



ACOUSTIC CONSULTING &
MULTIMEDIA STUDIO DESIGN

ACOUSTIC REPORT

Acoustic Environmental Impact Assessment: North Head Quarantine Station.

This document was prepared for:

NORTH HEAD QUARANTINE STATION
North Head Scenic Drive, Manly, NSW, 2095.

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Glossary of Terms

The ISO and IEC maintain terminological databases for use in standardisation at the following addresses:

- ISO Online, available at <http://iso.org/obp>
- IEC Electropedia, available at <http://www.electropedia.org/>

These terminological standards have been followed as closely as possible. Any deviation has been noted in the text.

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1 Executive Summary

1.1 Introduction

This Acoustic Environmental Impact Assessment (EIA) has been prepared to accompany the Review of Environmental Factors (REF) undertaken by North Head Station Pty Ltd (NHS) for the continued operation of the North Head Quarantine Station (Q Station) from beyond 2024, subject to the extension of the lease under option(s) until 2050.

The REF process, managed by Keylan Consulting, seeks to support an application before the NSW National Parks and Wildlife Service for the ongoing operation of the Q Station with proposed conditions of consent. That application aims to support future conservation and community objectives for the Q Station. Although no new uses are proposed; a comprehensive review and update of the environmental management strategies are being carried out concurrently to this REF to ensure sustainable operations that meet both legislative requirements and community expectations.

The core focus of this EIA is to evaluate the existing acoustic environment, address any issues related to operational noise, and suggest methods to minimise impacts. This evaluation is a direct response to the requirements specified in the REF.

This report includes:

- **Comments on Proposed Changes to the Conditions of Planning Approval (COPA):** We respond directly to suggested amendments whilst allowing for the Station's continued operation. These changes are grounded in environmental analysis and public feedback, ensuring they are both necessary and beneficial. A detailed review of the proposed modifications can be found in APPENDIX D.
- **Review of Q Station Travel and Access Plan:** An evaluation of current and anticipated noise impacts from road traffic and sea arrivals. The plan proposes enhanced noise management strategies to mitigate the identified impacts on the local environment and community well-being.
- **Review of Integrated Monitoring and Adaptive Management System:** We review existing conditions and propose updates to improve environmental monitoring and adaptive management practices, ensuring they remain robust and responsive to the evolving needs of the Station and its surroundings.
- **Review of Noise Management Plan:** A comprehensive review considering the long-term operation until 2050, with proposals to refine existing noise management practices ensuring they are effective and adaptable to future events and operational changes.
- **Review of Approved Internal Fit-out Plan:** Recommendations for modifications based on acoustical assessments are outlined, aiming to minimise internal and external noise pollution and enhance the overall environmental quality within the Station.
- **Suggested Updates to the Environmental Management Plan:** Following feedback from the latest ecological assessments, we recommend updates to address identified environmental impacts. These updates aim to strengthen conservation efforts and reduce ecological footprints.

The updates and strategies proposed in this Environmental Impact Assessment (EIA) are aligned with the ecologically sustainable development (ESD) goals of Q Station, ensuring that its operations continue to harmoniously coexist with both the natural and community environments. The approval of the ongoing operations as detailed in the Review of Environmental Factors (REF), supported by the findings and recommendations within this EIA, will ensure that the North Head Quarantine Station continues to operate effectively and responsibly well into the future.

1.2 References

The following third-party consulting reports and management plans have been referred to in this document;

Department of Environment and Conservation (NSW). (2005). North Head Quarantine Station *Environmental Management Plan 2005*. Version 12.

écologique (2024). Species Impact Statement [Draft].

GTA Consultants. (2018). Q Station Manly, Travel and Access Plan N126511.

Mawland Hotel Management Pty Ltd. (2005). Visitor Management Plan.

Mawland Quarantine Station Pty Ltd. (2005). Internal Fitout Plan – Part 1.

Mawland Quarantine Station Pty Ltd. (2005). Integrated monitoring and adaptive management system for the conservation and adaptive re-use of the Quarantine Station.

Mawland Quarantine Station Pty Ltd (2005). Noise Management Plan for the conservation and adaptive re-use of the Quarantine Station

Stantec Australia Pty Ltd (2024). Site Travel and Access Plan. Ref: 300305408.

McCutcheon, C. [Biosis] (2015). North Head Quarantine Station Modification – Potential Impacts on Little Penguins.

Flaherty, S. [Wilkinson Murray] (2015). Baseline Noise Monitoring – Quarantine Station.

2 Introduction

2.1 Purpose & Scope

The purpose of this Environmental Impact Assessment, specifically focused on acoustics, noise and vibration, is to support the REF application submitted by North Head Station Pty Ltd for the continued operation of the North Head Quarantine Station.

This application seeks approval to extend the operation of the Q Station by NHS beyond December 2024, and potentially to 2050, without introducing new uses or new works beyond the current Key Site Activities as defined in the existing conditions of approval.

The scope of this acoustic assessment encompasses an in-depth review of the current and projected noise environment within and surrounding the Quarantine Station. This includes a thorough evaluation of the impacts of existing and potential noise sources under the various proposed operational plans. The assessment also reviews modifications to the Conditions of Planning Approval (COPA), necessary updates to the Environmental Management Plan based on recent ecological findings, adjustments to the Approved Internal Fit-out Plan in response to events and entertainment systems, and a comprehensive evaluation of the Noise Management Plan considering the station's potential operational extension to 2050.

This acoustic EIA is designed to ensure that the ongoing operations at North Head Quarantine Station are conducted in an environmentally responsible manner, adhering to relevant statutory requirements and best practice standards. The ultimate goal is to avoid, minimise or mitigate acoustic impacts on the surrounding environment and community while supporting the heritage significance and continued use of the site.

2.2 Background

The North Head Quarantine Station, known historically as 'Q Station', is a site of rich historical significance located on the traditional lands of the Gayamagal people, part of Sydney's North Head at Manly. Established in the 1830s, the station served as a quarantine facility for migrants arriving in Australia, aiming to prevent the spread of infectious diseases. Over the decades, it has transitioned from its original medical purpose to become a significant cultural and environmental landmark, embodying layers of historical, social, and ecological narratives.

From an environmental perspective, Q Station is situated within the Sydney Harbour National Park, a place of spectacular natural beauty and biodiversity. The area is characterised by native bushland, stunning coastal views, and diverse wildlife. The proximity of the station to these natural elements underscores the importance of maintaining a careful balance between preserving the site's heritage and ensuring environmental sustainability.

The integration of the Quarantine Station business unit within this ecologically-sensitive area has necessitated the development of comprehensive environmental management practices. Wildlife in the area includes several protected species, which are sensitive to changes in their environment, particularly noise and human activity. For instance, the Little Penguin colonies nearby and the Long-nose Bandicoot population are of significant interest, as they are indicative of the ecological health of the region and listed as endangered populations under the Biodiversity Conservation Act.

Historically, environmental considerations have been woven into the fabric of the station's operation and maintenance, reflecting an ongoing commitment to conservation and sustainability. This has included;

1. measures to avoid, minimise or mitigate disruption to wildlife, protect natural habitats, and preserve the area's scenic and ecological values,
2. managing noise that is crucial to preserving the site's unique historical and cultural ambiance, ensuring that the amenity of this heritage-rich location remains intact for visitors and future generations,

3. providing maximum acoustic-comfort and amenity to staff, patrons, visitors and hotel guests in line with best-practices.

Typical noise-generating activities from the site include, but are not limited to;

- Arrival and departure by road and sea.
- Construction-related noise and vibration.
- General operational noise (transportation, logistics, maintenance).
- Patron noise, events, and recreational activities.
- Amplified music or entertainment.
- Mechanical services (Heating, Ventilation, and Air Conditioning, exhaust and extraction fans).

The current application for the ongoing operation of Q Station, potentially extending to 2050, continues this legacy by emphasising the importance of environmental stewardship and the careful management of acoustics to mitigate potential impacts on the local wildlife and natural surroundings.

Q Station's role as a custodian of cultural heritage and environmental integrity makes the REF not just a statutory requirement but a commitment to the sustainable future of this historically and ecologically significant site. The REF, supported by this acoustic assessment, aims to ensure that the Quarantine Station's operations are conducted with strong consideration for the surrounding natural environment, safeguarding the area's biodiversity and ecological value for future generations.

2.3 Existing Acoustical Frameworks

The existing acoustical framework for Q Station is governed by a series of environmental management plans and noise control measures, established under the oversight of the Department of Environment and Conservation (NSW).

The principal document guiding this framework is the current Conditions of Consent application, which outlines the overarching environmental policies and strategies for the site.

Further detailed stipulations concerning noise management are outlined in the "Noise Management Plan" (2005), curated by Mawland Hotel Management and Q-Station Pty Ltd. This plan outlines the operational guidelines and noise control measures that must be observed to mitigate acoustic impacts on the surrounding environment and the local wildlife, especially during activities that are prone to generating significant noise levels.

2.3.1 Legislative Requirements

The site, and all ongoing activities, will be governed and assessed under the following policies;

- Department of Environment and Climate Change NSW. (2009). *The Interim Construction Noise Guideline*.
- Liquor & Gaming NSW License Number No. LIQO624015664.
- NSW and the Department of Environment, Climate Change and Water NSW. (2011). *NSW Road Noise Policy*.
- NSW Environmental Protection Agency. (2017). *Noise Policy for Industry*.
- NSW Government. (2022). *Code of Conduct – Commercial vessels using amplified sound systems on Sydney Harbour*.
- NSW Parliamentary Counsel. (2017). *Protection of the Environment Operations (Noise Control) Regulation*.

2.3.2 Historical Acoustic Compliance Assessments

In order to evaluate compliance with pre-established noise-related conditions, AKA Acoustics were engaged to perform an environmental noise assessment, detailed in report R-106QST230306.1 (APPENDIX A). This assessment specifically targeted noise emissions from the Boilerhouse Restaurant, located at the northern end of Wharf Road, adjacent to Quarantine Beach. The restaurant, alongside all other sites within the Q Station precinct, operates under conditions outlined in the Consolidated Consent (MP08 0041-Mod-3, dated 25/05/2018), designed to protect nearby endangered populations of Little Penguins and Long-Nosed Bandicoots, particularly in known nesting areas;

201. Amplified music or noise on the site shall be managed on the following basis:

- (a) any amplified music or noise or ambient dining music shall not exceed the LAeq noise level of 50 dB_A as measured up to 20 metres away from the edge of the building in which the music or noise is being generated;
- (b) outdoor amplification may only occur during the day period and must not exceed LAeq noise level of 50 dB_A, as measured at any point along the existing fence line (as at 2017) to the beach area;

The assessment, conducted between February 9 and February 27, 2023, focused on measuring levels of amplified music and entertainment noise during peak operational times such as the *Live at Boilerhouse* sessions.

The key findings from this assessment were;

- Condition 201(a): Compliance was achieved for amplified dining music, which did not exceed the 50dB_A threshold at a distance of up to 20 meters from the edge of the suspect building.
- Condition 201(b): Challenges were noted, as noise levels from outdoor amplification systems frequently exceeded the 50dB_A limit along the boundary fence line.

Our report recommended various mitigation strategies;

- All outdoor amplified music systems (both portable Bluetooth PA's, and large-format systems for live entertainment) should be configured at the northern-end of the venue. All loudspeakers (including foldback) should be aimed away from the northern boundary. This will ensure that noise emissions do not directly propagate towards the critical area at the northern/eastern boundary fence.
- Venue staff are responsible for maintaining noise levels during live events. A Class 1/Class 2 handheld Sound Level Meter should be employed during setup/soundcheck to ensure that the system output levels do not exceed 50dB_A at the critical boundaries. In the case that the ambient noise level is higher than 50dB_A (caused by other extraneous noise sources) then it is crucial that any amplified music is not measurably audible above this level.
- Amplified dining music emitted from consumer-level equipment (such as Bluetooth PA's) should be completely inaudible, or barely audible, at any point along the existing fence line.
- All permanent hardware systems must be controlled by a noise limiter to ensure that maximum noise emissions (under operational conditions) do not exceed 50dB_A. Limiter controls (including thresholds and maximum output Sound Power Levels) should only be accessible by a qualified acoustic consultant.
- During high-capacity events, all operable windows and doors should remain closed.
- Interior noise levels which exceed safe hearing levels are in no way supported or condoned.
- Notwithstanding the conditions above, the venues must adhere to the noise-related conditions outlined in the Liquor License (No. LIQO624015664).

The Food & Beverage team implemented the various operational changes to address the acoustical challenges identified in our initial report, and a follow-up assessment in April 2023 was conducted to evaluate the effectiveness of the proposed strategies (see APPENDIX B).

Given the significant variables involved from event-to-event – including musical line-up, genre, weather conditions, and ambient background noise – true verification and management of amplified music with noise regulations cannot be fully ensured through sporadic or ‘one-time’ measurements. Instead, effective management requires the venue staff to take on-site measurements on a case-by-case basis using a calibrated sound level meter. This approach will allow the venue to adaptively manage and verify compliance consistently, ensuring that sound levels are maintained within legal limits across all events.

The approach towards managing live acoustic performances, particularly the reliance on artists to adhere to noise controls, emphasises the importance of cooperative engagement and education in sustaining compliance. This approach allows for flexibility and ongoing adjustment to the site’s acoustic management strategies, ensuring that they remain responsive to the site’s environmental and operational needs.

2.3.3 Notes on Future Compliance Assessments

The beach fence line was selected as the primary monitoring location due to its status as the most-sensitive receptor, based on discussions with NHS staff and planning consultants. This choice is further supported by previous consulting assessments conducted by Wilkinson Murray (Flaherty, S., 2015) and Biosis (McCutcheon, C., 2015). Given the impracticality of evaluating ‘every’ point along the fence line simultaneously, this location provides a representative assessment of the required compliance conditions. To ensure consistency and repeatability, it is recommended that this location is maintained for future monitoring. Any ecological evidence to support alternate locations should be reviewed as part of the Noise Management plan review.

