

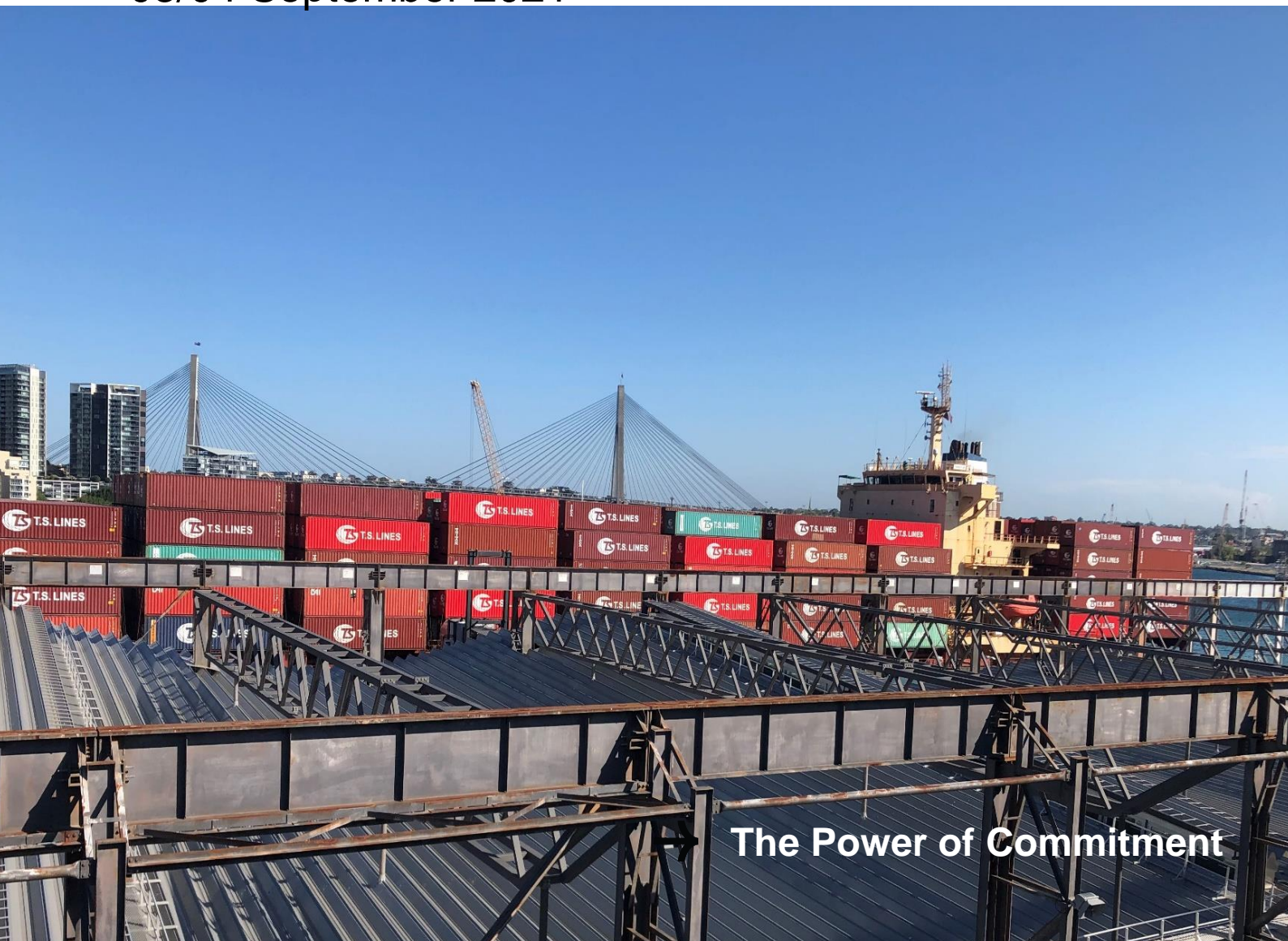


# Compliance noise monitoring report

## White Bay 5 – Thorstar

Port Authority of New South Wales

03/04 September 2021



The Power of Commitment

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# 1. Introduction

GHD Pty Ltd (GHD) has been engaged by Port Authority of New South Wales (Port Authority) to undertake compliance noise monitoring, as required by the *Port Noise Policy* (Port Authority, 2020).

