Macquarie Point Stadium

Noise and Vibration Technical Review

City of Hobart

18 November 2024

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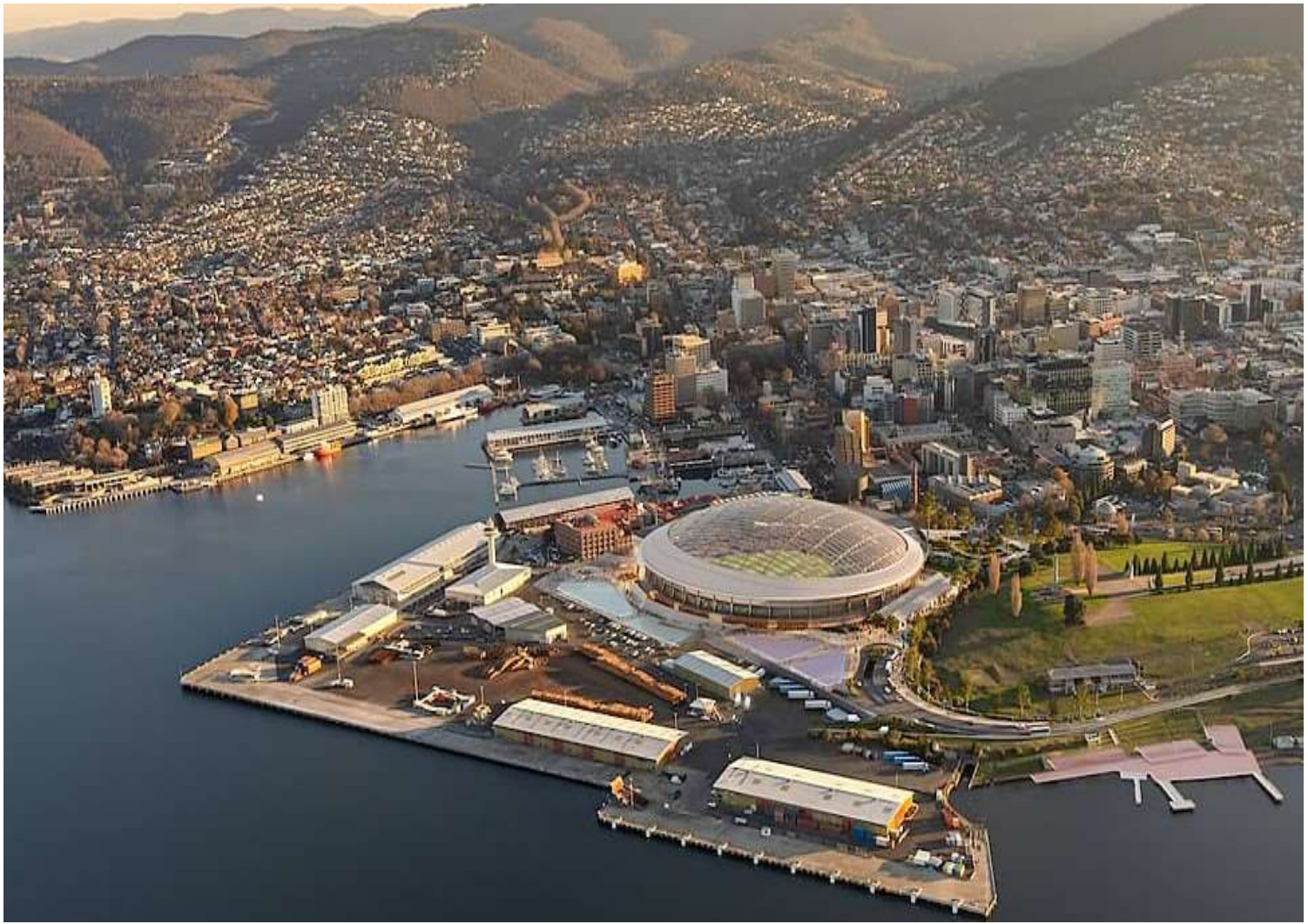

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1. Introduction

A proposal by the Crown Right of Tasmania for the development of a multipurpose stadium at Macquarie Point has been declared a Project of State Significance. The project involves assessment of impacts performed in accordance with requirements of guidelines prepared by the Tasmanian Planning Commission. Technical studies have been submitted to estimate degree of influence of the project on the environment and communities that may be affected by construction and operation of the project.