Additionally, Condition 201(A) presents significant challenges for consistent evaluation. Differentiating between ambient noise sources, such as waves, marine sounds, patrons, and wildlife, and amplified music using a single-number L_{Aeq} noise descriptor is not feasible without accompanying subjective listening assessments. For instance, if ambient noise is measured at 60 dB_{Aeq} , amplified music contributing 50 dB_A will not be discernible against this baseline.

Given these complexities, alternative methods for evaluating noise from PA systems should be considered. Instead of focusing solely on amplified music, noise sources should be evaluated as the sum of all operational noise (including patron activities). A true baseline measurement should be conducted over an extended period to accurately capture the ambient noise environment. This approach allows for a truly comprehensive and adaptive management strategy, ensuring that noise levels remain within permissible limits whilst accounting for the dynamic nature of the acoustic environment. Effective management under the Integrated Monitoring and Adaptive Management System (IMAMS) necessitates that venue management maintain noise levels during live events, educate third-party vendors about prevailing noise conditions, and ensure adherence to noise controls through continuous monitoring and adaptive measures.

3 Existing Environmental Conditions

3.1 Impact on Noise-Sensitive Fauna

Q Station is uniquely situated within Sydney Harbour National Park, an area of significant environmental value and biodiversity. It is located close to habitats that support several noise-sensitive wildlife species, which are crucial for maintaining the ecological health and balance of the region.

The purpose of the following section is not to conduct an independent study on the impact of acoustic disturbances on local wildlife health. Instead, the detailed analysis of environmental sensitivity to noise will be thoroughly addressed within the Species Impact Statement (SIS). The primary objective of this report is to ensure the effective management and adherence to the conditions and guidelines established in the SIS. This approach aims to minimise operational noise impacts and support the overarching conservation goals.

The environmental impact of operations at Q Station, particularly concerning wildlife, is well acknowledged; however, the specific effects of airborne sound and vibration on the local fauna population remain largely undocumented. Current data does not sufficiently link noise levels to ecological impacts, especially in terms of the breeding habits of native species. This highlights a need for more site-specific research and ongoing investigation to establish definitive connections between operational noise and its effects on these sensitive ecological groups.

Currently, our understanding of these impacts is based on assumptions and general findings from broader ecological studies rather than concrete, site-specific evidence.

3.1.1 Little Penguins (*Eudyptula Minor*)

The area surrounding Q Station is known for housing a population of Little Penguins.

The impact of ambient music and other amplified noises on this species has been extensively reviewed in the Species Impact Statement (SIS) prepared by ecologique, which includes a thorough literature review (refer to APPENDIX C). Findings from this review, alongside studies from other penguin colonies like those on Phillip Island and St Kilda, indicate that these penguins demonstrate a considerable resilience to noise associated with human activities. The research suggests that the presence of ambient music and general visitor activity does not significantly affect breeding success or population dynamics compared to more secluded colony areas.

Moreover, observations from these studies highlight that Little Penguins may exhibit increased vigilance in response to novel or sudden noises, such as those from construction activities, without a significant rise in stress indicators like heart rate. This behavior supports the view that these penguins may not perceive such noises as major threats, especially in the absence of visual stimuli that might indicate a predator. This adaptability is crucial at Q Station, where other environmental factors, such as availability of food sources, are likely more influential on the health and reproductive success of the penguins than noise exposure.

Despite these findings, the SIS has not established a direct link between ambient noise levels at Q Station and adverse ecological impacts on Little Penguins. Therefore, the inferences made are based on analogous conditions observed in other similar environments.

While the current evidence suggests that noise impacts are unlikely to pose a significant threat, it remains essential to continue monitoring and managing potential impacts through an adaptive management framework. This should include setting clear monitoring benchmarks and management thresholds that, if exceeded, would trigger necessary protective responses to ensure the conservation of this species at Q Station.

3.1.2 Long-Nosed Bandicoots

Research on the impact of noise pollution on Long-Nosed Bandicoots is limited. However, general behavioural patterns of this species suggest potential vulnerability to noise. Long-Nosed Bandicoots are nocturnal and utilise diverse habitats such as coastal areas, woodlands, and heathlands. They rely on well-concealed nesting sites located under dense vegetation or debris for daytime protection, which provides shelter from predators and environmental conditions.

Given their nocturnal nature and sensitivity, it is plausible that Long-Nosed Bandicoots could experience stress or behavioural changes in response to excessive noise. This could particularly affect their foraging activities, as they rely on lower ambient noise levels at night to detect prey and avoid predators. Although the direct impact of noise on these marsupials at Q Station has not been specifically studied, the potential for sudden or loud noises to disturb their natural behaviours warrants consideration.

Recent assessments by the National Parks and Wildlife Service (NPWS) have highlighted the difficulty in precisely mapping Long-Nosed Bandicoot habitats due to their variable foraging behavior. These assessments suggest that the entire site should be considered as potential high-quality habitat, underscoring the importance of site-wide noise mitigation measures rather than localized efforts. This approach is essential to protect the bandicoots effectively across the entire site, ensuring that all areas where they may be active or resting are considered in conservation efforts.

3.1.3 Native Bird Species

The native bushland within the area serves as habitat for a diverse range of bird species. Given that many of these birds are nocturnal or rely heavily on vocal communication for mating and territorial disputes, there is a potential concern that increased noise levels may disrupt their natural behaviours such as feeding, mating, and migration. However, it must be noted that specific impacts of noise on individual bird species at this site have not been detailed in the Species Impact Statement (SIS) due to the absence of concrete data linking noise levels to specific ecological outcomes.

As such, while preliminary observations suggest a general sensitivity among avian species to increased noise, the exact consequences remain largely undefined within the specific context of Q Station. This underscores a significant gap in our understanding and highlights the need for comprehensive site-specific studies. These studies would provide the quantitative data necessary to discern the true impact of noise and vibration on these bird species. Moving forward, a systematic approach to monitoring and research will be essential to formulating effective conservation strategies and ensuring that operational noise management aligns with the ecological preservation goals of the area.

3.2 Conclusions

3.2.1 Comprehensive Research and Continuous Monitoring

Despite the acknowledgement of potential impacts on wildlife such as Little Penguins and Long-Nosed Bandicoots, the current data linking operational noise at Q Station to definitive ecological consequences remains insufficient. This gap underscores the necessity for targeted, quantitative research and ongoing environmental monitoring. Establishing a robust framework for continuous assessment will provide a clearer understanding of how noise and human activity affect these species. Such efforts should not only aim to document current impacts but also forecast potential future disruptions, facilitating the development of proactive conservation strategies.

3.2.2 Adaptive Management and Mitigation Strategies

In light of the findings from the Species Impact Statement and other ecological assessments, it is evident that while some species show resilience to human-induced noises, the overall ecological dynamics at Q Station are complex and warrant careful management. The adaptive management framework currently in place should be enhanced by incorporating specific monitoring benchmarks and management thresholds. These measures should be clearly defined and rigorously implemented to ensure they effectively

mitigate any adverse effects and support the long-term conservation goals of the region.

With reference to SECTION 6.1.7.2 of the Species Impact Statement (2024), the following mitigation measures were identified as an existing adaptive management response required in the event that the existing Trigger 1's threshold is exceeded. This response should be considered and undertaken in consultation with relevant discipline specialists (i.e., penguin biology/ecology, acoustics, landscaping/bush regeneration).

Table 1: Little Penguin recommended management and mitigation measures (ref: Table 6-6, SIS 2024, p 76).

Recommended Measure	Rationale
Installation of acoustic barriers to reduce noise to habitat areas and beach adjacent to the Boilerhouse Restaurant.	Draft SIS feedback provided by NPWS required that suspected threats on an AOBV, and in turn the little penguin population, be treated as an actual threat.
Noting that opaque noise barriers such as glass or perspex can be used to maintain water views to the beach.	Hence, despite the lack of certainty regarding causal factors (for the cessation in use of the QS Beach / Boilerhouse habitat), immediate measures to reduce potential noise impacts on the species habitat are recommended. Note: the provision of acoustic barriers in the vicinity of the restaurant at night, especially the outdoor eating area is an adaptive measure that identified in CoPA no. 179 (Adaptive Management).

3.2.3 Specific Recommendations for Future Research

Filling the existing knowledge gaps with site-specific data collection will enable a more informed approach to managing habitat areas within the Q Station lease area and elsewhere in the AOBV areas.

Additional data collection and mitigation measures, including noise reduction measures and habitat enhancement are provided to align with the SIS recommendations:

- **Quantify Noise Impact:** Employ precise measurement techniques to determine the actual levels of noise exposure experienced by various species and correlate these with observable changes in behaviour and population dynamics.
- **Habitat Sensitivity Analysis:** Conduct detailed analyses of habitat use and the spatial distribution of sensitive species to understand the differential impacts of noise within various sections of the park. This will aid in refining mitigation measures to be more targeted and effective.
- **Longitudinal Studies:** Implement long-term monitoring programs to track the health and behaviour of key species over time. This will provide data on the chronic effects of noise and help in adjusting management strategies in response to long-term trends.
- **Threshold Trigger Points for Action:** Develop a set of criteria that, when met or exceeded, will prompt immediate conservation actions to prevent irreversible damage. These criteria should be based on scientific evidence gathered through the aforementioned studies.

4 Legislative Guidelines & Noise Criteria

4.1 Transportation, Arrival and Departure

4.1.1 Patron Numbers

The *Site Travel and Access Plan* prepared by Stantec (2024) outlines the expected site capacities during various common activities (open days, large weddings, corporate events, and normal day-to-day activities), alongside a modal breakdown of patrons arriving and departing the primary area at North Head.

The patron capacities listed in FIGURE 1 reflect the anticipated occupancy levels, based on the maximum visitation capacity as specified under Condition 120 of the COPA.

Event	Anticipated no. of people on-site	Recommended event-specific management measures	Recommended general management measures
Open day (weekend)	600	<ul style="list-style-type: none"> Attendants at reception to escort overnight guests with cars to lower car park. Encourage other modes of transport including the 161 bus route and future ferry services. The ferry could be subsidised by Q Station for people who book accommodation. Increase frequency of shuttle bus services. 	<ul style="list-style-type: none"> Booking system to require overnight guests to specify if they require a car parking space, allowing Q Station to reserve spaces for guests and identify how many spaces are available for visitors. Additional signage indicating a full car park to be positioned at the Q Station welcome sign on North Head Scenic Drive roundabout once the upper car park is full, with monitoring by attendants. Any unplanned overnight guests with cars would be able to work with reception to organise parking in the lower car park if available or along the Entrance Road past the existing boom gates. Encourage staff for large events to car-pool, use public transport and/ or ride share when feasible and safe to do so. Ensure access provision for persons with disabilities, non-English speaking visitors, services/ contractors and emergency vehicles are maintained and/or improved. Install boom gates and a paid parking scheme to be implemented at the upper car park to reduce parking demand to guests and visitors of Q Station only. Recommence ferry access to the Q Station wharf. This would encourage reduction in private vehicle mode share.
Large weddings or one-off events (typically weekend)	550	<ul style="list-style-type: none"> Attendants at reception to escort overnight guests with cars to lower car park. Encourage other modes of transport including the 161 bus route, water taxis and future ferry services. Water taxis/ future ferry services could be subsidised by Q Station for people who book accommodation. Event organisers would be encouraged to arrange mass transport options for their guests such as shuttle buses and/ or coaches from a key transport hub. Increase frequency of shuttle bus services. 	
Corporate events (weekday)	375	<ul style="list-style-type: none"> Event organisers would be encouraged to arrange mass transport options for their guests such as shuttle buses and/ or coaches from a key transport hub, use of water taxis/ chartered ferries, or fund taxis/ rideshare services for staff. 	
Yearly Celebrations (weekday or weekend)	325	<ul style="list-style-type: none"> No specific measures are proposed, however on-site shuttle bus drivers would be able to assist in escorting any overflow vehicles down to lower car park if required. 	
Normal day-to-day activity (weekday or weekend)	200	<ul style="list-style-type: none"> No specific measures are proposed, however on-site shuttle bus drivers would be able to assist in escorting any overflow vehicles down to lower car park if required. 	

Figure 1: Proposed general and event-specific traffic management measures (Site Travel and Access Plan, 2024).

4.1.2 Water-based Access – Motorised Watercraft

A ferry service commenced operation soon after Mawland Quarantine Station Pty Ltd became lessee of the site. The service struggled to attract visitors to the site, however, continued spasmodically until the first COVID lock down in 2020. It has not recommenced due to a variety of factors; reluctance of ferry operators to include Q Station in their schedules as indicated by costs they have proposed for a service connection, and low visitor demand evidenced by past usage patterns being two key aspects.

Currently, NHS plans to revitalise the wharf precinct are anticipated to increase visitor demand and arrivals by water. This planned revitalisation will be addressed in a separate Review of Environmental

Factors (REF). It is crucial to note that this current REF does not include provisions for the redevelopment of the wharf. Any modifications or new uses would be subject to future planning approvals, ensuring that all environmental and community impacts are thoroughly assessed before implementation. Under Condition 140 of the COPA, “the wharf shall only to be used for the casual berthing of the vessel ‘The Jenner’, or an appropriate vessel of similar dimensions and loadings.”

APPENDIX E.2 provides a General Arrangement Plan for a model vessel that is proposed for ferry services to and from Quarantine Station wharf.

The specifications of an Inboard Diesel Engine V12-1550 (D2862LE426) are detailed in APPENDIX E.1, with the associated Sound Power Levels presented in TABLE 2.

Table 2: Engine Surface Noise and Free Exhaust Noise of a V12-1550 Engine

A-Weighted Sound Power Level	
Engine Surface Noise	101.8 dB
Free Exhaust Noise	114.5 dB

For clarification;

“Engine surface noise” refers to the sound emitted from the engine’s exterior surfaces due to vibrations generated during its operation. This noise is produced by the mechanical actions within the engine, such as the movement of pistons, crankshafts, valves, and other components. It also includes noise generated by auxiliary systems attached to the engine, like cooling fans, fuel pumps, and alternators.