This report provides the details of the compliance noise monitoring of the Thorstar container vessel, while at berth at White Bay 5 (WB-5), which was undertaken on the 3 September 2021 for daytime time measurements and 4 September 2021 for night-time measurements. The noise monitoring methodology, noise limits for vessels at berth and the noise monitoring locations are detailed in Appendix A.

# 2. Noise monitoring details

| Client                                                  | Vessel name / location                                | Engineer details                                                                                                                                                                                                                                                                                                                | Sound level meter details                                                                                                                                                                                                                                                     | Sound level calibrator results                                                                                     | Equipment settings                                                                                                                                                                                                  |
|---------------------------------------------------------|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Port Authority of New South Wales                       | Thorstar<br><br>White Bay 5                           | Chris Gordon (GHD) <ul style="list-style-type: none"> <li>– is a member employee of GHD, a member firm of the Association of Australasian Acoustical Consultants (AAAC)</li> <li>– Bachelor of Engineering (Mechanical), UTS 2012</li> <li>– Has over 11 years of professional experience in the field of acoustics.</li> </ul> | Svantek 977<br>Type 1 Sound level meter<br>SN: 45744 and 36871<br>IEC 61672-3:2013 Compliant<br>Manufactured prior 2019<br>1.5 m above ground level<br>Free-field conditions                                                                                                  | GRAS 42AG<br>Class 1 Sound level calibrator<br>SN: 278663<br>AS<br>60942:2003 Compliant<br>Manufactured prior 2017 | A-weighted<br>Fast time response<br>15 minute intervals<br><br>Pre and post calibration variation:<br><b>SN 45744 (M06)</b><br>Day: +0.5 dB<br>Night: -0.2 dB<br><b>SN 36871 (M07)</b><br>Day: + 0.2<br>Night: -0.2 |
| Date and time                                           | Monitoring locations<br>(see Appendix A for site map) | Meteorological conditions                                                                                                                                                                                                                                                                                                       | Site observations                                                                                                                                                                                                                                                             |                                                                                                                    |                                                                                                                                                                                                                     |
| <b>Daytime:</b><br>3 September 2021<br>13:54 to 14:58   | <b>Location M06</b> – 32 Grafton Street               | Wind: < 5 m/s<br>Rain: Nil                                                                                                                                                                                                                                                                                                      | – Attended measurements were dominated by the Thorstar, however the noise environment was impacted by some extraneous noise, including: <ul style="list-style-type: none"> <li>• Construction at Location M06 at nearby residential, however this was intermittent</li> </ul> |                                                                                                                    |                                                                                                                                                                                                                     |
| <b>Night-time:</b><br>4 September 2021<br>03:50 to 4:24 | <b>Location M07</b> – 12 Grafton Street               | Wind: < 2 m/s<br>Rain: Nil                                                                                                                                                                                                                                                                                                      | – Attended measurements during the night-time period were not affected by extraneous noise.<br>– Observed noise levels were dominated by noise emission from the Thorstar berthed at White Bay 5.                                                                             |                                                                                                                    |                                                                                                                                                                                                                     |