1.1 Purpose of this report

GHD has been commissioned by the City of Hobart to undertake an independent peer review of the reports submitted to address the Tasmanian Planning Commission Guidelines for the Macquarie Point Multipurpose Stadium Project of State Significance. This report specifically addresses Section 8.4 (Noise and Vibration) and has been prepared by Dr Valeri Lenchine, Technical Director – Noise and Vibration and has been reviewed by Mr. Chris Gordon, Technical Director Acoustics.

The acoustic terminology used in this paper is consistent with the terminology used in the acoustic report and relevant standards.

1.2 Documents considered

The 'Noise and Vibration' technical review is undertaken based upon Section 8.4 of the Tasmanian Planning Commission (TPC) Project of State Significance Guidelines, with reference to Chapter 7.4 of the Macquarie Point Multipurpose Stadium Summary Report and referenced technical documentation as noted below:

- **The Project Guidelines** – Macquarie Point Multipurpose Stadium – Project of State Significance. (Tasmanian Planning Commission, Feb. 2024)
- **The NVIA** - Macquarie Point Multipurpose Stadium. Project of State Significance Noise and Vibration Assessment, (AECOM Australia, Aug. 2024)
- **The Policy** - Environment Protection Policy (Noise) (Department of Environment, Parks, Heritage and the Arts, 2009)
- **The Manual -** Noise Measurement Procedures Manual (Department of Environment, Parks, Heritage and the Arts, July 2008)

1.3 Scope and limitations

This report: has been prepared by GHD for the City of Hobart and may only be used and relied on by the City of Hobart for the purpose agreed between GHD and the City of Hobart.

GHD otherwise disclaims responsibility to any person other than the City of Hobart arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section 1.4 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

1.4 Assumptions

This 'Noise and Vibration' technical review was largely focused on the Noise and Vibration Assessment (AECOM Australia, Aug. 2024). The supplementary documentation provided was considered but is not explicitly discussed in this report.

GHD's technical review is based upon qualified 'professional judgement' and does not include quantified verification of assumptions, calculations, recommendations or the like. The review does not include:

– Independent verification and analysis of noise and vibration monitoring data at noise monitoring locations
– Independent verification and analysis of wind speed and local weather data
– Accuracy verification of acoustic model or acoustic inputs used in the NVIA

This document contains GHD's professional opinion based on the assessment of the documents indicated in the submission as relevant to Section 8.4 of the Project Guidelines. Our review does not consider, nor have visibility of, the scope that was requested of the technical consultant(s) that provided documentation for the submission. Where our review has indicated an omission, shortcoming or discrepancy relating to the suitability of the material provided, this is to indicate what impacts this may have from the view of City of Hobart and is not an assessment of the scope requested or undertaken.

Identified risks have been provided for consideration by City of Hobart, however they not been rated for likelihood and consequence.

2. Methodology

In undertaking this review, consideration has been given to:

– The requirements of the Project Guidelines as relevant to noise and vibration (sections 1.4, 8.4 and 9.2 of the guidelines).
– Findings in the AECOM Australia Noise and Vibration Impact Assessment Report.

The Project Guidelines do not clearly specify applicable noise and vibration criteria and procedure for compliance checking. It is noted that sport and music noise may require different procedures for assessing the environmental impact. The noise and vibration impact assessment report references similar stadium developments in other jurisdictions to explore different approaches that may be relevant to the Macquarie Point Multipurpose Stadium.

The review has taken a risk-based approach and has sought to identify the more important issues where operational problems might arise. The findings of the technical review are provided in a tabulated format in Section 4. A summary of the key findings from the peer review is provided in Section 3.