“Free exhaust noise” is the sound emitted from the engine’s exhaust system when gases are expelled from the combustion chamber. This type of noise is directly related to the combustion process and the flow of exhaust gases through the exhaust system components like the manifold, pipes, muffler, and catalytic converter. The level and characteristics of free exhaust noise are influenced by the engine’s operational state (e.g., idling, full throttle), the design of the exhaust system, the speed at which exhaust gases are expelled, and the presence of noise-reduction components within the exhaust system.

It is recommended that an acoustic environmental assessment be undertaken prior to the reinstatement of the wharf and operation of ferry services, as envisaged, to ensure minimal impacts on the local Little Penguin Operation.

The current planning conditions currently permit the berthing of vessels specifically approved by the relevant authorities and will not allow mooring when not in active use or during adverse weather conditions. Notably, any significant changes to these operations, including those affecting noise impacts from watercraft, will necessitate a separate planning application under Part 5 of the Environmental Planning and Assessment Act 1979, ensuring that all environmental impacts are appropriately managed and mitigated in future development stages.

When considering amplified music from ferries and other manned watercraft, the concept of ‘offensive noise’ must be applied.

In response to increased community awareness and concern about noise from vessels on Sydney Harbour, Transport for NSW, through its Commercial Vessels User Group, developed a Code of Conduct for Charter Vessels Operating with Amplified Music Systems. The Code of Conduct was introduced to ensure that Owners and Masters of charter vessels comply when on NSW navigable waters.

The Code specifies that no offensive noise will be emitted from any charter vessel, at any time. In addition to this, between midnight and 8am, charter vessels operating amplified music systems:

- Will not anchor.
- Will remain underway.
- Will operate at a distance of at least 200 metres from any shore.
- Will not operate on Sydney Harbour, west of a line between Kirribilli and Bennelong point.

In the time period between 8am and midnight, charter vessels operating amplified music systems:

- Will remain underway when operating at a distance of less than 200 metres from any shore.
- Will only anchor at a distance of at least 200 metres from any shore.

4.1.3 Water-based Access – Non-Motorized Watercraft (e.g., SUPs, Kayaks)

Non-motorized watercraft – including Stand-Up Paddleboards (SUPs), kayaks, and canoes – can be categorised under the “water-based access” section of the COPA. These vessels are favoured for recreational use, particularly due to their low environmental impact, making them ideal for ecologically sensitive areas.

These crafts are characteristically quiet, emitting minimal noise primarily from the paddles moving through the water and sporadic human conversation. Such low acoustic output significantly reduces the likelihood of disturbing wildlife, such as marine animals and birds.

The use of non-motorized watercraft for arrival by water is consistent with the approved 2018 Traffic and Access Plan. Further, water-based access (including the use of non-motorised vessels) is sought to be continued as part of the REF, as outlined within the Traffic and Access Plan prepared by Stantec (submitted with the REF). By promoting these low-impact modes of transport, the REF aims to minimise the overall acoustic disturbance in sensitive ecological areas. This approach not only aligns with the conservation objectives of the COPA but also fosters a more sustainable and environmentally conscious means of accessing these unique marine environments for recreational purposes.

4.1.4 Road Traffic Noise Criteria

The primary access for visitors to the site is via North Head Scenic Drive. Visitors can park in the upper car park near reception or alight at the bus stop directly outside the car park entrance.

To enhance safety and protect the surrounding wildlife, independent driving on-site by visitors is prohibited (excluding visitors with accessibility requirements, or overnight guests accessing the lower car park, as detailed in the Site Travel and Access Plan, 2024). Instead, a shuttle bus from reception is available to transport visitors throughout the Q Station precinct.

Road noise assessment at the site is guided by the criteria set forth in the NSW Road Noise Policy (2011). This policy categorises roads and projects to determine the applicable noise criteria based on land use sensitivity. The specific criteria applicable to Q Station are detailed in TABLE 2 and 3. Stringent noise standards are expected in areas with existing land uses sensitive to noise. The noise assessment criteria shown in FIGURE 2 and 3 are crucial for evaluating impacts and determining necessary mitigation measures under two main conditions:

- when there is a new road or road redevelopment
- when there is a land use development with the potential to generate additional traffic on local, sub-arterial or arterial roads.

According to the Road Noise Policy, feasible and reasonable mitigation measures should be considered if noise increases up to 2 dB, which is deemed a minor impact and is barely perceptible to the average person.

Road category	Type of project/land use	Assessment criteria – dB(A)	
		Day (7 a.m.–10 p.m.)	Night (10 p.m.–7 a.m.)
Freeway/ arterial/ sub-arterial roads	1. Existing residences affected by noise from new freeway/arterial/sub-arterial road corridors	L _{Aeq} , (15 hour) 55 (external)	L _{Aeq} , (9 hour) 50 (external)
	2. Existing residences affected by noise from redevelopment of existing freeway/arterial/sub-arterial roads	L _{Aeq} , (15 hour) 60 (external)	L _{Aeq} , (9 hour) 55 (external)
	3. Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments		
Local roads	4. Existing residences affected by noise from new local road corridors	L _{Aeq} , (1 hour) 55 (external)	L _{Aeq} , (1 hour) 50 (external)
	5. Existing residences affected by noise from redevelopment of existing local roads		
	6. Existing residences affected by additional traffic on existing local roads generated by land use developments		

Figure 2: Road traffic noise assessment criteria for various sensitive land uses (NSW Road Noise Policy (2011) p.12)

Existing sensitive land use	Assessment criteria – dB(A)		Additional considerations
	Day (7 a.m.–10 p.m.)	Night (10 p.m.–7 a.m.)	
4. Open space (active use)	L _{Aeq} , (15 hour) 60 (external) when in use	–	Active recreation is characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion. Passive recreation is characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, e.g. playing chess, reading.
5. Open space (passive use)	L _{Aeq} , (15 hour) 55 (external) when in use	–	In determining whether areas are used for active or passive recreation, the type of activity that occurs in that area and its sensitivity to noise intrusion should be established. For areas where there may be a mix of passive and active recreation, e.g. school playgrounds, the more stringent criteria apply. Open space may also be used as a buffer zone for more sensitive land uses.
6. Isolated residences in commercial or industrial zones	–	–	For isolated residences in industrial or commercial zones, the external ambient noise levels can be higher than those in residential areas. Internal noise levels in such residences are likely to be more appropriate in assessing any road traffic noise impacts, and the proponent should determine suitable internal noise level targets, taking guidance from Australian Standard 2107:2000 (Standards Australia 2000).
7. Mixed use development	–	–	Each component of use in a mixed use development should be considered separately. For example, in a mixed use development containing residences and a childcare facility, the residential component should be assessed against the appropriate criteria for residences in Table 3, and the childcare component should be assessed against point 8 below.

Figure 3: Road traffic noise assessment criteria for various sensitive land uses (NSW Road Noise Policy (2011) p.13)

4.1.5 Considerations for Non-Implementation of Wharf Upgrades:

While the intention is to enhance ferry operations through wharf upgrades, it is essential to prepare for the possibility that these upgrades may not occur. In the event that the revitalisation of the wharf does not proceed, a comprehensive re-assessment of the noise and traffic impacts related to alternative arrival methods by road will be necessary. This assessment will particularly focus on the expected increase in the use of general road traffic and ride-share services such as Uber.

The evaluation of potential impacts shall be conducted by traffic consultants, who will identify specific areas of concern regarding increased road traffic. Based on these findings, there will be a consideration for revising the appropriate noise criteria within the existing environmental guidelines to ensure that they remain relevant and effective under the changed circumstances.

4.2 Construction-Related Noise and Vibration

As part of this Review of Environmental Factors (REF), no new physical works or construction activities are proposed. The criteria listed below have been included as general controls to guide the future operations and management of these previously-approved construction activities, ensuring compliance with standard NSW planning and development guidelines.

4.2.1 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 (FIGURE 3).

Table 3: Construction noise management levels at other noise sensitive land uses

Land use	Where objective applies	Management level $\text{dB}_{\text{LAeq}(15\text{min})}$
Passive recreation areas	External noise level	60
Active recreation areas	External noise level	65
Education institutions	Internal noise level	45
Childcare premises	Internal noise level	45
Museums	Internal noise level	45
Community premises	Internal noise level	45
Commercial premises	External noise level	70
Place of Worship	Internal noise level	45
Industrial	External noise level	75

4.2.2 Sleep Disturbance

Noise sources of short-duration and high-level (such as car ignitions, doors slamming, tires screeching) that may cause disturbance to sleep if occurring during the night-time are not always adequately addressed by long-term noise assessment procedures.

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

A review of research on sleep disturbance documented in the NSW Road Noise Policy concludes that:

- “Maximum internal noise levels below 50 ~ 55dB_A are unlikely to cause awakening reactions”
- “One or two noise events per night, with maximum internal noise levels between 65dB_A and 70dB_A are not likely to affect health or well-being significantly. ”

Therefore, a maximum indoor noise level of 55 dB_{AFMax} (measured inside the nearest habitable room of a residential receiver; bedroom, living room etc.) or the L_{AF1(1 minute)} level of a noise event which should not exceed the ambient A₉₀ noise level by more than 15 dB – whichever is lower – will be used as the criteria for short-duration, transient sounds.

4.2.3 Construction Vibration Criteria

The NSW EPAs *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.

Table 4: Acceptable vibration dose values for intermittent vibration (m/s^{1.75}). Criteria for sensitive areas are only indicative, and there may be a need to assess intermittent vibration against impulsive or continuous criteria.

Location	Daytime 0700 - 2200h		Night-time 2200 - 0700 h	
	Preferred Value	Maximum Value	Preferred Value	Maximum Value
Critical Areas	0.1	0.2	0.1	0.2
Residences	0.2	0.4	0.13	0.26
Offices, schools, other occupied buildings.	0.4	0.8	0.4	0.8

Direct studies focusing on vibration impacts on fauna like penguins are not prevalent. But, understanding from related areas, such as the impacts of anthropogenic noise on marine life, suggests the importance of considering these factors.

Given this context, it’s prudent for projects near penguin & bandicoot habitats to include project-specific assessments of potential vibration impacts in their environmental planning. While the detailed vibration effects on penguins are yet to be fully documented, the known sensitivity of other species to environmental changes calls for a cautious approach.

For further understanding and detailed studies, referring to site-specific environmental evidence and conservation research would be beneficial.

4.3 Amplified Music and Entertainment

Notwithstanding the conditions outlined in the COPA, all amplified music and entertainment must also adhere to the specific noise related conditions stipulated in the North Head Quarantine Station Liquor License LIQO624015664 for all events and functions.

- The L_{A10} noise level emitted from the licensed premises shall not exceed the background noise level in any Octave Band Centre Frequency (31.5Hz - 8kHz inclusive) by more than 5dB between 07:00 am and 12:00 midnight at the boundary of any affected residence.
- The L_{A10} noise level emitted from the licensed premises shall not exceed the background noise level in any Octave Band Centre Frequency (31.5Hz - 8kHz inclusive) between 12:00 midnight and 07:00 am at the boundary of any affected residence.
- Notwithstanding compliance with the above, the noise from the licensed premises shall not be audible within any habitable room in any residential premises between the hours of 12:00 midnight and 07:00 am.
- Interior noise levels which still exceed safe hearing levels are in no way supported or condoned by the Authority.
- For the purposes of this condition, the L_{A10} can be taken as the average maximum deflection of the noise emission from the licensed premises.

4.3.1 The Importance of User Operation and Training

The successful management of amplified music hinges significantly on the user operation and the comprehensive training of those in charge of audio equipment, as detailed in the Noise Management Plan.

Proper operation and understanding of the audio systems not only ensure compliance with established noise regulations but also enhance the quality of the audio output, minimising disturbances to nearby wildlife and local communities.

Training should cover the correct setup, operation, and troubleshooting of equipment, as well as awareness of the noise levels permissible under our guidelines. It's imperative that all individuals involved in managing or operating sound systems are familiar with these protocols to prevent noise pollution and ensure a harmonious balance between event activities and environmental conservation.

The following are recommended steps towards an adequate user-operated training module for amplified music operators;

1. Understanding Noise Regulations and Guidelines: Ensure operators are aware of local noise regulations and site-specific guidelines, including permissible noise levels and operational time restrictions.
2. Equipment Setup and Configuration: Train on proper setup of audio equipment, including speaker placement, orientation, and connection to ensure optimal sound distribution and minimal noise leakage.
3. Volume Control and Monitoring: Educate on managing volume levels, using sound level meters to monitor output, and adhering to the specified dB limits to prevent disturbances.
4. Frequency and Sound Checks: Guide operators on conducting sound checks prior to events to adjust frequencies and volume, ensuring clarity while avoiding excessive bass that can lead to noise complaints.
5. Awareness of Sensitive Areas: Highlight the importance of understanding the layout of the site, identifying noise-sensitive areas, and directing sound away from wildlife habitats and neighboring communities.
6. Troubleshooting Common Audio Problems: Provide basic troubleshooting techniques for common audio issues such as feedback, distortion, and connectivity problems to ensure smooth operation.
7. Event-Specific Planning: Emphasise the need for planning and adapting the audio setup based on the event type, audience size, and location within the site to ensure appropriate sound levels.
8. Communication Protocols: Train on the use of communication tools and protocols for coordinating with event organisers, security, and other relevant parties to manage noise effectively.

9. Environmental Conservation Awareness: Educate on the ecological significance of the site and the importance of minimising acoustic disturbances to protect wildlife and maintain the site's natural ambiance.
10. Emergency Procedures: Ensure operators are familiar with emergency procedures and how to quickly reduce or shut off sound in case of an emergency or complaint.
11. Record Keeping and Reporting: Instruct on the importance of documenting sound levels, complaints, and any actions taken to resolve issues for regulatory compliance and future reference.

