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5 July 2024

Project Reference: SVM3449

Elly Yuan

Acorn Project Advisory

Level 8, 124 Walker Street

North Sydney, NSW 2060

Dear Elly,

Re: Broken Hill Hospital Redevelopment – REF Extended Construction Hours

This letter provides an acoustic assessment to consider the noise and vibration impact associated with the proposed changes to construction hours for the Broken Hill Hospital Redevelopment.

This letter serves an addendum to the NVIA previously prepared for the initial REF (originally submitted in 2023) to support the REF modification and proposed changes to construction hours submitted by Health Infrastructure NSW. It confirms the additional mitigation measures that will be incorporated to minimise noise impact to surrounding noise sensitive receivers.

Should you have any queries or require any further information, please do not hesitate to contact us.

Yours sincerely,

Anthony Cano
Acoustic Engineer

1 Introduction

Acoustic Studio has been engaged by HI NSW to assess the impact related to the proposed changes for construction hours related to the Broken Hill Hospital Redevelopment Project.

1.1 Previous Noise and Vibration Impact Assessment (NVIA) for Review of Environmental Factors (REF)

Acoustic Studio has previously prepared a Noise and Vibration Impact Assessment (NVIA) ('the NVIA') Review of Environmental Factors (REF) submission, and should be read in conjunction with this letter.

The assessment was prepared in support of the REF of the project in 2023.

- [1] *Broken Hill Hospital Redevelopment Noise and Vibration Impact Assessment for Review of Environmental Factors (REF)* (ref: *20231018 SVM3440.0004.Rep), issued on* 18 October 2023.

1.2 Relevant Documents

The assessment of the proposed change in construction hours has considered the following documents:

- [2] **NSW DECC Interim Construction Noise Guideline** and outside recommended standard hours criteria as outlined above in Section 2.1.
- [3] **HI Out Of Hours Work (OOHW)** Protocol and application requirements for HI Projects, with additional mitigations measures considered in Section 1.3.1 & 2.6.
- [4] **REF Approval 20/2023** – Broken Hill Hospital Redevelopment, Decision Statement for Review of Environmental Factors – Prepared by _planning Pty Ltd, dated October 2023

1.3 Proposed Construction Hours

1.3.1 Proposed changes to operating hours

The project construction hours (including proposed changes to construction hours - which are outside recommended standard hours as defined in the ICNG, and are shown in bold) are as follows:

- Monday to Friday - 7:00am to 6:00pm.
- Saturday
  - **7:00am to 8:00am (outside ICNG recommended standard hours).**
  - 8:00am to 1:00pm (recommended standard hours).
  - **1:00pm to 3:30pm (outside ICNG recommended standard hours).**
- Sunday and Public Holidays – No works

The proposed construction works outside standard construction hours fall into the category of Out Of Hours Works (OOHW) Period 1 (Day) which is the first level of hierarchy in the HI OOHW Protocol [3], as shown in Figure 1.

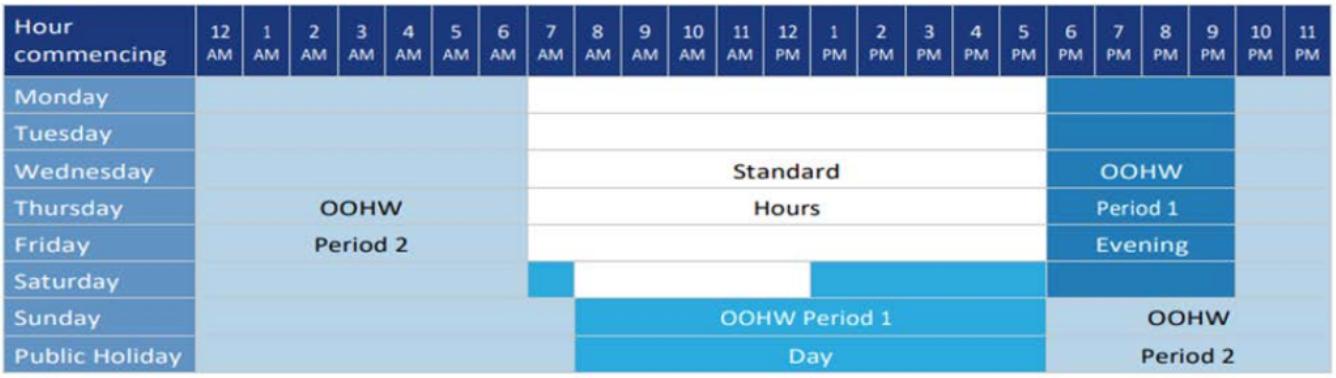

Figure 1 Construction Hours - Source: Health Infrastructure, Out of Hours Works – Protocol and application requirements for HI Projects

1.3.2 REF Approval General Measures 49 – Restriction Hours

The REF Approval [4] notes the following with regard to restriction of construction hours

"...