### 3. Attended noise monitoring results

| Location                                                                                            | Measurement time | L <sub>Aeq</sub> (15 min) | L <sub>Ceq</sub> (15 min) | L <sub>Ceq</sub> - L <sub>Aeq</sub> | L <sub>A10</sub> (15 min) | L <sub>A90</sub> (15 min) | L <sub>Amax</sub> | Estimated vessel contribution <sup>1</sup> , dBA                                                                  |
|-----------------------------------------------------------------------------------------------------|------------------|---------------------------|---------------------------|-------------------------------------|---------------------------|---------------------------|-------------------|-------------------------------------------------------------------------------------------------------------------|
| <b>Daytime – 3 September 2021</b>                                                                   |                  |                           |                           |                                     |                           |                           |                   |                                                                                                                   |
| M6                                                                                                  | 13:54 to 14:09   | 59                        | 75                        | 16                                  | 60                        | 57                        | -                 | L <sub>Aeq</sub> (15 hour) ≈ 58 dBA                                                                               |
|                                                                                                     | 14:10 to 14:25   | 59                        | 77                        | 18                                  | 60                        | 58                        | -                 |                                                                                                                   |
|                                                                                                     | 14:26 to 14:41   | 60                        | 75                        | 15                                  | 61                        | 58                        | -                 |                                                                                                                   |
|                                                                                                     | 14:42 to 14:57   | 61                        | 78                        | 17                                  | 61                        | 58                        | -                 |                                                                                                                   |
| M7                                                                                                  | 13:55 to 14:10   | 54                        | 72                        | 18                                  | 56                        | 52                        | -                 | L <sub>Aeq</sub> (15 hour) ≈ 52-53 dBA                                                                            |
|                                                                                                     | 14:11 to 14:26   | 54                        | 74                        | 20                                  | 56                        | 52                        | -                 |                                                                                                                   |
|                                                                                                     | 14:27 to 14:42   | 54                        | 73                        | 19                                  | 55                        | 52                        | -                 |                                                                                                                   |
|                                                                                                     | 14:43 to 14:58   | 53                        | 73                        | 20                                  | 55                        | 52                        | -                 |                                                                                                                   |
| <b>Night-time – 4 September 2021</b>                                                                |                  |                           |                           |                                     |                           |                           |                   |                                                                                                                   |
| M6                                                                                                  | 03:50 to 04:05   | 58                        | 77                        | 19                                  | 59                        | 57                        | -                 | <b>L<sub>Amax</sub> event:</b><br>No max noise level events from vessel<br><br>L <sub>Aeq</sub> (1 hour) ≈ 58 dBA |
|                                                                                                     | 04:07 to 04:22   | 58                        | 77                        | 19                                  | 59                        | 57                        | -                 |                                                                                                                   |
| M7                                                                                                  | 03:52 to 04:07   | 52                        | 71                        | 19                                  | 53                        | 51                        | -                 | <b>L<sub>Amax</sub> event:</b><br>No max noise level events from vessel<br><br>L <sub>Aeq</sub> (1 hour) ≈ 52 dBA |
|                                                                                                     | 04:09 to 04:24   | 52                        | 71                        | 19                                  | 53                        | 51                        | -                 |                                                                                                                   |
| Note<br>1) Refer to standard methodology in Appendix A for method of estimating vessel contribution |                  |                           |                           |                                     |                           |                           |                   |                                                                                                                   |

## 4. Assessment of modifying factors

| Location                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Measurement time | Low frequency noise |                 | Tonal noise |             | Intermittent noise |             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------------|-----------------|-------------|-------------|--------------------|-------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  | Y/N                 | Penalty, dB     | Y/N         | Penalty, dB | Y/N                | Penalty, dB |
| <b>Daytime – 3 September 2021</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |                     |                 |             |             |                    |             |
| M6                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 13:54 to 14:09   | Y                   | NA <sup>1</sup> | N           | -           | N                  | -           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 14:10 to 14:25   | Y                   | NA <sup>1</sup> | N           | -           | N                  | -           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 14:26 to 14:41   | Y                   | NA <sup>1</sup> | N           | -           | N                  | -           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 14:42 to 14:57   | Y                   | NA <sup>1</sup> | N           | -           | N                  | -           |
| M7                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 13:55 to 14:10   | Y                   | NA <sup>1</sup> | N           | -           | N                  | -           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 14:11 to 14:26   | Y                   | NA <sup>1</sup> | N           | -           | N                  | -           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 14:27 to 14:42   | Y                   | NA <sup>1</sup> | N           | -           | N                  | -           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 14:43 to 14:58   | Y                   | NA <sup>1</sup> | N           | -           | N                  | -           |
| <b>Night-time – 4 September 2021</b>                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |                     |                 |             |             |                    |             |
| M6                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 03:50 to 04:05   | Y                   | NA <sup>1</sup> | N           | -           | N                  | -           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 04:07 to 04:22   | Y                   | NA <sup>1</sup> | N           | -           | N                  | -           |
| M7                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 03:52 to 04:07   | Y                   | NA <sup>1</sup> | N           | -           | N                  | -           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 04:09 to 04:24   | Y                   | NA <sup>1</sup> | N           | -           | N                  | -           |
| <p>Note 1) The Port Noise Policy does not currently apply the NPfI method modifying factor for low frequency noise. A 2 dB penalty for daytime and a 5 dB penalty for the evening/night-time period would apply when assessed in accordance with Fact Sheet 3 Corrections for annoying noise characteristics from the EPA's Noise Policy for Industry Further investigation is currently being undertaken to determine impacts from low frequency noise from vessels.</p> |                  |                     |                 |             |             |                    |             |