4.3.2 Portable Outdoor Systems Compliance

All amplified music on-site should be subject to noise monitoring and management as per the currently-approved conditions, to ensure compliance with the COPA.

All conditions should be evaluated on a case-by-case basis, taking into account the variables associated with each individual set-up and performance, including loudspeaker type, location, orientation, height, musical content, area covered, and event capacity.

Users of portable systems should be well-informed about the correct positioning, directional orientation, and operational levels to ensure that emissions do not exceed the established thresholds, thereby upholding the site's commitment to noise management and community respect.

4.3.3 Permanent or High-Capacity Systems

Permanent or fixed audio systems, as well as those intended for high-capacity outdoor events, require a more detailed approach to noise management.

Prior to installation and use, these systems must undergo acoustic propagation modelling. This process is essential to understand how sound disperses from the source, taking into account the specific topography and prevailing meteorological conditions of the site. The modelling helps in designing sound systems that fit within the natural and architectural confines of the area, thereby ensuring that sound levels are maintained within acceptable limits. This proactive approach allows event organisers and site managers to predict and control the impact of sound, ensuring that all outdoor events can proceed without negatively affecting the local environment or exceeding regulatory noise limits.

4.4 Noise from Commercial Operations and Mechanical Services

With reference to the NSW Parliamentary Counsel *Protection of the Environment Operations (Noise Control) Regulation (2017)*, operational noise, and noise generated from mechanical services equipment, is regulated by the New South Wales Environmental Protection Agency *Noise Policy for Industry (2017)*.

The 'project noise trigger level' provides a benchmark or objective for assessing a proposal or site. It is not intended for use as a mandatory requirement. 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; for example, further investigation of mitigation measures. The project noise trigger level, feasible and reasonable mitigation, and consideration of residual noise impacts are used together to assess noise impact and manage the noise from a proposal or site. It is the combination of these elements that is designed to ensure that acceptable noise outcomes are determined by decision makers.

The scientific literature indicates that both the increase in noise level above background levels (that is, intrusiveness of a source), as well as the absolute level of noise are important factors in how a community will respond to noise from industrial sources.

The *Noise Policy for Industry* indicates the minimum assumed Rating Background Noise Levels and Intrusiveness Noise Levels at various times of day, and should be used to evaluate amenity benchmarks

as per standard industry practice.

Table 5: Minimum assumed RBL's and project intrusiveness noise levels, as per Table 2.1 of the Noise Policy for Industry.

Time of Day	Minimum assumed rating background noise levels (dB _A)	Minimum project intrusiveness noise levels (L _{A,eq 15min} dBA)
Day	35	40
Evening	30	35
Night	30	35

The cumulative level of noise emissions from normally-operating mechanical plant (HVAC, kitchen/-bathroom exhaust fans etc.) in any operational development on-site should comply with the established noise emission criteria (i.e. no greater than the minimum project intrusiveness noise levels at the nearest sensitive receiver, as per TABLE 5).

5 Document Review

5.1 Noise Management Plan

Mawland prepared a Noise Management Plan dated May 2005, which formed part of the 2005 Environmental Management Plan. Originally drafted for the construction phase, the plan has since been adapted for the operational phase, with a focus on the conservation and adaptive reuse of the site.

We recommend that the operations of the site continue to adhere to the guidelines and stipulations outlined in the relevant site-wide plan. This ensures that all activities remain compliant with environmental regulations and contribute to the ongoing conservation efforts.

Additionally, it is suggested that the Noise Management Plan should undergo periodic reviews and updates with respect to the following:

- **Changes in Legislation or Guidelines:** New environmental standards or legislative changes could necessitate an update to ensure compliance with the latest requirements regarding noise levels and management practices.
- **Operational Changes:** Potential changes in site activities, such as new events or different usage patterns, could alter noise profiles and impacts, requiring the NMP to be revised to address these changes effectively.
- **Community Feedback:** Feedback or complaints from nearby residents or community groups about noise levels could prompt a reassessment of current noise management strategies and lead to updates in the plan.
- **Technological Advances:** New technologies or noise mitigation strategies may become available, offering more effective ways to manage noise impacts, thus necessitating an update to incorporate these new methods.
- **Environmental Changes:** Changes in the surrounding environment, such as new developments or alterations in land use, could affect noise propagation and impacts, requiring adjustments to the existing noise management strategies.
- **Monitoring and Evaluation Results:** Regular monitoring and evaluation might reveal that existing noise control measures are ineffective or that certain aspects of the plan need strengthening to meet the set objectives.
- **Extended Operations:** As in the case of the Q Station, extending the operation period through to 2050 necessitates a review to ensure the NMP remains relevant and effective over the longer term.

5.2 Integrated Monitoring and Adaptive Management System

The objective of the Integrated Monitoring and Management System (IMAMS) is to continually observe the effects of site activities on both the site itself and the immediately adjacent areas. This system is a mandated requirement under the lease conditions of the North Head Quarantine Station (NHQS).

Formal monitoring forms the foundation of the IMAMS and includes 102 specific indicators. Each indicator is defined by a preset benchmark, an acceptable performance range (desirable performance), a monitoring method, and potential responses for results that fall outside the acceptable range. These specific indicators are grouped under 36 headlines, which summarise the performance of the specific indicators. This clustering simplifies the process, making it easier to quickly understand the sustainability of the activity at a glance. The headline indicators represent various aspects of sustainability, encompassing environmental, cultural, social, and economic conditions.

The following indicators fall under the Headline Indicator “Noise”

- Construction Noise

- Traffic Noise
- Operations Noise Outside Site
- Operations Noise Inside Site
- Amplified Indoor Music or Noise Levels

We recommend that the indicators, benchmarks, monitoring methods, and adaptive management responses regarding noise, vibration and acoustics be reviewed collaboratively by NPWS in conjunction with NHS and a qualified acoustical consultant, as required. This collaboration aims to provide a comprehensive framework for self-compliance and effective management under variable operational conditions, ensuring that noise impacts are minimised and environmental standards are upheld.

5.2.1 Compliance Criteria

The indicators, acceptable ranges, benchmarks, and management responses stipulated by the Integrated Monitoring and Adaptive Management System for the adaptive re-use of the Quarantine Station (Sixth Draft dated 15th December 2006) have been included in APPENDIX F.

5.2.2 Conditions Review

The background noise level cited in the Integrated Monitoring and Management System (IMAMS) should be reassessed before any re-publication. Given the potential changes in the acoustic environment over time, re-establishing this baseline is essential for accurate current and future assessments. This reassessment does not suggest modifying the already-set “Acceptable Range” criteria but aims to provide an updated benchmark for evaluating the suitability of other criteria against the established amenity levels. An updated baseline will ensure that the noise management strategies and criteria accurately reflect the current acoustic conditions, enabling more precise and relevant measures for maintaining the site’s amenity levels in line with the evolving environment and community expectations.

All monitoring methods must adhere to the relevant Australian Standards, the *Noise Policy for Industry*, or other applicable guidelines.

5.3 Approved Internal Fit-out Plan:

We suggest incorporating a set of acoustic-specific considerations into any future Internal Fit-out Plans aimed at enhancing the overall functionality and comfort of the properties on-site. These recommendations are strategically designed to address key areas crucial for creating an optimal auditory environment;

- speech privacy,
- noise control and sound isolation,
- reverberation control and acoustic comfort.

The subsequent recommendations and guidelines are detailed with the intention of providing a comprehensive framework to assist in achieving the desired acoustic standards throughout the facility. These guidelines serve as framework for new/future developments, maintenance, or upgrades/modifications to existing facilities.

1. Interior Room Acoustics: Evaluate the materials and designs used for walls, ceilings, and floors to ensure they meet the required sound insulation and absorption properties as outlined in Australian Standard AS 2107:2016 *Acoustics – Recommended design sound levels and reverberation times for building interiors* to minimise echo and reverberation, enhancing speech intelligibility and acoustic comfort.
2. Sound Transmission: In venues where high-capacity entertainment is taking place;
 - (a) all new doors should include acoustic/fire-compliant perimeter seals and drop seals.

- (b) all new glazing should be acoustic-laminate glass.
- 3. Audio Systems: All fixed internal AV systems, including TVs, integrated speakers, conferencing systems, public address systems, and any other noise-generating components, must strictly adhere to the amplified emissions guidelines as outlined in this report.

6 Current Site Operations and Daily Activities

The following operations occur on a regular basis at the Q Station site, and have been identified and endorsed under the site-wide Noise Management Plan;

- Food facilities and preparation;
 - The Boilerhouse Kitchen and Bar operates out of building A6.
 - The Engine Room bar at the beachside end of A6 offers a casual dining option for lunch, dinner, or refreshments.
 - The kitchen for the Boilerhouse and Engine Room bar is located within A6.
 - A restaurant is located in building P12, with food preparation conducted in the neighboring building P13. This restaurant provides a buffet breakfast for guests every morning from 7 am.
 - The Wharf Caf, located inside buildings A14-17 and forming part of the Visitor Centre complex in the Wharf precinct, operates from Sunday to Tuesday from 8 am to 5 pm and Wednesday to Saturday from 8 am to 4 pm. Food preparation for this caf is completed in P13 and delivered to the caf each day.
 - Q Station vehicles are used to transport food to all locations outside of immediate venues.
- Staff and training
 - There are currently 140 staff employed at the site. This includes a mix of permanent full time and part or casual roles.
- Conferences, functions and events
 - Q Station hosts a range of conferences, functions and events over the year, with the potential of up to 45% of total revenue being generated in this way. The follow 11 buildings are available for meetings and functions: P3, P7, P10, P12, P15, P16, P27, A2 & H1A.
- Environmental
 - Waste management
 - * Waste and recycling bin storage is located at the end of CP5.
 - * On site bin collection and replacement is completed by housekeeping team.
 - * Contractors empty full bins accumulated in CP5.
 - Maintenance/conservation
 - * Specific maintenance tasks on site are logged through the inhouse Protel system.
 - * Daily report tasks are attended to by maintenance team in the first instance.
 - * Specialised trades eg electrical, plumbing services are contracted when appropriate.
 - * Regular use and inspection of buildings and infrastructure also informs ongoing maintenance requirements such as painting of buildings, drain clearing, road potholes.
 - * Repairs to buildings and infrastructure are carried out in line with CWP guidelines.
 - * Mown areas are subject to ongoing grass cung. Weeding and other gardening tasks are predominately carried out in the immediate garden beds adjacent to buildings or on the periphery of the mown areas.
 - * Pest control.

The continuation of the abovementioned site operations and activities is sought as part of this REF application. These activities will continue to be undertaken in accordance with the management and mitigation measures listed within the relevant Site Wide Plan:

- Endorsed Plans:

- Noise Management Plan, 2005.

- Proposed Drafts:

- Refer to the Environment and Heritage Site Wide Management 2023: Appendix 12 Noise Management Plan (draft).

Notwithstanding, the mitigation and management measures outlined in this REF should be considered to ensure the ongoing operation of the site is acceptable.

7 Conclusions & Recommendations

This Acoustic Environmental Impact Assessment (EIA) for the North Head Quarantine Station thoroughly evaluates the current and projected acoustic environment, as presented under the Review of Environmental Factors (REF) submission. It identifies areas where noise impacts can be effectively managed in alignment with ecological sensitivities and community expectations. The assessment confirms adherence to existing regulatory standards and highlights specific areas where improvements are critical for long-term sustainability and compliance.

7.0.1 Environmental and Wildlife Considerations

Despite the recognition of potential impacts on wildlife such as Little Penguins and Long-Nosed Bandicoots, there is insufficient data directly linking operational noise at Q Station to definitive ecological consequences. This gap underscores the necessity for targeted, quantitative research and ongoing environmental monitoring. Establishing a robust framework for continuous assessment will provide a clearer understanding of how noise and human activity affect the species specific to this region. These efforts should aim to document current impacts and forecast potential future disruptions, facilitating the development of proactive conservation strategies.

The findings from the Species Impact Statement (SIS) and other referenced ecological assessments indicate that while some species exhibit resilience to anthropogenic noise, the overall ecological dynamics at Q Station are complex and require further evaluation.

7.0.2 Patron Activity and Noise Management

The assessment reviews the noise generated from various operational activities and events. Most activities comply with legislative noise regulations; however, outdoor events are identified as potential sources of noise pollution. Implementing strict controls during these events, coupled with a robust real-time noise monitoring system, will allow the site to effectively self-mitigate these concerns.

It is important to note that the current REF does not include provisions for modifications or redevelopment related to the wharf precinct, including potential changes to encourage arrival by water. Specific activities and modifications related to the wharf precinct will be addressed under a separate planning pathway, ensuring a focused evaluation and enabling tailored mitigation strategies that align with the broader environmental and operational objectives of the North Head Quarantine Station.

7.0.3 Regulatory Compliance and Future Planning

This EIA underscores the necessity for ongoing compliance with evolving environmental regulations and standards. This includes regular reviews of the Noise Management Plan and other environmental management strategies to incorporate legislative changes, technological advancements, and new ecological data. It is recommended that these reviews be conducted periodically to address any non-compliant activities, operational changes, updates to environmental conditions, and to provide inductions for new staff. Additionally, the reviews should anticipate and address potential future changes to ensure continued compliance and effectiveness.

Operational plans should be dynamically adapted based on comprehensive noise and environmental monitoring results. This approach will help maintain a balance between operational requirements and environmental conservation, ensuring that the activities at the Quarantine Station do not compromise the welfare of local wildlife or the quality of life for the surrounding community.

Filling the existing knowledge gaps with site-specific data collection will enable us to fully-understand the holistic impact of the environment, including all anthropogenic noise sources, on these species in their specific conditions. These study should aim to:

- Quantify noise impact through precise measurement techniques to establish a clear baseline and assess deviations.

- Implement long-term monitoring programs to track the health and behaviour of key species over time, providing data on both immediate and chronic effects.
- Review, update, or develop threshold trigger points for action based on scientific evidence, ensuring that any potential adverse impacts are promptly and effectively mitigated.

