is the energy-average level over a period of time (i.e. the constant sound level that contains the same sound energy as the measured level). When the dBA weighting is applied, the level is denoted dB LAeq. Often the measurement duration is quoted, thus LAeq,15 min represents the dBA weighted energy-average level of a 15 minute measurement. | | |
| **$L_{max}$** | The Lmax statistical level can be used to describe the "absolute maximum" level of a sound or vibration level that varies with time.<br>Mathematically, Lmax is the highest value recorded during the measurement period. As an example, 94 dB LAmax is a highest value of 94 dBA during the measurement period.<br>Since Lmax is often caused by an instantaneous event, Lmax levels often vary significantly between measurements. | | |
| **Frequency** | Frequency is the number of cycles per second of a sound or vibration wave. In musical terms, frequency is described as "pitch". Sounds towards the lower end of the human hearing frequency range are perceived as "bass" or "low-pitched" and sounds with a higher frequency are perceived as "treble" or "high pitched". | | |

| Term | Definition |
|---|---|
| |  <br>  |
| **Peak Particle Velocity (PPV)** | Peak Particle Velocity (PPV) is the highest velocity of a particle (such as part of a building structure) as it vibrates. Most sound level meters measure root mean squared (RMS) values; it is common to approximate the PPV based on an RMS measurement.<br>PPV is commonly used as a vibration criterion, and is often interpreted as a PPV based on the Lmax or Lmax,spec index. |
| **Sound Power and Sound Pressure** | The sound power level ($L_w$) of a source is a measure of the total acoustic power radiated by a source. The sound pressure level ($L_p$) varies as a function of distance from a source. However, the sound power level is an intrinsic characteristic of a source (analogous to its mass), which is not affected by the environment within which the source is located. |
| **Vibration** | Waves in a solid material are called “vibration”, as opposed to similar waves in air, which are called “sound” or “noise”. If vibration levels are high enough, they can be felt; usually vibration levels must be much higher to cause structural damage.<br>A vibrating structure (eg a wall) can cause airborne noise to be radiated, even if the vibration itself is too low to be felt. Structureborne vibration limits are sometimes set to control the noise level in a space.<br>Vibration levels can be described using measurements of displacement, velocity and acceleration. Velocity and acceleration are commonly used for |

| Term | Definition |
|---|---|
| | structureborne noise and human comfort. Vibration is described using either metric units (such as mm, mm/s and mm/s$^2$) or else using a decibel scale. |

# Appendix B

Noise Monitoring

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# B1 Noise monitoring equipment

Unattended monitoring was carried out using the following equipment:

| Measurement location | Equipment/model | Serial No. | SLM Type |
|---|---|---|---|
| La Perouse Logger - 51-52 Endeavour Ave | Ngara | 878060 | Class 1 |
| Kurnell Logger - 3/1 Captain Cook Dr | Ngara | 878061 | Class 1 |
| Notes: All meters comply with AS IEC 61672.1 2013 "Electroacoustics - Sound Level Meters" and designated either Class 1 as per table, and are suitable for field use. | | | |

The equipment was calibrated prior and subsequent to the measurement period using a Bruel & Kjaer Type 4231 calibrator. No significant drift in calibration was observed.

# B2 Extraneous/weather affected data

Measurement samples affected by extraneous weather conditions, i.e wind greater than 5 m/s or rain, were excluded from the recorded data in accordance with the procedures outlined in Fact Sheet A of the NSW EPA's *Noise Policy for Industry* (NPfI 2017).

Weather data was obtained from the Bureau of Meteorology (BOM) collection station at Little Bay (AWS:66051) and Kurnell (AWS:66043) in 15-minute intervals for the monitoring period. Wind speed data was adjusted to account for the difference in measurement height and surrounding environment between the BOM weather station, measured 10 m above ground, and the microphone height, based on Table C.1 of ISO 4354:2009 '*Wind actions on structures*'