## 5. Compliance assessment

| Location | Estimated vessel noise (WB-5), dBA<br>(inclusive of any modifying factor penalties) |                                         |                                 | Vessel Noise Trigger Levels, dBA      |                                         |                                 | Compliance |       |
|----------|-------------------------------------------------------------------------------------|-----------------------------------------|---------------------------------|---------------------------------------|-----------------------------------------|---------------------------------|------------|-------|
|          | Daytime<br>L <sub>Aeq</sub> (15 hour)                                               | Night-time<br>L <sub>Aeq</sub> (1 hour) | Night-time<br>L <sub>Amax</sub> | Daytime<br>L <sub>Aeq</sub> (15 hour) | Night-time<br>L <sub>Aeq</sub> (1 hour) | Night-time<br>L <sub>Amax</sub> | Day        | Night |
| M6       | 58                                                                                  | 58                                      | -                               | 60                                    | 55                                      | 65                              | Yes        | No    |
| M7       | 53                                                                                  | 52                                      | -                               |                                       |                                         |                                 | Yes        | Yes   |

# Appendices

# **Appendix A**

**Standard methodology**

# 1. Methodology

## 1.1 Attended noise monitoring methodology

The methodology for the attended compliance noise monitoring included the following:

- Identification of suitable noise monitoring locations. This was selected based on the location of the vessel, and identifying the nearest sensitive receivers in accordance with the locations detailed in Figure 2-1.
- Noise logging was conducted during the daytime and night-time, in accordance with the requirements of the *Port Noise Policy*
- A calibration check was performed on the noise monitoring equipment using a sound level calibrator with a sound pressure level of 94 dB) at 1 kHz. At completion of the measurements, the meter's calibration was re-checked to ensure the sensitivity of the noise monitoring equipment had not varied. The tolerance for each measurement is detailed in Section 2
- Noise monitoring was undertaken using a Svantek 977 or 979 environmental noise logger. The noise logger was programmed to accumulate  $L_{A90}$ ,  $L_{A10}$ ,  $L_{Amax}$ ,  $L_{Aeq}$  and  $L_{Ceq}$  noise descriptors continuously over the entire monitoring period. Details of the noise monitoring equipment are provided in the main body of the report
- Noise monitoring was undertaken during periods of time where average wind speeds were less than 5 m/s, or when rainfall did not occur.
- The data collected was downloaded and analysed to remove extraneous noise and determine the noise contribution from the vessel. Where required, this was done in accordance with techniques detailed in Section 7.1.1 of the Noise Policy for Industry, including:
  - Using frequency filtering techniques
  - Using other descriptors such as  $L_{A90}$
  - Analysing data (or pausing meter) to determine noise levels during period without extraneous noise
- Noise monitoring was conducted by a competent Acoustic Engineer from GHD, with details provided in Section 2

All noise monitoring activities were undertaken and processed in accordance with the Noise Policy for Industry (EPA 2017) short-term monitoring method and Draft Approved Methods. All noise logger settings and descriptors used were based on this method.

## 1.2 Noise limits for vessels at berth

The noise trigger level for vessels at berth are defined in the Port Noise Policy and are presented in Table 1.1. These are assessed at the worst affected sensitive receiver. Note that these are proposed to be reviewed periodically to consider whether they can be lowered to reduce noise impacts from overall port operations. The anticipated ultimate noise trigger level is 50 dBA, following multiple 2 dBA reductions.