A more-robust noise monitoring system will enable adaptive management by providing real-time feedback when noise triggers are exceeded, allowing for immediate mitigation measures. The Integrated Monitoring and Adaptive Management System (IMAMS) will guide venue management in maintaining compliance, educating staff, patrons and vendors about noise conditions, and ensuring adherence to noise controls.

7.1 Concluding Statement

The Acoustic Environmental Impact Assessment provides a detailed framework for managing the acoustic environment at the North Head Quarantine Station, ensuring responsible operations with minimal impact on the natural environment and the community.

The implementation of these recommendations will position Q Station as a model of sustainable operation, harmonising its historic significance with its commitment to environmental stewardship and community welfare. The ongoing success of these initiatives will depend on diligent application of adaptive management practices, robust stakeholder engagement, and a commitment to continuous improvement.

On the basis that the recommended management measures are implemented, it is expected that the site will continue to operate satisfactorily from an acoustic perspective beyond 23 December 2024.



DANIEL NATOLI
(Master of Architectural Science, Audio & Acoustics, MAAS, MAES, AllEAust)
Company Director & Principal Acoustical Consultant
for and on behalf of AKA Acoustics Pty. Ltd.

Appendix A Acoustic Compliance Report R-106QST230306.0

106QST230306.pdf [1]



ACOUSTIC CONSULTING &
MULTIMEDIA STUDIO DESIGN

ACOUSTIC COMPLIANCE REPORT

North Head Quarantine Station.

Submission Date: March 6th 2023
Document No.: R-106QST230306.0



March 6th 2023

Dear Glenn Piper,

On behalf of AKA ACOUSTICS PTY. LTD., thank you for affording us the opportunity to assist with the ongoing compliance of the North Head Quarantine Station.

The following report documents the results of our environmental noise assessment, conducted between Thursday February 9th 2023 and Monday February 27th 2023, to evaluate the impact of amplified music from the Boilerhouse restaurant & adjacent outdoor area. These measurements provide an accurate noise model of the activities occurring during peak periods, and provide a benchmark for future mitigation responses.

If you have any questions, or would like to discuss the following report with us directly, please don't hesitate to contact me for further clarification.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'D. Natoli', is written over a light blue circular stamp.

DANIEL NATOLI
(Master of Architectural Science, Audio & Acoustics, MAES, AffilIEAust)
Company Director and Principal Acoustical Consultant
for and on behalf of AKA ACOUSTICS PTY LTD

Disclaimer

“AKA ACOUSTICS” is a registered trading name of AKA MUSIC PTY. LTD.

The work presented in this document was carried out and prepared in accordance with the scope of services described in the consultancy engagement letter delivered to the Client by AKA Acoustics

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Recommendations made in this report are intended to resolve acoustical problems only. No claims of expertise in other areas are made and no liability is accepted in respect of design, operation or construction for issues falling outside the specialist field of acoustical engineering. The report relies upon data, surveys, measurements and results taken at or under the particular times and conditions specified herein. Any findings, conclusions or recommendations only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by the Client.

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Glossary of Terms

The ISO and IEC maintain terminological databases for use in standardisation at the following addresses:

- ISO Online, available at <http://iso.org/obp>
- IEC Electropedia, available at <http://www.electropedia.org/>

These terminological standards have been followed as closely as possible. Any deviation has been noted in the text.

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1 Introduction

1.1 Scope of Work

AKA ACOUSTICS were engaged to conduct an environmental noise assessment of the NORTH HEAD QUARANTINE STATION (also referred to as “Q Station”) located at 1 North Head Scenic Drive, Manly, New South Wales, 2095, to evaluate the compliance with the noise-related conditions listed in the permissions of Consolidated Consent (MP08_0041-Mod-3, dated 25/05/2018).

Q Station has been identified as home to an endangered population of Little Penguins and Long-Nosed Bandicoots.

The Boilerhouse Restaurant is located at the northern-end of Wharf Road, adjacent to Quarantine Beach. The restaurant has an outdoor dining area which is occupied by patrons in the Summer months. Penguins are known to nest in the general area surrounding this external dining area.

The restaurant has approval to operate, subject to the conditions stipulated by the Modified Conditions of Consent. Condition 201 provides management controls to limit the impact from amplified music/noise, to maintain amenity and provide protection to the identified wildlife.

The following Acoustics Report presents the findings from the environmental noise assessment conducted between Thursday February 9th 2023 and Monday February 27th 2023, to determine the restaurant’s compliance with the Approval Conditions listed above.

1.2 Limitations

The purpose of this report is to provide an independent acoustic assessment of the area surrounding the Restaurant, with specific reference to noise emissions from amplified music and patron activity. It is not the intention of the assessment to cover every element of the acoustic environment on the Q Station estate, but rather to conduct the assessment with consideration to the prescribed work scope and general operational activities related to the development.

This assessment only aims to address Condition 201 of MP08_0041-Mod-3, and does not address noise relating to maximum-capacity events (as per Condition 201(A)).

1.3 List of Referenced Standards & Noise Policies

The site development and this corresponding noise assessment draw compliance from the following documents:

- Australian Standard AS 1055:2018 Acoustics - Description and measurement of environmental noise.
- Consolidated Consent - Quarantine Station North Head (MP08_0041-Mod-3 - 25/05/2018)
- NSW Environmental Protection Agency. (2017). Noise Policy for Industry.
- NSW Parliamentary Counsel. (2017). Protection of the Environment Operations (Noise Control) Regulation.
- Liquor & Gaming NSW License Number No. LIQO624015664

2 Criteria For Noise Assessment

As issued on Page 33 of the Conditions of Consolidated Consent (MP08_0041-Mod-3), the following noise-related items are to be addressed in this assessment;

201. Amplified music or noise on the site shall be managed on the following basis:

- (a) any amplified music or noise or ambient dining music shall not exceed the LAeq noise level of 50 dB(A) as measured up to 20 metres away from the edge of the building in which the music or noise is being generated;
- (b) outdoor amplification may only occur during the day period and must not exceed LAeq noise level of 50 dB(A), as measured at any point along the existing fence line (as at 2017) to the beach area;

Notwithstanding the above, the venues must also adhere to the noise-related conditions stipulated in the North Head Quarantine Station Liquor License No. LIQO624015664:

The LA10 noise level emitted from the licensed premises shall not exceed the background noise level in any Octave Band Centre Frequency (31.5Hz - 8kHz inclusive) by more than 5dB between 07:00 am and 12:00 midnight at the boundary of any affected residence. The LA10 noise level emitted from the licensed premises shall not exceed the background noise level in any Octave Band Centre Frequency (31.5Hz - 8kHz inclusive) between 12:00 midnight and 07:00 am at the boundary of any affected residence. Notwithstanding compliance with the above, the noise from the licensed premises shall not be audible within any habitable room in any residential premises between the hours of 12:00 midnight and 07:00 am. Interior noise levels which still exceed safe hearing levels are in no way supported or condoned by the Authority. For the purposes of this condition, the LA10 can be taken as the average maximum deflection of the noise emission from the licensed premises.

3 Site Evaluation

The Boilerhouse Restaurant is located at the northern-end of Wharf Road;



Figure 1: The North Head Quarantine Station lease area. The assessment location is denoted in red.



Figure 2: An ariel view of the assessment location. The dotted yellow line denotes the 20m boundary from the Boilerhouse Restaurant. The red marker illustrates the measurement location at the beach-side fence line.

In order to satisfy Condition 201, amplified music must be assessed at the following locations;

- for condition 201(a): 20 metres away from the edge of the building in which the music or noise is being generated.
- for condition 201(b): measured at any point along the existing fence line (as at 2017) to the beach area.

With consideration for the above, the noise monitoring location marked in FIGURE 2 was deemed accurately representative of the two approval conditions.

Unattended noise monitoring equipment (an ARL NGARA Environmental Noise Logger) was set up at the marked location in accordance with FACT SHEET B1: DETERMINING BACKGROUND NOISE USING LONG-TERM NOISE MEASUREMENTS of the *NSW Environmental Protection Agency Noise Policy for Industry 2017*.

Hand-held attended noise measurements were also conducted using a Brüel & Kjær Type-2270 Sound Level Meter in accordance with FACT SHEET B2: DETERMINING BACKGROUND NOISE USING SHORT-TERM NOISE MEASUREMENTS of the *NSW Environmental Protection Agency Noise Policy for Industry 2017*.

4 Acoustic Assessment

4.1 Measurement Details

Location:

Quarantine Beach, at the boundary fence (as marked in FIGURE 2). 20m north-east of the Boilerhouse Restaurant.

Dates & Times:

SET 1: 12:07 on Wednesday February 9th 2023 to 13:05 on Monday February 13th 2023.

SET 2: 11:20 on Thursday February 16th 2023 to 11:44 on Tuesday February 21st 2023.

SET 3: 15:09 on Thursday February 23rd 2023 to 12:57 on Monday February 27th 2023.

Weather Summary:

Mixed conditions were experienced throughout the assessment period; mostly-cloudy skies, with temperatures ranging from a minimum of 18°C to a maximum of 27°C. Heavy rainfall was experienced on Wednesday February 9th, although this did not impact the Friday-to-Sunday assessment window.

Weather data was collected from the nearest station (Sydney Harbour, Wedding Cake West, Station No. 066196), 4.7km away, and has been included in APPENDIX A.

All periods affected by adverse weather (i.e. rain or wind greater than 5m/s) have been excluded from the analysis. Meteorological data collected during the noise monitoring at the Sydney Harbour weather station was reviewed for this purpose in conjunction with the audio recordings undertaken during the monitoring.

4.2 Survey Instrumentation & Certifications

Sound level measurements and analysis were made with the following instrumentation equipment & software:

Acoustic Research Labs Ngara Black Class-1 Sound Level Meter

(includes UC-53A Microphone & NH-17 Preamplifier)

Serial Number: 8781D4

Calibration Number: C22240

Calibration Certificate: 20/04/2022 to 20/04/2024

Acoustics Research Labs Model 105 Acoustic Calibrator

Serial Number: 87785

Calibration Number: C22241

Calibration Certificate: 20/04/2022 to 20/04/2024

Acoustics Research Labs WS-15 Windscreen

With digital Windscreen Correction applied for outdoor measurements

DIGITAL SOFTWARE ANALYSIS

Acoustics Research Labs Ngara Remote Host Software

Version Number: 4.03

Brüel & Kjær Type-2270 G-4 Class 1 Sound Level Meter

Serial Number: 3011656
Calibration Number: CAU2200361
Calibration Certificate: 01/06/2022 to 01/06/2023

Brüel & Kjær Type-4231 Sound Calibrator

Serial Number: 2513207
Calibration Number: CAU2200361
Calibration Certificate: 01/06/2022 to 01/06/2023

Brüel & Kjær BZ-5503 Measurement Partner Suite

Version Number: 4.8.1.1

Brüel & Kjær UA-1650 90mm Windscreen

With digital Windscreen Correction applied

The Brüel & Kjær Type-2270, ACOUSTICS RESEARCH LAB Class-1 UC-53A Microphone & NH-17 Preamplifier all exceed the recommendations cited in the standard AS IEC 61672.1:2019¹.

All measurement systems have been laboratory calibrated within the NATA (National Association of Testing Authorities) scope of accreditation and have been certified within twelve months of the conducted test.

The listed Acoustic Research Lab equipment is owned & maintained by TECH RENTALS (TR PTY LTD). The Brüel & Kjær equipment is owned & maintained by THE UNIVERSITY OF SYDNEY.

The measurement system was field-calibrated before and after all noise surveys. No deviation greater than ± 0.01 dB was noted.

¹AS/NZS IEC 61672.1:2019 Electroacoustics - Sound Level Meters Specifications, Standards Australia.

4.2.1 Background Noise Measurement Results

The A-Weighted measurement results have been post-processed and presented below in TABLE 1. Detailed daily noise-logging data has also been presented in FIGURES 3.

Table 1: Measured ambient noise levels (including all sources of environmental noise). The minimum and maximum L_{Aeq} range has been indicated for each time period. Values have been weighted and averaged over 15-minute periods as per the methodology outlined in the *Noise Policy for Industry*.

Day	Date	L_{Aeq} Ambient Noise Levels Range (dB)			Shoulder Periods	
		Day 7am to 6pm	Evening 6pm to 10pm	Night 10pm to 7am	Lunch 12pm to 4pm	Dinner 5pm to 9pm
Friday	10.02.2023	48 - 55	45 - 58	40 - 52	49 - 55	48 - 58
Saturday	11.02.2023	47 - 67	48 - 68	39 - 53	51 - 67	51 - 68
Sunday	12.02.2023	47 - 62	48 - 53	46 - 53	54 - 60	50 - 62
Friday	17.02.2023	45 - 57	50 - 90	37 - 51	45 - 52	49 - 90
Saturday	18.02.2023	46 - 65	53 - 65	37 - 54	49 - 62	55 - 65
Sunday	19.02.2023	42 - 74	44 - 61	40 - 49	48 - 74	45 - 66
Friday	24.02.2023	46 - 72	48 - 68	42 - 52	49 - 72	50 - 71
Saturday	25.02.2023	45 - 80	47 - 60	40 - 49	52 - 80	50 - 67
Sunday	26.02.2023	43 - 66	44 - 68	40 - 50	50 - 66	52 - 69

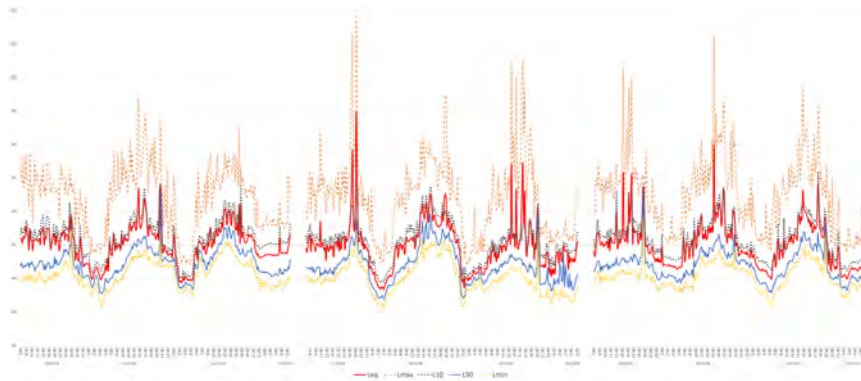


Figure 3: Ambient background noise levels at the Quarantine Beach fence line, recorded between 10.02.2023 and 26.02.2023, presented in 15-minute intervals as L_{Amax} , L_{Amin} , L_{A90} , L_{A10} and L_{Aeq} statistics.