# B3 Logger graphs

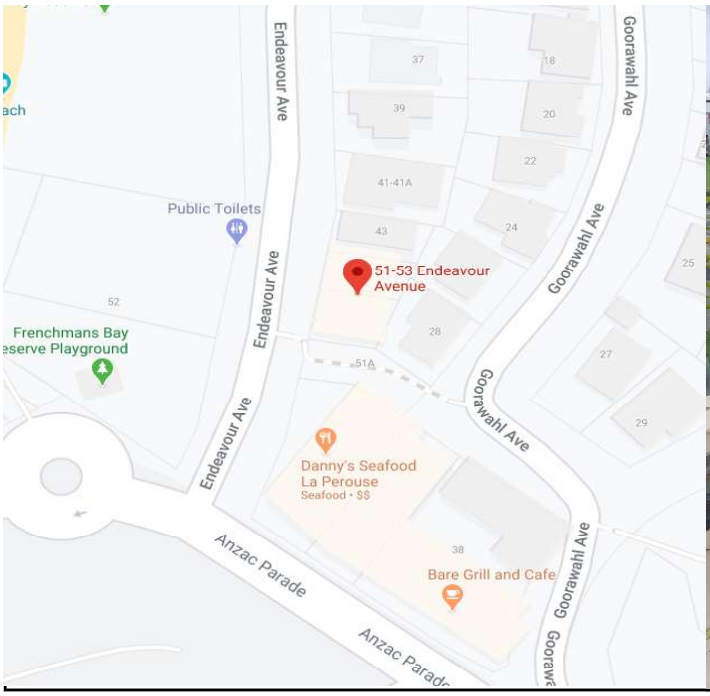
The following noise level vs time graphs present overall dB(A) levels recorded by the unattended logger(s) for a range of noise descriptors, including $L_{Aeq}$, $L_{A90}$, $L_{A10}$ and $L_{Amax}$, while line graphs are presented, sampling is at 15 minute intervals.

Wind speeds are also show where relevant, and periods of excluded data are shaded grey

ARUP

# 51-53 Endeavour Ave, La Perouse NSW 2036 (Free Field)

Additional detail:




**Background and ambient noise monitoring results - NSW 'Industrial Noise Policy', 2000**

| | $L_{A90}$ Background noise levels[4] | | | $L_{Aeq}$ Ambient noise levels | | |
|---|---|---|---|---|---|---|
| **Date** | **Day[1]** | **Evening[2]** | **Night[3]** | **Day[1]** | **Evening[2]** | **Night[3]** |
| Thursday-26-March-2020 | | 41 | 38 | | 62 | 49 |
| Friday-27-March-2020 | 42 | 42 | 36 | 63 | 61 | 51 |
| Saturday-28-March-2020 | | 40 | 38 | | 59 | 51 |
| Sunday-29-March-2020 | 45 | | 37 | 63 | | 48 |
| Monday-30-March-2020 | 44 | 42 | 36 | 63 | 63 | 47 |
| Tuesday-31-March-2020 | 42 | 36 | 34 | 65 | 65 | 44 |
| Wednesday-01-April-2020 | 39 | 39 | | 62 | 57 | |
| Thursday-02-April-2020 | 42 | 43 | 40 | 61 | 51 | 47 |
| Friday-03-April-2020 | 45 | | 41 | 62 | | 50 |
| Saturday-04-April-2020 | 45 | 42 | 36 | 61 | 55 | 46 |
| Sunday-05-April-2020 | 43 | 41 | 40 | 69 | 58 | 46 |
| Monday-06-April-2020 | | | | | | |
| **Representative Weekday[5]** | **42** | **41** | **37** | **63** | **62** | **48** |
| **Representative Weekend[5]** | **45** | **41** | **37** | **66** | **57** | **48** |
| **Representative Week[5]** | **43** | **41** | **37** | **64** | **61** | **48** |

Notes:

1. Day is 8:00am to 6:00pm on Sunday and 7:00am to 6:00pm at other times
2. Evening is 6:00pm to 10:00pm
3. Night is the remaining periods
4. Assessment Background Level (ABL) for individual days
5. Rating Background Level (RBL) for $L_{A90}$ and logarithmic average for $L_{Aeq}$

**Road / Rail noise monitoring results**

| | $L_{Aeq}$ Noise levels | | $L_{Aeq\ 1hr}$ Noise levels (upper 10th percentile) | |
|---|---|---|---|---|
| **Date** | **Day[1]** | **Night[2]** | **Day** | **Night** |