The trigger level is applicable at the worst affected sensitive receiver at the time of commencing this policy.



Table 1.1 Vessel Trigger Noise Levels (external) (Table 3 from Port Noise Policy)

| Environmental trigger applied to vessels at berth                                                          | Assessment Location                | Day (7 am to 10 pm)<br>L <sub>Aeq</sub> (15 hour) | Night 10 pm to 7 am       |                   |
|------------------------------------------------------------------------------------------------------------|------------------------------------|---------------------------------------------------|---------------------------|-------------------|
|                                                                                                            |                                    |                                                   | L <sub>Aeq</sub> (1 hour) | L <sub>Amax</sub> |
| Glebe Island 1 and 2<br>Glebe Island 7 and 8<br>White Bay 3<br>White Bay 4 and 5 <sup>1</sup> (non-cruise) | All residential land near the port | 60 dBA                                            | 55 dBA                    | 65 dBA            |

Note: 1) The Port Noise Policy doesn't specify a noise trigger for White Bay berth 5, which is predominantly used for cruise ships, and usually managed under a cruise specific Noise Restriction Policy. Hence the trigger for all other berths has been adopted for the purposes of this report

### 1.3 Noise Policy for Industry Modifying Factors

The vessel trigger noise levels within the Port Noise Policy are assumed to be inclusive of modifying factors for annoying characteristics and requires these to be assessed in accordance with the NSW Noise Policy for Industry (NPfI), with the exception of low frequency noise. As outlined in the Port Noise Policy (Section 2.5, Appendix F) an approach to low frequency noise will be developed following review of vessel noise levels which will provide a statistical understanding of low frequency noise.

A summary of the modifying factors as presented in the NPfI are detailed in Table 1.2.

Table 1.2 Modifying factor corrections (Table C1 from Noise Policy for Industry)

| Factor                                                              | Assessment / measurement                                                                                                                                 | When to apply                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Correction <sup>1</sup> | Comments                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Tonal noise                                                         | One-third octave band analysis using the objective method for assessing the audibility of tones in noise – simplified method (ISO1996.2-2007 – Annex D). | Level of one-third octave band exceeds the level of the adjacent bands on both sides by: <ul style="list-style-type: none"> <li>– 5 dB or more if the centre frequency of the band containing the tone is in the range 500–10,000 Hz</li> <li>– 8 dB or more if the centre frequency of the band containing the tone is in the range 160–400 Hz</li> <li>– 15 dB or more if the centre frequency of the band containing the tone is in the range 25–125 Hz.</li> </ul>                                                                  | 5 dB <sup>2,3</sup>     | Third octave measurements should be undertaken using unweighted or Z-weighted measurements.<br><b>Note:</b> Narrow-band analysis using the reference method in ISO1996-2:2007, Annex C may be required by the consent/regulatory authority where it appears that a tone is not being adequately identified, e.g. where it appears that the tonal energy is at or close to the third octave band limits of contiguous bands. |
| Low-frequency noise (penalty not currently applied to vessel noise) | Measurement of source contribution C-weighted and A-weighted level and one-third octave measurements in the range 10–160 Hz                              | Measure/assess source contribution C- and A-weighted Leq,T levels over same time period. Correction to be applied where the C minus A level is 15 dB or more and: <ul style="list-style-type: none"> <li>– Where any of the one-third octave noise levels in Table C2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB(A) positive adjustment to measured/predicted A-weighted levels applies for the evening/night period</li> <li>– Where any of the one-third octave noise levels in Table C2 are</li> </ul> | 2 or 5 dB <sup>2</sup>  | A difference of 15 dB or more between C and A-weighted measurements identifies the potential for an unbalance spectrum and potential increased annoyance.<br>The values in Table C2 are derived from Moorhouse (2011) for DEFRA fluctuating low-frequency noise criteria with corrections to reflect external assessment locations.                                                                                         |