4.3 Physically Observed Noise Sources

4.3.1 General Observations

A review of the measured noise levels, in conjunction with the captured audio recordings, identified a number of noise sources that contributed to the measured ambient noise levels;

- Ocean and wind conditions.
- Local fauna (primarily birds and insects, and cicadas).
- Patron activity and children, both on the nearby grass area, and audible from the beach.
- Noise from nearby moored boats (including low frequency music and party activities).

Noise generated by Boilerhouse patrons was clearly audible at times, but typically at a much lower noise level than the identified extraneous sources.

Ambient dining music from within the restaurant was barely audible at the assessment location, and was found to have no influence on the overall measured noise level. Music was only intermittently audible at the assessment location at brief times when the external doors to the restaurant were opened for access. It can be seen that the restaurant interior complies with Condition 201(a) regarding ambient dining music.

A large Bluetooth PA speaker was used to provide ambient dining music to patrons in the outdoor area. On review, the level of this speaker varied significantly from day-to-day; at times the level of music was inaudible behind the other extraneous noise sources, and on others, the PA speaker was clearly the dominant noise source in the area. This observation corresponds with the inconsistent noise levels measured during the 'Lunch' and 'Dinner' shoulder periods over the three weekends.

4.3.2 Comments on Amplified Entertainment

A set of hand-held attended noise measurements were taken during the performance on Sunday February 12th 2023, to determine compliance during a live music event.

The measurements were taken with a Brüel & Kjær Type-2270 Sound Level Meter in accordance with FACT SHEET B2: DETERMINING BACKGROUND NOISE USING SHORT-TERM NOISE MEASUREMENTS OF the *NSW Environmental Protection Agency Noise Policy for Industry 2017*.

The artist was set up under the covered awning, with a 12" PA (elevated at approximately 1.5m) aimed north towards the beach. The overall output level was controlled by the artist using a small-format mixing console. Approximately 70 patrons occupied the outdoor area.

The results of this short-term assessment have been presented in APPENDIX B.

Noise emissions from the PA system were logged at an average of 60dB_{Aeq} over the 15-minute assessment period, when measured 30m from the loudspeaker. Background noise levels (during breaks, without any amplified music present) were measured at approximately 54dB_{Aeq}.

4.4 Summary of Compliance

TABLE 2 summarises the compliance of the Boilerhouse Restaurant with the MP08_0041-Mod-3 Approval Condition 201.

Table 2: An evaluation of compliance with MP08_0041-Mod-3 Approval Condition 201.

Day	Date	Indoor Dining Compliance with Condition 201(a)
Friday	10.02.2023	Yes
Saturday	11.02.2023	Yes
Sunday	12.02.2023	Yes
Friday	17.02.2023	Yes
Saturday	18.02.2023	Yes
Sunday	19.02.2023	Yes
Friday	24.02.2023	Yes
Saturday	25.02.2023	Yes
Sunday	26.02.2023	Yes
Outdoor Dining Compliance with Condition 201(b)		
Friday	10.02.2023	Yes
Saturday	11.02.2023	No (measured & audible >50dB)
Sunday	12.02.2023	Yes
Friday	17.02.2023	Yes
Saturday	18.02.2023	Yes
Sunday	19.02.2023	No (measured & audible >50dB _{Aeq})
Friday	24.02.2023	No (measured & audible >50dB _{Aeq})
Saturday	25.02.2023	No (measured & audible >50dB _{Aeq})
Sunday	26.02.2023	Yes
Live Music Compliance with Condition 201(b)		
Friday	10.02.2023	-
Saturday	11.02.2023	No (measured & audible >50dB _{Aeq})
Sunday	12.02.2023	No (measured & audible >50dB _{Aeq})
Friday	17.02.2023	-
Saturday	18.02.2023	No (measured & audible >50dB _{Aeq})
Sunday	19.02.2023	No (measured & audible >50dB _{Aeq})
Friday	24.02.2023	-
Saturday	25.02.2023	No (measured & audible >50dB _{Aeq})
Sunday	26.02.2023	No (measured & audible >50dB _{Aeq})

5 Conclusions

5.1 Noise Mitigation Strategies

In order to achieve (and maintain) compliance with the Consolidated Conditions of Consent, the following mitigation strategies have been recommended to reduce noise emissions from the amplified music systems;

- All outdoor amplified music systems (both portable Bluetooth PA's, and large-format systems for live entertainment) should be configured at the northern-end of the venue. All loudspeakers (including foldback) should be aimed away from the northern boundary. This will ensure that noise emissions do not directly propagate towards the critical area at the northern/eastern boundary fence.
 - Venue staff are responsible for maintaining noise levels during live events. A Class 1/Class 2 handheld Sound Level Meter should be employed during setup/soundcheck to ensure that the system output levels do not exceed 50dB_A at the critical boundaries. In the case that the ambient noise level is higher than 50dB_A (caused by other extraneous noise sources) then it is crucial that any amplified music is not measurably audible above this level.
 - If available, an output limiter should be engaged on all mixing consoles and hardware. If no such limiter is present, an outboard processor (such as the NoiseMeters AVC2²) can be installed before the amplification stage to transparently attenuate the output signal.
 - Amplified dining music emitted from consumer-level equipment (such as Bluetooth PA's) should be completely inaudible, or barely audible, at any point along the existing fence line.
-

²NoiseMeters Australia AVC2 Automatic Volume Control System: <https://au.noisemeters.com/product/formula-sound/avc2/>

5.2 Concluding Statement

An Environmental Noise Assessment was conducted at the Boilerhouse Restaurant (on-premise at the North Head Quarantine Station) to determine the venue's compliance with the Conditions of Consolidated Consent (MP08_0041-Mod-3).

Long-term unattended noise measurements were taken at the northern boundary of Quarantine Beach over three weekend periods (Friday/Saturday/Sunday) to evaluate amplified music levels with respect to Noise Condition 201. Further attended measurements were also conducted to determine the impact of live amplified entertainment during the "Live at Boilerhouse" sessions on Sunday February 12th.

With respect to Condition 201(a), amplified dining music did not exceed 50dB_A when measured up to 20 meters away from the edge of the building in which noise was being generated.

With respect to Condition 201(b), noise from outdoor amplification systems did often exceed the 50dB_A threshold when measured along the boundary fence line. A number of mitigation strategies were presented in SECTION 5.1 to provide the venue with simple, realistic measures to ensure that there are no disruptions to nearby wildlife ecosystems.

It is understood that neither the Boilerhouse restaurant nor Q Station have received any complaints with respect to noise emissions during the previous twelve months. We have also been advised that noise monitoring will continue to be part of the site's environmental audit process.

In conclusion, with the appropriate mitigation strategies in place, the potential adverse impacts on the surrounding environment will be fully-managed and minimised.



DANIEL NATOLI
(Master of Architectural Science, Audio & Acoustics, MAES, AffilIEAust)
Company Director and Principal Acoustical Consultant
for and on behalf of AKA ACOUSTICS PTY LTD

Appendix A Weather Data

Sydney Harbour, New South Wales
February 2023 Daily Weather Observations



Date	Day	Temps		Rain	Evap	Sun	Max wind gust			8am					3pm						
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours	Dirn	Spd	Time	°C	%	eghts	Dirn	Spd	hPa	°C	%	eghts	Dirn	Spd	hPa
1	We	21.2	25.0				SW	46	23:15	22.4			WSW	20	24.1				SE	26	26
2	Th	22.2	26.8				NNE	56	18:34	23.2			NNE	22	24.4				NNE	35	35
3	Fr	23.0	26.7				SE	39	18:43	23.8			W	22	24.0				SE	30	30
4	Sa	18.7	27.1				W	44	10:06	19.1			WNW	28	25.0				SW	20	20
5	Su	19.0	24.8				SW	39	02:23	21.3			WSW	19	24.2				E	20	20
6	Mo	21.3	24.1				NE	44	17:19	23.1			NNW	6	23.9				NE	31	31
7	Tu	23.0	25.1				NNE	30	11:04	23.6			N	9	24.6				ENE	20	20
8	We	22.3	25.4				ENE	43	19:45	23.7			Calm		23.5				ESE	24	24
9	Th	19.1	23.3				ENE	85	15:29	22.8			NE	26	22.0				ENE	28	28
10	Fr	18.8	25.3				NNE	35	17:17	20.9			WSW	7	23.3				ENE	22	22
11	Sa	20.9	27.0				NNE	50	14:20	23.0			N	7	24.4				NNE	37	37
12	Su	21.9	24.9				S	63	13:10	24.9			SW	31	23.7				S	43	43
13	Mo	19.6	22.6				S	43	08:04	21.5			S	30	21.8				S	30	30
14	Tu	19.0	22.6				SSW	50	04:43	19.7			SSW	22	21.1				SW	11	11
15	We	18.8	24.7				NE	35	15:16	20.3			W	15	22.0				ENE	22	22
16	Th	19.7	24.3				NNE	44	20:36	22.2			NNE	19	23.7				NNE	35	35
17	Fr	21.5	24.4				NNE	44	14:48	22.7			NNE	17	24.1				NE	33	33
18	Sa	21.6	27.9				SSW	83	17:53	22.9			NNE	15	24.5				NNE	35	35
19	Su	22.1	26.3				SSW	43	00:35	23.2			SSW	24	25.5				SSE	15	15
20	Mo	22.5	25.4				NNE	46	15:13	23.5			NNE	19	24.0				NNE	31	31
21	Tu	21.9	26.1							23.9			WSW	2	24.9				ENE	17	17
22	We	20.1	22.4				SSE	65	01:52	22.2			SE	35	21.0				SE	28	28
23	Th	18.8	23.7				ESE	44	04:43	20.4			ESE	17	23.0				E	26	26
24	Fr	18.8	23.6				NE	37	11:13	20.9			SW	9	22.9				NNE	19	19
25	Sa	19.1	24.1				NNE	50	21:01	20.7			SW	9	23.1				NE	28	28
26	Su	20.0	25.9				WSW	63	22:24	21.4			N	9	24.9				NNE	22	22
27	Mo	21.3	24.3				S	43	01:59	23.1			SSW	20	24.1				SE	19	19
28	Tu	21.3	24.4				NE	35	15:31	22.8			SW	9	23.7				NE	22	22
Statistics for February 2023																					
Mean		20.8	24.9							22.3				16		23.7				26	
Lowest		18.7	22.4							19.1			Calm		21.0				SW	11	
Highest		23.0	27.9				ENE	85		24.9			SE	35		25.5			S	43	
Total																					

Observations were drawn from Sydney Harbour (Wedding Cake West) (station 066196)

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http://www.bom.gov.au/climate/idx/IDC_IDW0006.pdf

Appendix B Attended Background Noise Measurement Results: Sunday February 12th, 2023

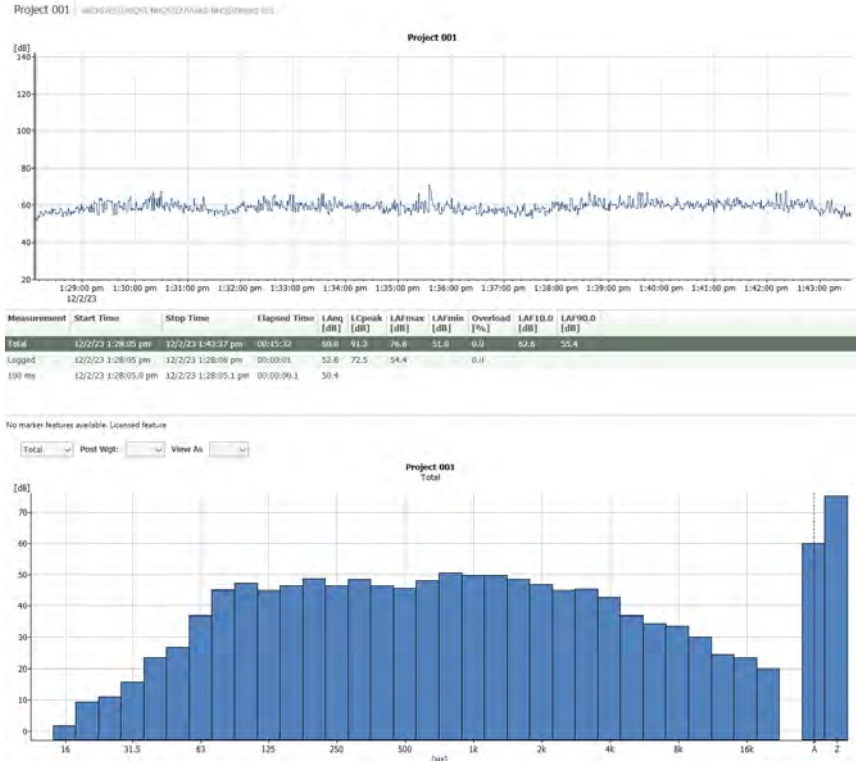


Figure B.1: Ambient sound pressure levels, measured at the fence-line during the musical performance. An average L_{Aeq} of 60dB was measured between 1:29pm and 1:43pm.



Figure B.2: Ambient sound pressure levels, measured at the fence-line during a break in the musical performance. An average L_{Aeq} of 54dB was measured between 1:52pm and 2:07pm.