3. Key findings

3.1 Preface

Environment Protection (Noise) Policy 2008 (The Policy) may be used for establishing relevant noise limits. However, frequency of sport and entertainment events must be carefully considered as well as the practicalities of noise control for such events.

Tasmanian regulatory documentation does not provide guidance on acceptable vibration impacts. Therefore, the necessity of strict vibration limits should be reviewed in context of the risk of adverse reaction from the community.

3.2 Key findings

1. Overall, the methodology outlined in the NVIA is consistent with relevant noise and vibration assessment practices. Assessment of pre-construction noise environment was carried out in accordance with recommendations in The Project Guidelines. However, possible low frequency impact from rock concerts and similar events (including both noise and possible structural vibration response) was not addressed in the NVIA.
2. The Project Guidelines do not prescribe noise and vibration limits. The NVIA considers relevant regulatory documentation and noise criteria applicable to other projects but does not suggest project specific goals. This may create difficulties in assessing compliance of noise and vibration impacts from the project, managing complaints and assessing effectiveness of suggested noise mitigation measures. It is expected that clear noise and vibration criteria, mitigation measures and predictions should be defined before commencing construction of the project, which are then refined at design finalisation and commissioning.
3. The Project Guidelines reference assessment of possible impacts of vibration. Such assessment was not performed as part of the NVIA. The assessment should include information confirming that operational vibration assessment is not necessary, due to low risk of perceivable vibration.
4. The NVIA does not contain a detailed construction noise and vibration assessment, rather an overview of the requirements, indicative noise assessment from piling and excavator use, and a list of construction noise and vibration mitigation measures. It is assumed that a Construction Noise and Vibration Management Plan (CNVMP) will address construction impacts separately as the NVIA does not contain sufficient information to make conclusions about associated risks.

The structure and content of the NVIA is aligned with some items in the Project Guidelines but does not fully demonstrate compliance with requirements in the document. Discussion on necessity of some recommendations in the Project Guidelines should be caried out to pinpoint sections of the report that needs updating. The NVIA would benefit from providing justification for the exclusion of quantitative operational vibration assessment at the affected receptors. Not all of the items in the Project Guidelines were addressed to a satisfactory level.

4. Noise and vibration technical review

Table 1: Section 1.4.3 and 8.4 – Noise and vibration

PoSS Guideline	Included	Suitability	GHD Submission Review Comments	Potential Risks
1.4 Design and Management Response				
Clause 1.4.3 Off-site noise sources and noise sensitive activities in the locality that may be affected by noise from the site **Section/s of the report** 2.0, 5.0	✓	✓	Section 2.1 of the NVIA describes the nearest noise sensitive receptors. It is difficult to list activities associated with all the receptors. This section would benefit from a description of noise sensitive activities that could be affected by the development.	-
8.4 Noise and Vibration				
Clause 8.4.1.i The reports are to describe the existing noise and vibration conditions of the project site and vicinity **Section/s of the report** 5.0	✓	✓	Section 5.3 of the NVIA details results of a long-term noise monitoring programme performed at 3 nearest noise sensitive locations and one vibration monitoring location. It should be noted that two of the noise monitoring locations were on rooftops of buildings. It is not clear if ambient / background noise magnitudes would be representative for ground level. The long-term monitoring was supplemented by short term noise measurements at 14 locations and vibration measurements at 10 locations (Section 5.1).	Noise monitoring results may not be indicative of the existing noise environment experienced at ground level receiver locations
Clause 8.4.1.ii The reports are to describe all sources of noise and vibration that can be reasonably identified from the use of the proposed Project, considering all types of expected and possible events **Section/s of the report** 3.0, 6.0	✓	⚠	Section 3 of the NVIA describes potential sources associated with operation of the site and Section 6 provides major acoustic inputs for modelling of different scenarios. Information for vibration operational sources is not presented, but unlikely operational vibration sources will be significant to impact on nearest sensitive receptors.	Uncertainty in expected vibration impact.