| | | | | |
|---|---|---|---|---|
| Thursday-26-March-2020 | 63 | 49 | 66 | 53 |
| Friday-27-March-2020 | 62 | 51 | 64 | 58 |
| Saturday-28-March-2020 | 62 | 51 | 66 | 59 |
| Sunday-29-March-2020 | 62 | 48 | 66 | 55 |
| Monday-30-March-2020 | 63 | 47 | 69 | 53 |
| Tuesday-31-March-2020 | 65 | 44 | 70 | 51 |
| Wednesday-01-April-2020 | 62 | 45 | 65 | 50 |
| Thursday-02-April-2020 | 59 | 47 | 64 | 53 |
| Friday-03-April-2020 | 61 | 50 | 64 | 58 |
| Saturday-04-April-2020 | 60 | 42 | 0 | 47 |
| Sunday-05-April-2020 | 67 | 46 | 68 | 50 |
| Monday-06-April-2020 | 58 | | 62 | |
| **Representative Weekday[3]** | **62** | **48** | **66** | **55** |
| **Representative Weekend[3]** | **64** | **48** | **65** | **55** |
| **Representative Week[3]** | **63** | **48** | **66** | **55** |

Notes:

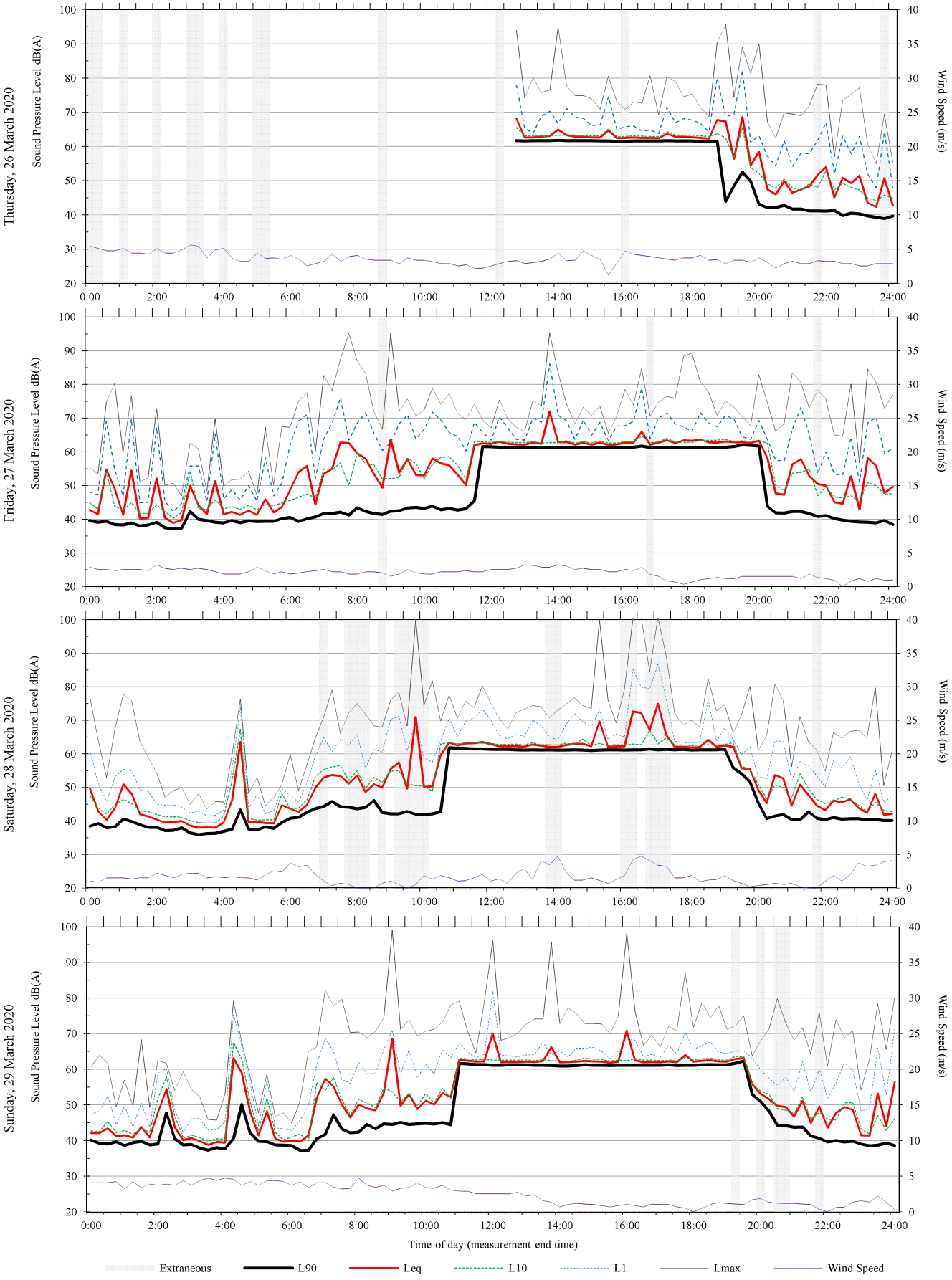
1. Day is 7:00am to 10:00pm

2. Night is 10:00pm to 7:00am

3. Logarithmic average of daily $L_{Aeq}$

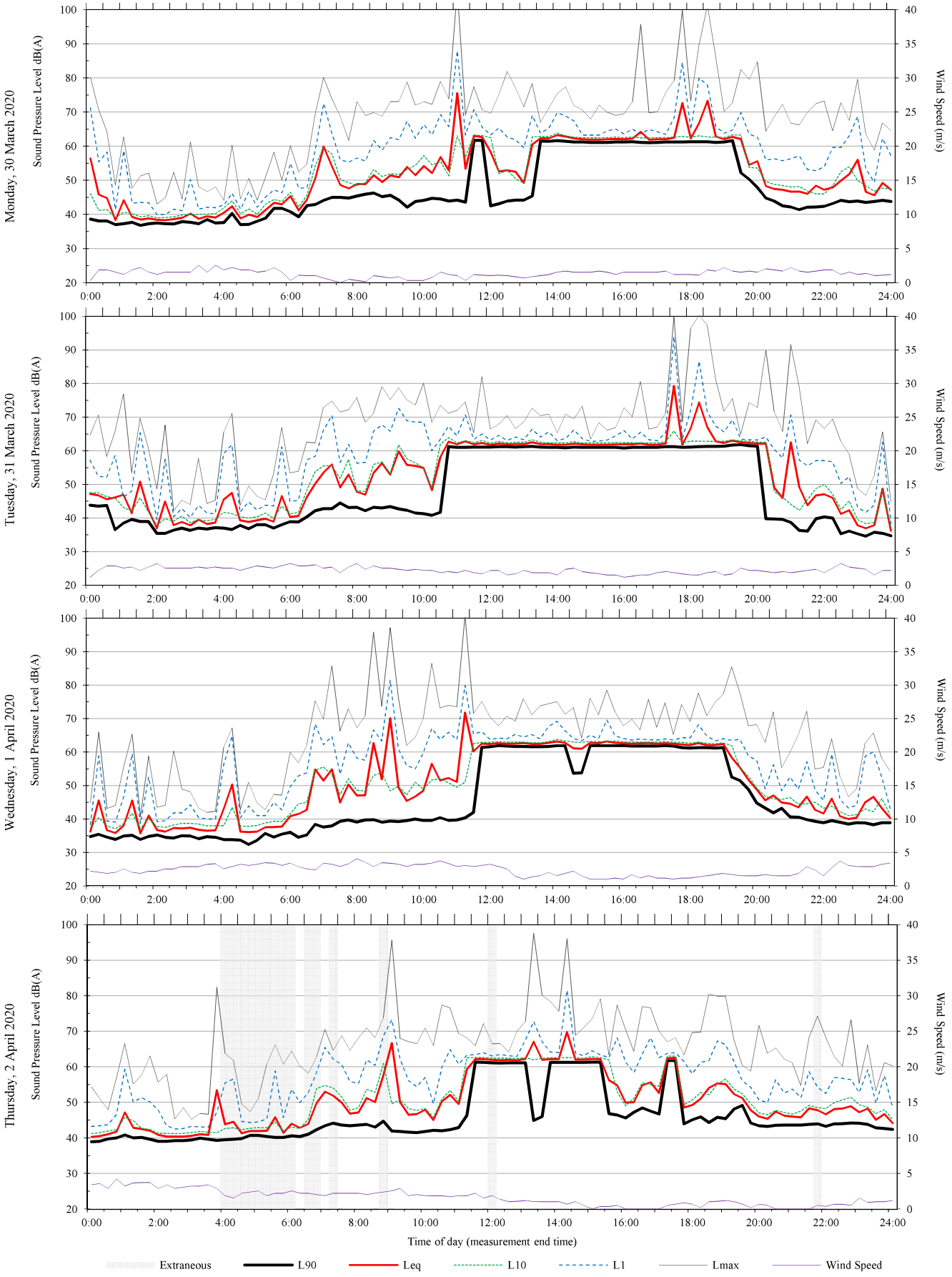
**Unattended monitoring: 51-53 Endeavour Ave, La Perouse NSW 2036 (Free Field)**