| Factor             | Assessment / measurement                                                                                    | When to apply                                                                                                                                                                                                                    | Correction <sup>1</sup>                                                     | Comments                                      |
|--------------------|-------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|-----------------------------------------------|
|                    |                                                                                                             | exceeded by more than 5 dB and cannot be mitigated, a 5-dB(A) positive adjustment to measured/predicted A-weighted levels applies for the evening/night period and a 2 dB(A) positive adjustment applies for the daytime period. |                                                                             |                                               |
| Intermittent noise | Subjectively assessed but should be assisted with measurement to gauge the extent of change in noise level. | The source noise heard at the receiver varies by more than 5 dB(A) and the intermittent nature of the noise is clearly audible                                                                                                   | 5 dB                                                                        | Adjustment to be applied for night-time only. |
| Maximum adjustment | Refer to individual modifying factors                                                                       | Where two or more modifying factors are indicated.                                                                                                                                                                               | Maximum correction of 10 dB(A) <sup>2</sup> (excluding duration correction) |                                               |

**Notes:**

1. Corrections to be added to the measured or predicted levels, except in the case of duration where the adjustment is to be made to the criterion.
2. Where a source emits tonal and low-frequency noise, only one 5-dB correction should be applied if the tone is in the low-frequency range, that is, at or below 160 Hz.
3. Where narrow-band analysis using the reference method is required, as outlined in column 5, the correction will be determined by the ISO1996-2:2007 standard
4. Standard approaches for low frequency noise in the Noise Policy for Industry evaluate differences between A and C weighted levels. However, this is not suitable when considering mitigation of vessel engines and fans that inherently have low frequency noise. For example, many engines may trigger a correction factor for annoying characteristics even when the low frequency component is too quiet to cause annoyance. Furthermore, the difference between A and C weighted noise levels from vessels may vary significantly in different directions. Using the Noise Policy for Industry this would result in penalties being triggered in some directions and not others when the low frequency noise impact on community is relatively constant in all directions.

## 2. Site description

Figure 2-1 below shows the following:

- Berth locations
- Key receiver locations for each berth

### 3. Glossary of terms

| Abbreviation             | Definition                                                                                                                                                                                                                                                                                                                                         |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| dB                       | Unit of measurement for Sound Pressure Level known as a decibel.                                                                                                                                                                                                                                                                                   |
| dB(A)                    | 'A-weighted' decibel measurement. A-weighting is an adjustment made to noise measurement to approximate the response of the human ear.                                                                                                                                                                                                             |
| Hertz (Hz)               | Hertz is the unit of frequency, representing one cycle per second.                                                                                                                                                                                                                                                                                 |
| Low frequency noise      | Noise containing high levels of energy in the low frequency range, defined as 10 Hz to 160 hz in the NPfI                                                                                                                                                                                                                                          |
| L <sub>Aeq(period)</sub> | Equivalent A-weighted sound pressure level is the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring. This is considered to represent ambient noise.                                                                                            |
| L <sub>Ceq(period)</sub> | Equivalent C-weighted sound pressure level is the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring. The adjustment takes account of low-frequency components of noise within the audibility range of humans                                   |
| L <sub>A90(period)</sub> | The A-weighted sound pressure level that is exceeded for 90 per cent of the time over which a given sound is measured. This is considered to represent the background noise.                                                                                                                                                                       |
| L <sub>A10(period)</sub> | The arithmetic average of the sound pressure level that is exceeded for 10 per cent of the time specified. This is considered representative of the average maximum noise                                                                                                                                                                          |
| L <sub>Amax</sub>        | The maximum sound pressure level of an event measured with a sound level meter satisfying AS IEC 61672.1-2004 set to 'A' frequency weighting and fast time weighting                                                                                                                                                                               |
| Sensitive Receiver       | A sensitive receiver can be defined as any dwelling; caretakers house; library; educational institution; religious facility; childcare centre; kindergarten; hospital; surgery or other medical institution including an institutional home; commercial and/or retail activity (such as any, hotel, motel, caravan park or tourist establishment). |
| Tonal noise              | Noise containing a prominent frequency and characterised by a definite pitch                                                                                                                                                                                                                                                                       |



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