PoSS Guideline	Included	Suitability	GHD Submission Review Comments	Potential Risks
Clause 8.4.1.iii The reports are to analyse the potential effects of impacts from noise and vibration, taking into account, but not limited by, the following: **Section/s of the report** 6.3, 7.1,7.2, 8.0	✓	⚠	The report generally addresses expected noise impact to a satisfactory level, however: – Structural response is possible during concerts or other events with significant low frequency impact. This is not considered in the report. – Assessment of operational vibration impact is formally required under the project guidelines. Qualitative or quantitative vibration assessment is not included in the report. More elaborate justification should have been provided as to why it may not be necessary.	Underestimated level of impact that may evoke adverse reaction of community
Clause 8.4.1.iii a) The maximum potential impact (maximum capacity and maximum sound amplification) for each proposed or possible type of event; **Section/s of the report** 6.3, 7.1, 7,2	✓	✗	Section 6.3 of the NVIA describes inputs for modelling of noise sources. It should be clearer that inputs in Table 13 of the report contain maximum assumed acoustic input. **Music concerts** – It is understood that Table 14 presents results of the worst case scenario (pop and rock music concerts). Section 7.1.1 also compares impact with noise requirements applicable to other stadiums throughout Australia and New Zealand. – While a comparison against these noise requirements is provided, an acceptable limit for this project has not been established (as required in item 8.4.2.i). – Assessment of low frequency impacts from music concerts has not been considered (as implied in item 8.4.2.iii (g)). – This comparison shows that the predicted levels may be up to 13 dB(A) greater than limits for similar stadiums in other states, however this comparison fails to address the impacts at the University of Tasmania School of Creative Arts and Media (R3) and Royal Hobart Regatta Grounds (The Cenotaph) (R13) which are greater than this. It is unclear why these receivers have not been discussed. – Assuming that an effected building façade provides minimum 20 dB attenuation (as discussed in the NVIA), the internal noise levels are still expected to be above acoustic indicator levels in the TAS Noise EPP (Table 4 of the NVIA), however applicability of the EPP indicator levels to concert events is arguable. – Information in section 3.1 of the report shows that a major concert event is expected to happen just 1 time per annum, with the potential for smaller concerts/festivals. No event numbers have been provided for the smaller events.	– Potential for low frequency noise impacts from music concerts and music being played through PA during sporting events. Given the potential for high impacts from low frequency noise, a detailed assessment of this should be provided. – An acceptable noise level for music concerts has not been established. These should be established for large and smaller concerts for the purposes of compliance assessments and impact noise management in the future – Impact to R3 and R13 have not been considered. R3 is an educational facility and would likely experience significant impacts. These have not been addressed based on the assumption that this won't operate during concerts and sporting events, which may not be the case (night classes, library operation etc).