ARUP



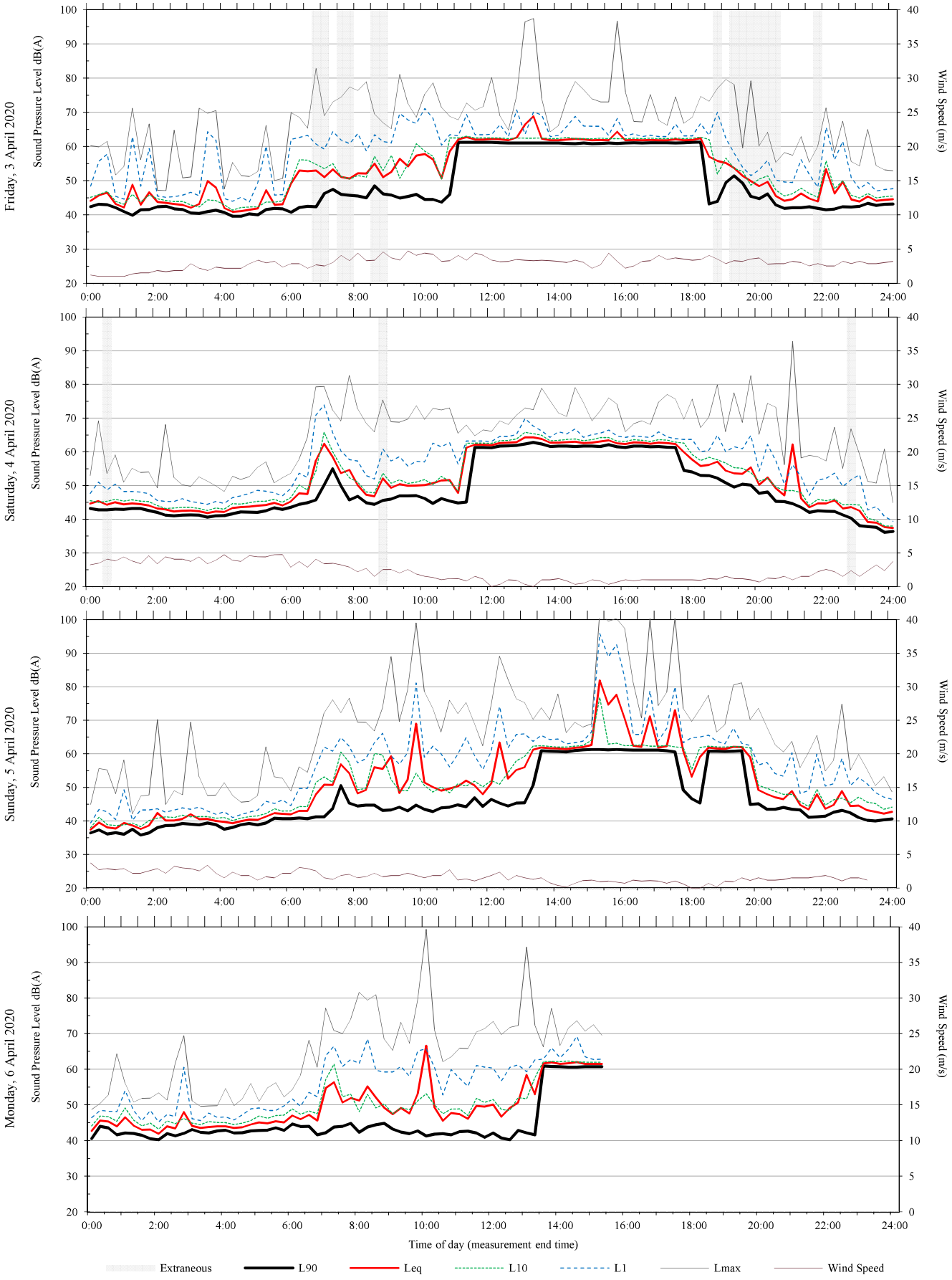
**Unattended monitoring: 51-53 Endeavour Ave, La Perouse NSW 2036 (Free Field)**