Appendix B Site-Wide Compliance Report L-106QST20230427.0

106QST20230427.pdf [1]



ACOUSTIC CONSULTING &
MULTIMEDIA STUDIO DESIGN

Document Number: L-106QST230427.0

NORTH HEAD QUARANTINE STATION
1 North Head Scenic Drive, Manly, NSW, 2095
Attn: Glenn Piper

April 27th 202

Re: Acoustic Compliance Assessment for MP08 0041-Mod-3, dated 25/05/2018.

Dear Glenn Piper,

Following the submission of our Acoustic Compliance Report (R-106QST230306.1) dated March 6th 2023, we have observed the implementation of the suggested noise mitigation strategies outlined in our document at the Boilerhouse Restaurant and surrounding Wharf Precinct.

For the purpose of compiling a site-wide noise management plan, the following conditions have been presented to assist with the control and mitigation of noise elsewhere on the North Head Quarantine Station property.

In order to satisfy the permissions of Consolidated Consent (MP08 0041-Mod-3, dated 25/05/2018). -

201. Amplified music or noise on the site shall be managed on the following basis:

- (a) any amplified music or noise or ambient dining music shall not exceed the LAeq noise level of 50 dB(A) as measured up to 20 metres away from the edge of the building in which the music or noise is being generated;
- (b) outdoor amplification may only occur during the day period and must not exceed LAeq noise level of 50 dB(A), as measured at any point along the existing fence line (as at 2017) to the beach area;

Regarding instances of amplified music indoors;

- All permanent hardware systems must be controlled by a noise limiter to ensure that maximum noise emissions (under operational conditions) do not exceed 50dB_A. Limiter controls (including

AKA ACOUSTICS - L-106QST230427.0

Page 1

thresholds and maximum output Sound Power Levels) should only be accessible by a qualified acoustic consultant.

- During high-capacity events, all operable windows and doors should remain closed.
- Interior noise levels which exceed safe hearing levels are in no way supported or condoned.
- Notwithstanding the conditions above, the venues must adhere to the noise-related conditions outlined in the Liquor License (No. LIQO624015664).

To the best of our understanding, it is the intention of the NHQS management to conduct a full-scale system audit, with the intention of implementing greater software/hardware control measures over any fixed amplified music systems.

Regarding instances of amplified music outdoors;

Due to the complex topography, building layout, and density of vegetation on the property, it is highly unlikely that noise emissions from the First Class, Second Class, Hospital and Glass House precincts will be audible at the sensitive areas along Quarantine Beach.

However, considerations must be made for meteorological conditions (such as temperature inversions, increased humidity, wind speed/direction) that can result in a potential increase in sound travelling over large distances.

It is the responsibility of NHQS management staff to ensure that any contracted musician or sound technician responsible for the supply, setup, and operation of any outdoor amplification equipment are made suitably-aware of the prevailing noise conditions, and to ensure that the relevant noise controls are adhered to throughout the event.

It is the responsibility of the system operator to maintain appropriate noise levels during any amplified events (including the use of a suitably-classified hand held sound level meter).

In conclusion, with the appropriate mitigation strategies in place, the potential adverse impacts on the surrounding environment will be fully-managed and minimised.

Yours sincerely,



DANIEL NATOLI
(Master of Architectural Science, Audio & Acoustics, MAES, AffilIEAust)
Company Director & Principal Acoustical Consultant
for and on behalf of AKA ACOUSTICS PTY LTD

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Appendix C Noise Impacts on Little Penguins

The following is an extract from the 2024 Species Impact Statement submitted by ecologue;

6.1.3.3 Noise

“An assessment of potential noise impacts of the proposal on little penguins was undertaken by Biosis to support the MOD 3 EIS. The assessment reviewed available literature and consulted with the leader of a team undertaking research on Little Penguin at St Kilda in Victoria. The study identified the challenges of isolating noise impacts on wildlife in general. Notwithstanding this, the Biosis report reviewed an analysis of breeding data at Port Phillip Island in Victoria (Dann 1992). That large penguin colony is a focus of a major tourism attraction and is exposed to human visitation, artificial lighting and increased background noise.

The study found that breeding productivity and recruitment of little penguins at Phillip Island in areas exposed to tourism impacts was no different to that of penguin colonies in areas with no public access.

Consequently, the Biosis report concluded that it is unlikely that the proposed introduction of ambient dining music, as proposed at Q Station, would result in any adverse impacts on the species.

Further, the assessment of background noise levels in the area adjacent to the Boilerhouse Restaurant by Wilkinson Murray (2015) also concluded that it is unlikely that the proposed introduction of dining music as proposed would result in any adverse impacts on Little Penguins (AKA Acoustics, March 2024).

The species are a highly vocal colonial nesting species that are known to use vocalisations in terrestrial disputes, to locate chicks and partners, and as contact calls whilst foraging in groups at sea. Studies have demonstrated that the species are also capable of individual call recognition (Wass 2006)

The species therefore has the potential to be impacted by any excessive noise that masks their vocalisations or impacts on their ability to hear the vocalisations of conspecifics (a member of the same species).

Within their distribution a number of breeding colonies in Australia and New Zealand are the focus of tourism attractions or are located in urbanised areas, where anthropogenic noise is a possible disturbance factor. A colony located on the Summerland Peninsula, Phillip Island, Victoria is home to an estimated 32,000 breeding little penguins and is also the focus of a major tourism operation that attracts over 500,000 visitors each year.

A previous analysis of breeding data demonstrating that rates of breeding activity and recruitment of little penguins nesting with the tourist areas, and therefore exposed to human visitation, artificial lighting and increased background noise, are not significantly different to rates observed in areas with public access (Dann 1992).

Another example provided was from the breeding colony in St Kilda approximately 5kms from Melbourne CBD, where they nest between large boulders that form the artificially constructed breakwater located at the end of St Kilda pier. First recorded breeding in 1974 and now support 1200 adult penguins (2015). Noise pollution from St Kilda Kiosk and Little Blue Restaurant both located within the historic St Kilda Kiosk building at the entrance to the breakwater. Since 2006 the building has featured a large outdoor dining space and has broadcasted amplified music, particularly on Saturday nights when bands and DJs occasionally perform at the venue. Little penguins have been recorded nesting within 2m of the kiosk building and anecdotal evidence also suggests that the density of penguin burrows remains consistent across the entire length of the breakwater. Thus, proximity to noise appears to be having little if any impact on this population.

This population has consistently exhibited higher breeding success and higher body mass than those from Phillip Island population, this believed largely due to the presence of a local and reliable food source in Port Phillip Bay. Exposure to anthropogenic noise is therefore

likely to be a negligible factor affecting population dynamics and body condition compare to other major documented factors such as prey availability, predation, climatic conditions, litter entanglement and oil spill events.

These observations are consistent with studies from other penguin populations that have demonstrated that environmental factors such as prey availability exert greater effects than human disturbance (e.g., Carlini et al. 2007).

Iasiello Colombelli-Ngrel (2023) investigated the behavioural and physiological responses of little penguins to introduced anthropogenic noises resulting from coastal development (specifically, construction noises) v. rainfall noises (our control) and the potential impacts of construction noises on little penguin breeding success. The rainfall noises were played at 60-65 db (measured at 1m) and the construction sounds were played at 70 db (measured at 1m) with peaks of 75-80 db when a jackhammer was used.

This study showed that little penguins spent significantly more time in vigilance (but showed no increase in heart rate) during the construction noise playback than during the rainfall playback, supporting the distracted prey hypothesis. However, little penguins did not increase their heart rate in response to the disturbance. This result aligns with a study by Derose-Wilson et al. (2015) showing that Wilsons plovers increased their vigilance, but not their heart rate, when aircrafts flew overhead, but contrasts with other studies in seabirds. This supports the distracted prey hypothesis (Chan et al. 2010) because the stimulus still caused individuals to become distracted, with a clear deviation in attention and potentially brain function, but not the anti-predator hypothesis that suggests that humans (and related disturbances) should elicit a response similar to that towards predators.

One hypothesis to explain these results is that little penguins did not perceive the construction noises as a substantial threat and responded to the noise with increased vigilance only because of its novelty. Alternatively, the stimulus was too short to exhibit a stress response. A study by Larcombe (2016) found that little penguins displayed a more intense response when approached by researchers than to playback recordings. Therefore, the lack of visual threat could also have led to the low response observed in the Iasiello Colombelli-Ngrel study” (pp.36-38).

Appendix D Proposed Changes to Conditions of Planning Approval (COPA)

The proposed modifications to the Conditions of Planning Approval (COPA) have been identified by Keylan Consulting and other relevant stakeholders, and addressed in the Review of Environmental Factors (REF). Conditions with acoustic/vibration implications have been commented on below;

D.1 Water-Based Access

D.1.1 Conditions 138 - 141

Site Access:

Travel to the site is effectively managed under Condition 120 of the COPA, as delineated in the Site Travel and Access Plans. This condition ensures that any change in travel modality does not exceed the site's capacity or disrupt the surrounding environment. The strategic management of road traffic, including scheduling and routing, aims to mitigate potential noise and congestion, contributing to a controlled and environmentally considerate increase in road-based visitor access.

Arrival onto the beach e.g., kayaks, SUPs (Stand-Up Paddleboards):

Expanding 'water-based access' to include non-motorized vessels such as kayaks and SUPs may contribute less to acoustic pollution compared to motorised watercraft. The increase in beach landings could lead to localised increases in noise, particularly from group activities, conversations, and equipment handling, however, these noise levels are significantly lower than those from motorised vessels. Upon the completion of the Wharf Precinct, the cumulative impact should be considered, especially during peak visitor times and in areas close to sensitive wildlife habitats.

Use of the wharf by other recreational/commercial vessels:

While diversifying access options, the presence of recreational boats and the associated marine traffic could increase ambient noise levels in the water and along the shoreline. This change requires careful consideration of the types of vessels allowed and their potential noise emissions, as well as the timing of their operations, to mitigate adverse effects on the environment and the visitor experience.

As stated by Stantec in their General Transport Management Measures (2024), redevelopment works of the Wharf do not form part of this REF and will be sought via a future separate planning pathway.

D.2 Adaptive Management – Foraging Habitat

D.2.1 Conditions 168

Under the current Integrated Monitoring and Adaptive Management System, there are no provisions for long-term noise/vibration monitoring that directly correlate ambient noise levels and triggers with the ecological impacts on wildlife. This will be explored in detail in SECTION 5.2 where the necessity for raw, site-specific control data will be emphasised. Such datasets are essential to accurately inform and refine future development conditions, ensuring they align more closely with the actual ecological sensitivities and conservation objectives of the site.

D.3 Noise

D.3.1 Conditions 199 & 200

We are happy to support the modification to this clause, pending the inclusion of these provisions in the Noise Management Plan. The assessment methodologies outlined in the Integrated Monitoring and Adaptive Management System (2006, 2023) will be reviewed in SECTION 5.2.

D.3.2 Conditions 201 & 202

Conditions 201 a) and b) specifically refer to the NSW EPA’s Noise Policy for Industry, where the amenity noise level for “area specifically reserved for passive recreation (e.g. national park)” is listed at 50 dB(A).

Table 2.2: Amenity noise levels.

Receiver	Noise amenity area	Time of day	L _{Aeq} , dB(A)	
(see Table 2.3 to determine which residential receiver category applies)			Recommended amenity noise level	
Residential	Rural	Day	50	
		Evening	45	
		Night	40	
	Suburban	Day	55	
		Evening	45	
		Night	40	
	Urban	Day	60	
		Evening	50	
		Night	45	
Hotels, motels, caretakers’ quarters, holiday accommodation, permanent resident caravan parks	See column 4	See column 4	5 dB(A) above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day	
School classroom – internal	All	Noisiest 1-hour period when in use	35 (see notes for table)	
Hospital ward	All	internal	Noisiest 1-hour	35
		external	Noisiest 1-hour	50
Place of worship – internal	All	When in use	40	
Area specifically reserved for passive recreation (e.g. national park)	All	When in use	50	

Figure D.1: Amenity Noise Levels, (NSW EPA Noise Policy for Industry, 2017, p.11).

It is worth noting that the amenity noise levels listed in the Noise Policy for Industry are not used directly as regulatory limits. They are used in combination with project intrusiveness noise levels to assess the potential impact of noise, assess reasonable and feasible mitigation options, and subsequently determine achievable noise requirements.

To our understanding, the time-related restrictions outlined in condition 201 c) are specifically designed to accommodate the breeding habits of the Bandicoot and Penguin populations.