PoSS Guideline	Included	Suitability	GHD Submission Review Comments	Potential Risks
			Sporting matches – AFL matches are expected to be the major noise generation events at the stadium. Noise levels for public announcements and crowd noise are predicted to be significantly lower than from rock concerts. Game sirens may result in high L_{Amax} levels, which are short in duration.	
Clause 8.4.1.iii b) Noise and vibration generated by the operation of the proposed development outside of event times, including building services plant, loading and waste collection; **Section/s of the report** 7.2, 8.0	✓	⚠	Scenario S7 (Section 3.2) of the NVIA is intended to address this requirement. Results of waste collection and loading dock operations are summarised in Section 7.2 and show that they are expected to be below recommended noise indicator levels. Inputs for the modelling are described in Section 6, including modelling inputs and assumptions (Section 6.2), and noise sources (Section 6.3). Section 8 is dedicated to operational vibration. This information does not contain any indicative estimates. This section should contain some vibration estimates for typical activities and relevant separation distances.	Impacts of operational vibration has not been quantified and assessed. Risk of excessive vibration impact is unknown.
Clause 8.4.1.iii c) Noise and vibration generated by crowds arriving at and departing from the venue; **Section/s of the report** 7.1.5, 8.0	✓	⚠	Modelling scenario S3 (Section 3.2) addresses this requirement. The report does not suggest any specific criteria for this sort of activities and refers to EPP indicator levels (Section 7.1.5). Generally impact inside affected receptors is predicted to be low with windows closed. Similar to other scenarios, there are no qualitative or quantitative estimates of vibration in Section 8.	Impacts of operational vibration has not been quantified and assessed. Risk of excessive vibration impact is unknown.
Clause 8.4.1.iii d) Noise and vibration generated by any entertainment provided outside the venue; **Section/s of the report** 7.1.6, 8.0	✓	⚠	It is understood that modelling scenario S6, Plaza events (Section 3.2) addresses this requirement. The report does not suggest any specific criteria for these sort of activities. Results of noise predictions in Section 7.1.6 show that generally outdoor impact at affected receptors is expected to be below EPP recommended levels for day and evening time moderate annoyance, except of marginal exceedance which is predicted at Royal Hobart Regatta Grounds (R13). Section 8 does not provide sufficient details on expected vibration impact.	Impacts of operational vibration has not been quantified and assessed. Low frequency impact and risk of structural response is not assessed.
Clause 8.4.1.iii e) Noise levels estimated at the boundary of land owned or controlled by the Proponent and at	✓	✓	Noise contours for the site and adjacent areas are included in Appendix A of the report. Noise estimates are presented for different modelling scenarios. Noise impact estimates for particular receptors are included in Section 7.1.	-

PoSS Guideline	Included	Suitability	GHD Submission Review Comments	Potential Risks
the curtilage of noise-sensitive uses in the locality; **Section/s of the report** 7.1, Appendix A			It would be beneficial to have a clear summary of this information for the project boundary in Section 7.1 of the report.	
Clause 8.4.1.iii f) How and where noise and vibrations are likely to travel, based on contour predictions; **Section/s of the report** Appendix A	✓	⚠	Noise contour predictions are included in Appendix A. There is no vibration assessment in the report and Section 8 does not contain sufficient justification for not including vibration assessment. It is likely that it will be impracticable to produce vibration contours due to complexity of such assessment. The requirement is addressed adequately for noise impact, vibration assessment should be supplemented by more details and explanations.	Impacts of operational vibration has not been quantified and assessed. Safe separation distances for vibration are not known.
Clause 8.4.1.iii g) The nature of the noise and its potential to cause nuisance (tonal components, impulsive or intermittent noise, etc.); **Section/s of the report** 7.4	✓	✗	Results of noise predictions are summarised in Section 7.1. Potential noise characters that may exacerbate perception of noise are included in Section 7.4. These characteristics are considered from risk perspective, however low frequency impact is not considered in the report. TAS Noise Measurement Procedures Manual considers adjustments to measured (or predicted) noise levels depending on presence of the characters. This may change expected compliance of the impact with recommended noise levels. Such assessment is not included in the NVIA.	Potential for low frequency noise impacts from music concerts and music being played through PA during sporting events. Given the potential for high impacts from low frequency noise, a detailed assessment of this should be provided. Consideration should be given to possible change in compliance due to applicability of penalties for noise characters.
Clause 8.4.1.iii h) Time of day (day, evening and night) and day of the week; **Section/s of the report** 7.1, 7.3	✓	✗	This is considered in different parts of the report in accordance with TAS regulations (Sections 7.1, 7.3 and 7.4). It would be beneficial to clarify when particular noise modelling scenarios may occur. The assessment of potential sleep disturbance impacts is very light and appears to rely on time restrictions/management measures. Given the potential for both concerts and sporting events to continue into the nighttime period, a more detailed night time assessment (including sleep disturbance) should be undertaken.	The level of impacts during the nighttime period is not well defined. There is a risk that concerts and sporting events will lead to sleep disturbance impacts should the event continue into the nighttime period.
Clause 8.4.1.iii i)	✓	⚠	Meteorological conditions for modelling scenarios were included in Section 6.2 of the NVIA. Contextual information on typical environmental conditions in the area would be beneficial (wind	Insufficient information to identify how often worst-case noise