ARUP



**Unattended monitoring: 51-53 Endeavour Ave, La Perouse NSW 2036 (Free Field)**

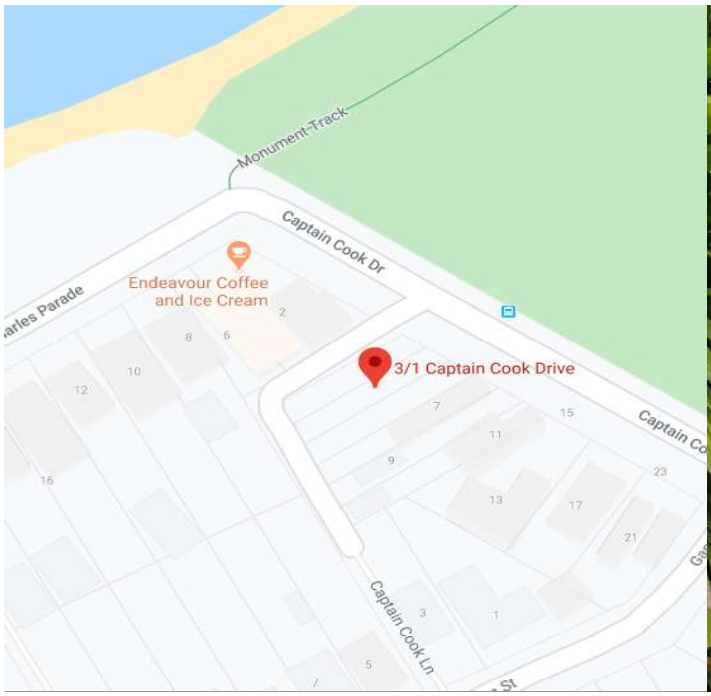
ARUP



ARUP

# 3/1 Captain Cook Dr, Kurnell NSW 2231 (Free Field)

Additional detail:




**Background and ambient noise monitoring results - NSW 'Industrial Noise Policy', 2000**

| Date | $L_{A90}$ Background noise levels[4] | | | $L_{Aeq}$ Ambient noise levels | | |
|---|---|---|---|---|---|---|
| | Day[1] | Evening[2] | Night[3] | Day[1] | Evening[2] | Night[3] |
| Thursday-26-March-2020 | | 37 | 37 | | 53 | 50 |
| Friday-27-March-2020 | 36 | 35 | 30 | 56 | 56 | 47 |
| Saturday-28-March-2020 | | 38 | 39 | | 53 | 53 |
| Sunday-29-March-2020 | 44 | | 33 | 59 | | 54 |
| Monday-30-March-2020 | 43 | 42 | 35 | 56 | 50 | 51 |
| Tuesday-31-March-2020 | 40 | 36 | 42 | 56 | 48 | 56 |
| Wednesday-01-April-2020 | 43 | 43 | | 55 | 49 | |
| Thursday-02-April-2020 | 47 | 42 | 40 | 62 | 51 | 51 |
| Friday-03-April-2020 | 43 | | | 56 | | |
| Saturday-04-April-2020 | | 32 | | | 46 | |
| Sunday-05-April-2020 | | | | | | |
| **Representative Weekday[5]** | **43** | **39** | **37** | **57** | **52** | **52** |
| **Representative Weekend[5]** | **44** | **35** | **36** | **59** | **51** | **54** |
| **Representative Week[5]** | **43** | **37** | **37** | **58** | **52** | **53** |

Notes:

1. Day is 8:00am to 6:00pm on Sunday and 7:00am to 6:00pm at other times
2. Evening is 6:00pm to 10:00pm
3. Night is the remaining periods
4. Assessment Background Level (ABL) for individual days
5. Rating Background Level (RBL) for $L_{A90}$ and logarithmic average for $L_{Aeq}$

**Road / Rail noise monitoring results**

| Date | $L_{Aeq}$ Noise levels | | $L_{Aeq\ 1hr}$ Noise levels (upper 10th percentile) | |
|---|---|---|---|---|
| | Day[1] | Night[2] | Day | Night |
| Thursday-26-March-2020 | 56 | 50 | 57 | 57 |

| | | | | |
|---|---|---|---|---|
| Friday-27-March-2020 | 56 | 47 | 58 | 52 |
| Saturday-28-March-2020 | 58 | 53 | 61 | 59 |
| Sunday-29-March-2020 | 59 | 54 | 60 | 63 |
| Monday-30-March-2020 | 55 | 51 | 57 | 57 |
| Tuesday-31-March-2020 | 55 | 56 | 57 | 62 |
| Wednesday-01-April-2020 | 54 | 50 | 55 | 54 |
| Thursday-02-April-2020 | 61 | 51 | 65 | 56 |
| Friday-03-April-2020 | 56 | 54 | 57 | 56 |
| Saturday-04-April-2020 | 61 | 54 | 0 | 57 |
| Sunday-05-April-2020 | 55 | | | |
| **Representative Weekday[3]** | **56** | **52** | **59** | **57** |
| **Representative Weekend[3]** | **59** | **54** | **59** | **60** |
| **Representative Week[3]** | **57** | **53** | **59** | **58** |