Appendix E Typical Profile & Draft Dimensions for Possible Quarantine Station Ferry Service

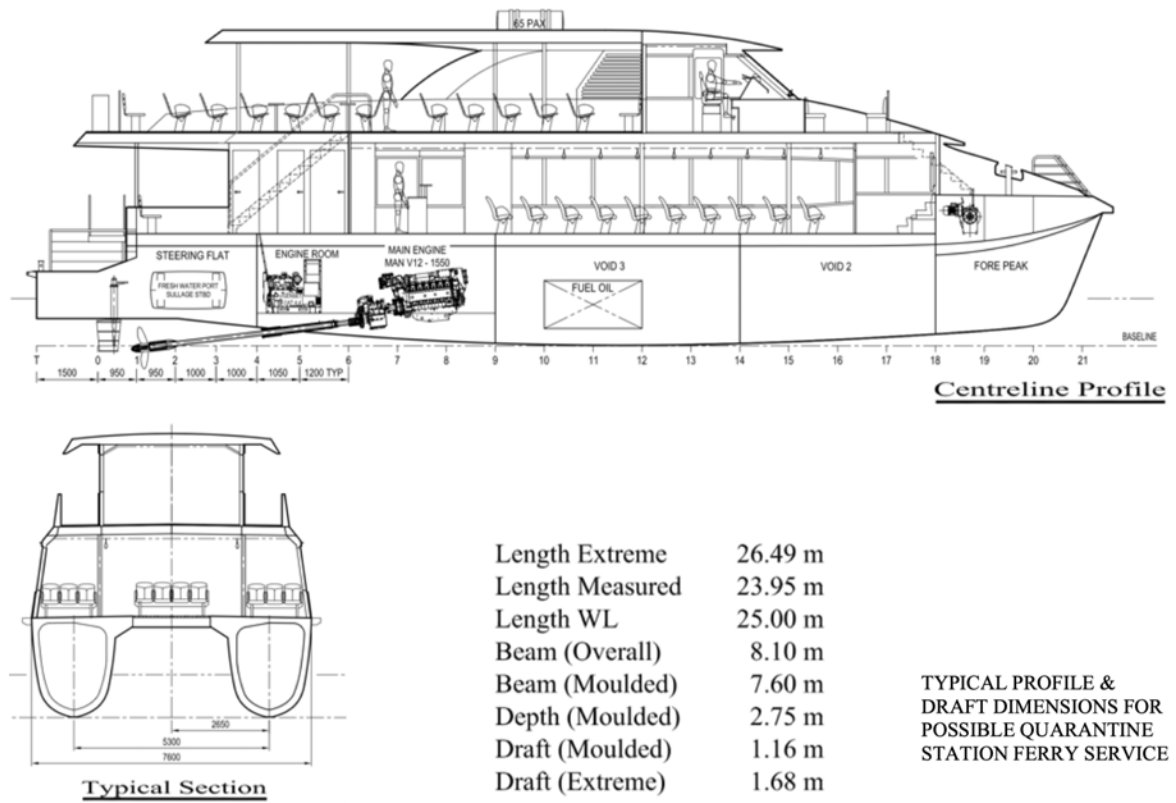


Figure E.2: As cited in *QUARANTINE STATION NORTH HEAD CONSOLIDATED CONSENT MP08-0041 CONDITION 184 SEAGRASS MONITORING: Summer 2022/2023 Baseline Survey and Recommended Annual Summer Seagrass Monitoring Program Methodology* by Marine Pollution Research Pty Ltd, November 2023, Appendix D.

E.1 Technical data sheet: Marine diesel engine D2862LE426 (V12-1550)

MANdatasheet.pdf [134]



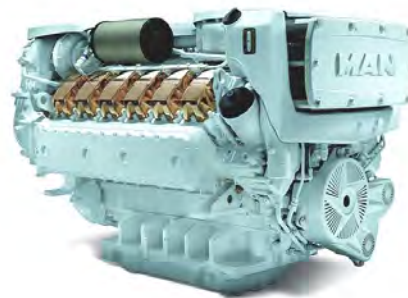
Technical data sheet

Marine diesel engine
D2862LE426 (V12-1550)

19.02.2019
(Version 2)

Performance data ¹

Rated power	1140	kW
Rated power	1550	PS
Speed	2300	rpm
Bore/Stroke	128/157	mm
Displacement	24,24	liter
Rated torque	4740	Nm
Maximum torque	5180	Nm
at speed	1200-2100	rpm
Compression ratio [ε]	17,0	:1
Mean effective pressure	24,54	bar
Mean piston speed	12,04	m/s



The engine illustrated may not entirely be identical to production standard engine

Consumption data ²

Specific fuel consumption ¹	220	g/kWh
Absolute fuel consumption ¹	299	l/h
Lowest fuel consumption ³	203	g/kWh

Engine description

Application	Main propulsion diesel for ships with fixed pitch propeller
Operation profile	Up to 1000 hours per year at a maximum of 20 % of time at full load average load < 50 %
Construction	Four-stroke marine diesel engine, direct injection, SAE 1 flywheel housing
Cylinders	12 cylinders in V-arrangement, single cylinder heads with wet replaceable cylinder liners
Air system	Single-stage turbocharger with charge air intercooler and wastegate
Cooling system	Seawater cooled charge air cooler and plate heat exchanger by rubber impeller pump
Oil system	Force-feed lubrication by gear pump, lubricating oil cooler in cooling water circuit of the engine
Fuel system	Common Rail injection system with high pressure pump and EDC control, fuel to DIN EN 590
Auxiliary PTO	PTO for hydraulic pump 16 cm ³ (180Nm)
Alternator	Three-phase generator with rectifier and transistorized governor, 28 V, 110 A
Starting system	Solenoid-operated electric starter, 24 V, 7.0 kW
Service	Oil change interval 400 operating hours
Classification	-----

Exhaust status IMO Tier II, RCD 2013/53/EC, EPA Tier 3 recreational, EU Stage IIIA

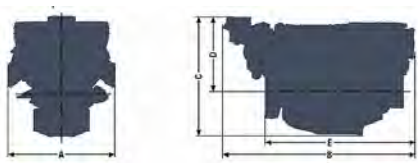
¹ Values at rated power

² Diesel fuel according to DIN EN 590 (tolerance +5% - ISO 3046)

³ Values on propeller curve

D2862LE426 (V12-1550)

A - overall width.....	1153 mm
B - overall length.....	2130 mm
C - overall height.....	1230 mm
D - above crank shaft....	765 mm
E - length to flywheel....	1630 mm
Engine weight (dry).....	2270 kg



Combustion parameters ¹

Intake air temperature (max.)	45 °C
Intake air vacuum (min/max)	30/60 mbar
Intake air volume flow	4340 m³/h

Exhaust gas temperature	550 °C
Exhaust gas volume flow	12400 m³/h
Exhaust gas mass flow	5200 kg/h
Exhaust back pressure (min/max)	20/80 mbar

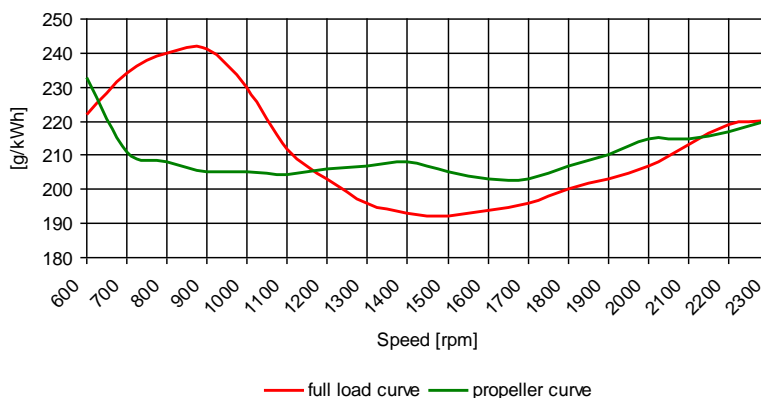
Heat balance ¹

Exhaust gas heat	835 kW
Cooling water heat	755 kW
Intercooler heat	230 kW
Radiation heat	37 kW

Noise emission (sound power) ¹

Engine surface noise (Lwa)	101,8 dB(A)
Free exhaust noise (Lwa)	114,5 dB(A)

Specific fuel consumption²



< The rated power is based on reference conditions according to ISO 3046-1 (2002) >
 < Intake air temperature, max. 45°C | sea water temperature, max. 32°C >
 < Barometric pressure 1000 mbar | air humidity 60% >
 < Exponent for propeller curve 2,5 >
< Engine specifications are subjected to change without prior notice >

¹ Values at rated power
² Diesel fuel according to DIN EN 590 (tolerance +5% - ISO 3046)
³ Values on propeller curve

Appendix F Integrated Monitoring and Adaptive Management System for the adaptive re-use of the Quarantine Station (Sixth Draft dated 15 th December 2006) - Noise Impacts

Headline indicator: Noise impacts				
Indicators	Acceptable range	Benchmark	Monitoring method	Adaptive management responses
Construction noise levels within the site Periods of greater than 26 weeks Measured as: (LA90 + 5dB(A)) 4-26 weeks Measured as: (LA10 (min. 15 minutes) ≤ LA90 + 10dB)	0-45 dB(A) (periods of greater than 26 weeks) 0-50dB(A) (construction periods 4-26 weeks)	40 dB(A) (1997) Background noise level	WHAT: Monitor noise levels from construction sites at 8am every three months on the end of Quarantine Wharf (L4) HOW: Measure the decibel level with a noise meter on two days each month when it could be anticipated that noisy construction works are taking place. Undertake background noise monitoring before the start of construction to verify if background noise exceeds the 1997 level and refer to the higher level. WHO: Mawland (Site Manager) with initial input by an environmental specialist WHEN: From Year 1, Stage 1, initially on a quarterly basis	Within one week, determine the likelihood of the situation occurring again and consider one or more of the following actions: <ul style="list-style-type: none"> • Restrict noisy activities to limited time(s) during the day • Specify that contractors use equipment that is within acceptable noise levels. • Monitor construction noise levels from one other sensitive receptor outside of the lease area at the time of the carpark's construction to determine if the noise levels are within the acceptable criteria • Monitor construction noise levels from one other sensitive receptor outside of the lease area to determine if the noise levels are within the acceptable criteria • Include contractual provisions to penalise contractors and delivery companies that cause excessive noise where appropriate • Conduct follow up monitoring from the same receptor after adaptive management measures have been implemented to test their effectiveness
Traffic noise levels on Darley Road by Parkhill Gate Measured by: Laeq (1 hr)	0-62 dB(A) (7am-10pm) (day) 0-57 dB(A) (10pm-7am) (night)	40 dB(A) (1997) Background noise level	WHAT: Monitor noise levels under Parkhill Gate just past Manly Hospital (L1) during peak night traffic HOW: Measure the decibel level with a noise meter on Saturday evenings (between 8pm-11pm) every three months. Undertake background noise monitoring before the start of operations to verify if background noise exceeds the 1997 level and refer to the higher level. WHO: Mawland (Site Manager) with initial input by an environmental specialist WHEN: From Year 1, Stage 2, initially on a quarterly basis	Determine the likelihood of the situation occurring again and consider one or more of the following actions: <ul style="list-style-type: none"> • Respond promptly to noise complaints and take any appropriate actions to help alleviate the situation • Minimise activity around the area after dusk • Introduce maximum group size • Stagger events to disperse arriving and departing guests over a broader range of hours in conjunction with other adaptive management measures • Increased shuttle service to and from Manly at peak times to decrease the number of cars coming to the site • Conduct a letter drop to nearby residents if high traffic noise levels are expected at a particular time • Conduct follow up monitoring from the same receptor after adaptive management measures have been implemented to test their effectiveness

Figure F.3: Noise Impacts, as stipulated by the IMAMS (2006).

Headline indicator: Noise impacts				
Indicators	Acceptable range	Benchmark	Monitoring method	Adaptive management responses
Operations noise levels outside the site Measured by: (LA90 + 5dB(A))	0 – 50 dB(A)	45dB(A) (1997) Background noise level	WHAT: Monitor noise levels at Little Manly Point (south east end of Stuart St, L2) during peak restaurant activity HOW: Measure the decibel level with a noise meter on Saturday evenings (between 8pm-11pm) every three months. Undertake background noise monitoring before the start of operations to verify if background noise exceeds the 1997 level and refer to the higher level. WHO: Mawland (Site Manager) with initial input by an environmental specialist WHEN: From Year 1, Stage 2, initially on a quarterly basis	Identify the source of the noise spill, and depending on the likelihood of the situation occurring again, consider one or more of the following actions within six months: <ul style="list-style-type: none"> • Respond promptly to noise complaints and take any appropriate actions to help alleviate the situation • Consider monitoring noise levels from additional sensitive receptors or during the day time if there have been instances of resident complaints • Close doors of buildings with visitor activity within the Wharf Precinct after dusk, • Install sound absorption material inside A6 • Restricting ongoing use of the site to the group causing the problem • Introduce maximum group size in outdoor eating area • Increase awareness of visitors using ferry of the effects of noise on Little Penguins • Conduct follow up monitoring from the same receptor after adaptive management measures have been implemented to test their effectiveness • Consider additional educational signage for visitors entering and exiting the site to keep noise levels to a minimum
Operations noise levels within site Measured by: (LA90 + 5dB(A))	0 – 45 dBA	40 dB(A) (1997) Background noise level	WHAT: Monitor noise levels on the northern end of Quarantine Beach (L4) during peak restaurant activity HOW: Measure the decibel level with a noise meter on Saturday evenings (between 8pm-11pm) every three months. Undertake background noise monitoring before the start of operations to verify if background noise exceeds the 1997 level and refer to the higher level. WHO: Mawland (Site Manager) with initial input by an environmental specialist WHEN: From Year 1, Stage 2, initially on a quarterly basis	Identify the source of the noise spill, and depending on the likelihood of the situation occurring again, consider one or more of the following actions within six months: <ul style="list-style-type: none"> • Respond promptly to noise complaints and take any appropriate actions to help alleviate the situation • Consider monitoring noise levels during the day time if there is a high level of booked operations within the site • Close doors of buildings with visitor activity within the Wharf Precinct after dusk, • Install sound absorption material inside A6 • Restricting ongoing use of the site to the group causing the problem • Introduce maximum group size in outdoor eating area • Increase awareness of visitors using ferry of the effects of noise on Little Penguins • Conduct follow up monitoring from the same receptor after adaptive management measures have been implemented to test their effectiveness
Amplified indoor music or noise levels within the site Measured by the Laeq noise level	0-50 dB(A)	40 dB(A) 1997 Background noise level	WHAT: Monitor noise levels 20m from the edge of the building in which the amplified music or noise is being generated in. HOW: Measure the decibel level with a noise meter on Sat evenings (8pm-11pm) every three months when amplified music is being played. Undertake background noise monitoring before the start of operations to verify if background noise exceeds the 1997 level and refer to the higher level. WHO: Mawland (Site Manager) with initial input by an environmental specialist WHEN: From Year 1, Stage 2, initially on a quarterly basis	Determine the likelihood of the situation occurring again and consider one or more of the following actions within six months: <ul style="list-style-type: none"> • Close doors of buildings with amplified music or noise • Introduce minimum group size within the building with amplified music or noise • Install sound absorption material inside buildings • Restrict the type of activities within buildings with amplified music to lower noise output

Figure F.4: Noise Impacts, as stipulated by the IMAMS (2006).

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