PoSS Guideline	Included	Suitability	GHD Submission Review Comments	Potential Risks
Meteorological conditions, including normal and 'worst case' conditions and the expected frequency of 'worst case' conditions; **Section/s of the report** 6.2			rose) to show frequency of possible worst-case scenarios for different receptors. However, it will not change results of noise predictions, which were obtained for most conservative weather category in accordance with CONCAWE algorithm. An updated section on analysis of weather conditions is expected to fully address this requirement.	propagation conditions may occur in the area.
Clause 8.4.1.iii k) The proximity of current, proposed or potential noise-sensitive uses; **Section/s of the report** 2.1	✓	✓	Section 2.1 of the NVIA contains list of nearest affected receivers and separation distances.	-
Clause 8.4.1.iii l) Impacts and effects on fauna; **Section/s of the report** 9.0	✓	⚠	Section 9 of the NVIA provides general description of expected noise impact on fauna. There is statement in the section: "It is not expected that any existing fauna will be displaced due to the proposed Stadium". It is not confirmed by analysis of species in the area and their sensitivity to noise. Perhaps such analysis should be included in a separate report rather than in an acoustic report. Current assessment lacks this information.	Potential impacts on fauna in the assessment is not well defined
Clause 8.4.1.iii m) Cumulative impacts, taking into account surrounding sources of noise and vibration; **Section/s of the report** 7.3, 8.0	✓	⚠	Cumulative impact from the site and existing sources is considered in Section 7.3 of the NVIA. It is understood the resultant cumulative impact is given for operation of the stadium and some events but does not include noise estimates for all events. It is recommended to provide cumulative noise estimates for all modelled scenarios. Quantitative estimates of vibration are not provided in the report. Justification on absence of vibration impact assessment deemed to be necessary.	Impacts of operational vibration has not been quantified and assessed, which does not provide basis for expected levels of vibration in the area.
Clause 8.4.1.iii n) Comparison between the predicted emission levels with existing noise and vibration levels; **Section/s of the report** 7.3	✓	⚠	Similar to the comment above, stadium daily operation levels and some events are compared with existing noise environment. It should have been reported for all events as well. Vibration impact is not assessed. Section 7.3.2 of the NVIA indicates that the indoor impact may be high, but NVIA does not consider this effect as relevant to UTAS premises (receptor R3) claiming that it "is unlikely to operate during concerts".	Educational activities at UTAS may be impacted during concert events.
Clause 8.4.2.i)	✓	✗	Section 4 of the NVIA provides overview of regulatory documents, Section 4.1.2 emphasises that indicator levels in the	Acceptable noise and vibration levels have not been established. These should be established for all