Notes:

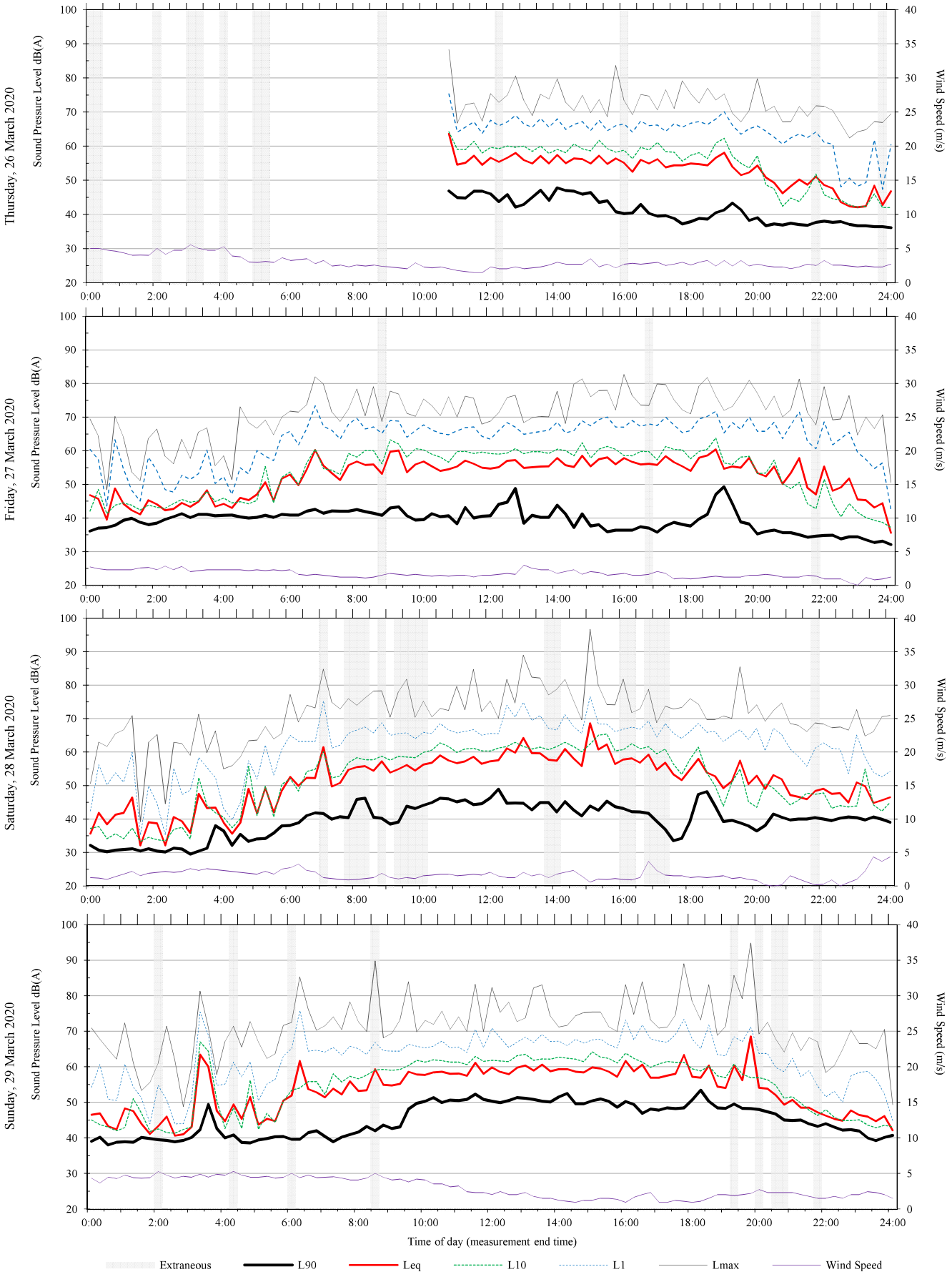
1. Day is 7:00am to 10:00pm

2. Night is 10:00pm to 7:00am

3. Logarithmic average of daily $L_{Aeq}$

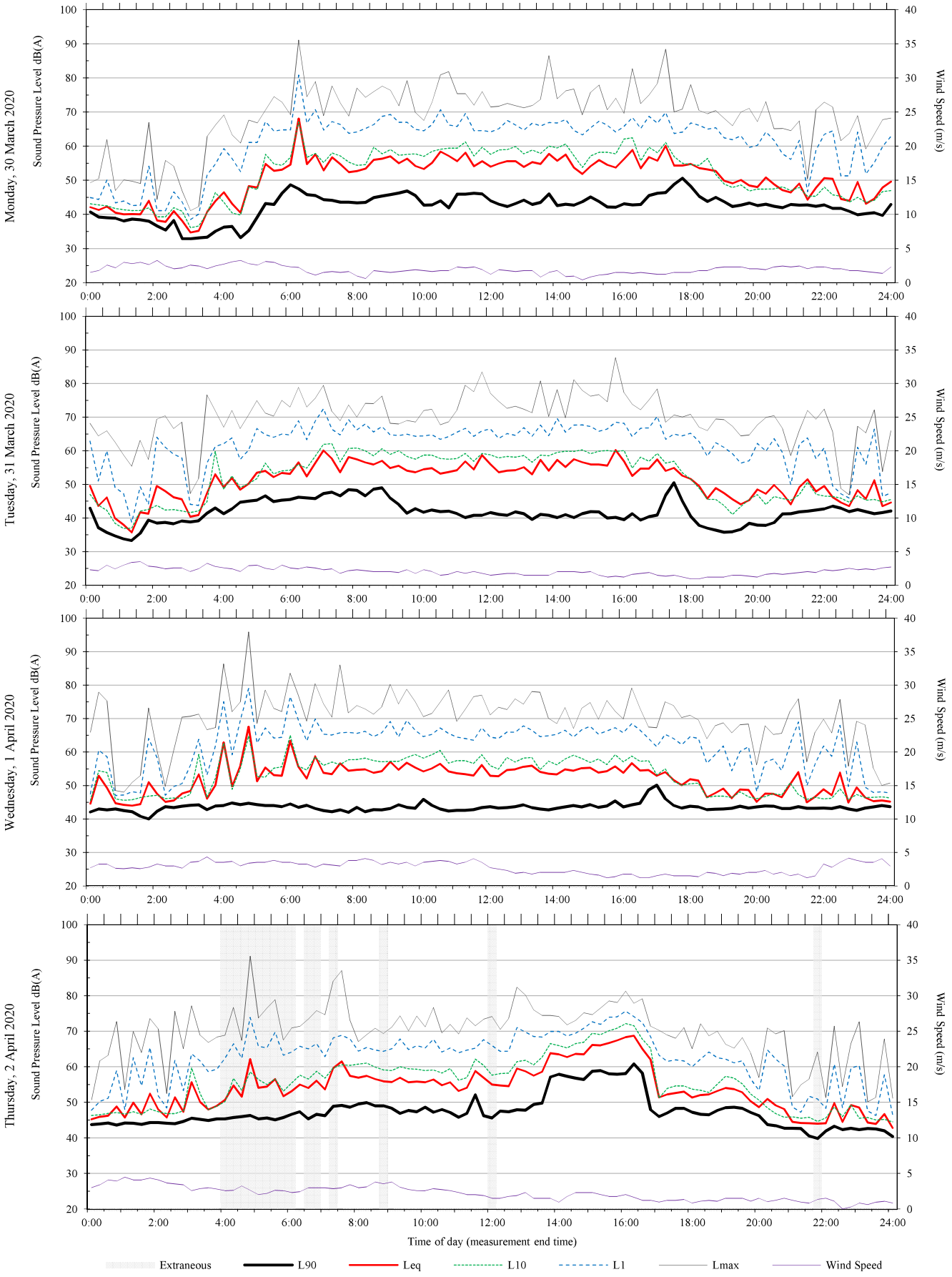
**Unattended monitoring: 3/1 Captain Cook Dr, Kurnell NSW 2231 (Free Field)**

ARUP



**Unattended monitoring: 3/1 Captain Cook Dr, Kurnell NSW 2231 (Free Field)**

ARUP



**Unattended monitoring: 3/1 Captain Cook Dr, Kurnell NSW 2231 (Free Field)**

ARUP