PoSS Guideline	Included	Suitability	GHD Submission Review Comments	Potential Risks
The reports are to review and detail appropriate noise and vibration assessment methodology, standards and acceptable limits; **Section/s of the report** 4.0, 6.0			EPP are not mandatory, section 4.4 summarises noise criteria applicable to stadiums in other jurisdictions. It is not clear what is suggested as the project specific goals. Vibration limits are not considered in the report.	types of events for the purposes of compliance assessments in the future
Clause 8.4.2.ii) Where relevant, the choice of a particular methodology over alternative methodologies is to be explained; **Section/s of the report** 6.0	✓	⚠	Tasmanian regulatory documents do not specify mandatory noise prediction algorithms. Section 6 of the NVIA references CONCAWE noise prediction algorithm. Reference to relevant document is not included in the list of references (Section 13). Since vibration predictions do not form part of the report, there is no reference to relevant methodology.	Uncertainties in estimates of expected noise and vibration impact.
Clause 8.4.2.iii) Assessment of impacts and effects is to include information on the significance and duration of the impact. **Section/s of the report** 7.1, 7.4	⚠	✗	Section 7.1 of the NVIA details results of noise predictions for few scenarios. Information on how long these impacts may last is not included in the report. Section 7.4 contains supplementary information on duration of some noise events. Additional information on duration of particular events will be beneficial to fully address this requirement. Duration of vibration impacts is not included in the report.	Duration of events required to determine extent of potential noise impacts is unknown.
Clause 8.4.2.iv) Assumptions and judgements are to be stated clearly and the nature and magnitude of uncertainties are to be clearly defined. **Section/s of the report** 1.2, 6.2	✓	⚠	Section 1.2 contains clarifications and limitations of the report. Information on assumed acoustic inputs for acoustic modelling of impact from the site is included into Section 6.2. There is a high degree of uncertainty in predicting noise from sport and music events. It is difficult to quantify accuracy of noise predictions. However, some discussion on expected uncertainties would be beneficial for report.	Actual impact may be greater than predicted due to high uncertainty of acoustic inputs.
Clause 8.4.3 The potential for emissions to cause nuisance is to be addressed, taking into account: **Section/s of the report** 6.3, 7.1,7.3, 7.4	✓	⚠	Most of information is provided in relevant section of the report, it should be supplemented by additional acoustic and duration of impact information as noted in the comments below	Insufficient information to determine the extent of some impacts

PoSS Guideline	Included	Suitability	GHD Submission Review Comments	Potential Risks
Clause 8.4.3 a) Changes in noise frequencies and tonal components. **Section/s of the report** 6.3, 7.1	✓	⚠	Section 6.3 of the NVIA provides general information about noise sources and Section 7.4 contains additional information about possible characters. The report does not include notes on dominant frequencies or severity of associated noise characters. Additional discussion on that would be beneficial.	Insufficient information to determine the extent of some impacts
Clause 8.4.3 b) Increases in ambient noise levels. **Section/s of the report** 6.3, 7.1	✓	⚠	Expected increase in cumulative impact for non- events operation of the site and some events is included in Section 7.3. The estimates should be obtained for all events scenario as well and included in table similar to Table 28.	Lack of clarity of expected cumulative impact for all activities associated with the project.
Clause 8.4.3 c) The time varying nature of emissions (e.g. impulsive or intermittent noise);. **Section/s of the report** 6.3, 7.1	✓	✓	Description of noise characters that may be associated with the site operation are included in Section 7.4.	-
Clause 8.4.3 d) The temporal span of the noise emissions and its effects on nearby uses. **Section/s of the report** 7.4	✓	⚠	Section 3.1 provides list of expected events and frequency of occurrence during a year. This information should be supplemented by expected duration of events and relevant time of a day.	Insufficient information to determine the extent of any impacts
Clause 8.4.4 The reports are to describe any measures to limit and control noise and vibration to an acceptable level. **Section/s of the report** 11.1	✓	⚠	Section 11.1 provides general recommendations on noise mitigation practices. Since this is not a design report, this may be considered sufficient. The report does not include project specific noise and vibration criteria, therefore it is difficult to identify measures that will be sufficient to reduce impact to an acceptable level. Noise mitigation relies on a number of substantial design solutions and some noise management practices.	Uncertainty for future compliance checking and complaint resolution due to absence of clearly defined noise and vibration criteria. Implementation of noise mitigation design measures may require additional budget allocations. If they are not included in the final design, impact from the project may be greater than predicted.
9.2 Construction management				

PoSS Guideline	Included	Suitability	GHD Submission Review Comments	Potential Risks
Clause 9.2.2 The reports are to outline: – potential adverse effects from construction noise **Section/s of the report** 10.1	✓	✓	The NVIA does not contain a construction noise or vibration assessment specific to the project. Section 10 describes potential noise and vibration impacts and relevant criteria. Section 11.2 also includes general construction noise and vibration mitigation practices. It is understood that detailed noise and vibration assessment is not required at the stage and may be carried out as a separate study should the project be approved (as recommended in the NVIA report).	-

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