49. Restriction on Hours during Construction

49.1 The undertaking of any construction activity on the subject site is to be limited to the following hours:

- Monday to Friday inclusive: 7:00am to 6:00pm

- Saturdays: 8:00am to 1:00pm; and

- Sunday and Public Holidays: no work permitted ...

... 49.3 Activities may be undertaken outside of hours in measures 49.1 and 49.2 if required:

- *By the police or a public authority for the delivery of vehicles, plant or materials; or*
- *In an emergency to avoid the loss of life, damage to property or to prevent environmental harm; or*
- *Where the works are inaudible at the nearest sensitive receiver, a disruption notice has been issued by the relevant Local Area Health District (LHD) or hospital and a letter of support has been provided from the relevant LHD or hospital for the Out of Hours Works.*

49.4 Consideration will be given to extending these hours to allow for specific work tasks on a case by case basis, subject to approval from HI being sought prior to this occurring and the assessment of any impact of this extension ..."

1.4 Works Outside Standard Construction Hours

Works outside standard construction hours are needed in order to:

- Minimise the impact on existing hospital operations and vehicle accessibility during core business hours.
- Extended construction hours will also aim to reduce overall construction periods by 3 months.
- The above is particularly critical to enable the ongoing operation of the Emergency Department (ED) during refurbishment.

The potential impacts of the extended hours have been considered as follows:

- Internal ED fit-out works will be below NMLs, including in the proposed extended work hour periods, and generally inaudible from within residential receivers off campus.
- Extended construction hours will also aim to reduce the overall construction period by 3 months, lessening the length of time of potential construction noise impacts to receivers.
- All feasible and reasonable mitigation measures will be implemented to minimise noise impact during extended construction hours. This includes:
    - Ensuring that noise intensive works such as excavation and hammering or saw cutting is not carried out during the 7:00am to 8:00am period and will be avoided where practical during the 1pm to 3:30pm periods.
    - Any work predicted to be above the Highly Noise Affected Level or the Highly Intrusive Level as defined in Table 5 at residential receivers will not be carried out during the 7:00am to 8:00am period and will be avoided where practical during the 1pm to 3:30pm periods.

If any work outside the proposed changes to construction hours are required, an out of hours works procedure will be implemented as part of the construction noise and vibration management plan. The Contractor will agree the process with HI, LHD, and residents to address the approvals and additional measures required to scheduling works (if required outside the above noted hours). Therefore, working hours outside those proposed above (Saturday OOHW Period 1) are excluded from the assessment.

2 Assessment

2.1 Noise Management Levels

The project specific construction Noise Management Levels (NMLs) for residential and other receivers established in the NVIA[1], are repeated in Table 1 and Table 2.

Table 1 Project Specific residential construction NMLs

Location	Period		Rating Background Level (RBL)*, dB(A)	Noise Management Level dB $L_{Aeq(15\ min)}$	
Residential (All Catchments)	Recommended Standard Hours	Monday to Friday 7am to 6pm	38	RBL + 10	48
		Saturday 8am to 1pm	38		48
Residential Catchment 1	Outside Recommended Standard Hours	Saturday 7am to 8am	31	RBL + 5	36
		Saturday 1pm to 6pm	37		42
Residential Catchment 2		Saturday 7am to 8am	34		39
		Saturday 1pm to 6pm	37		42

Table 2 Hospital and Commercial NMLs

Location	Noise Management Level dB $L_{Aeq(15\ min)}$
Hospital Wards and Operating Theatres	45 dB(A) – Internal / 65 dB(A) - External[1]
Commercial	70 dB(A) - External

[1] For hospitals, where windows are typically fixed (inoperable), it is assumed that the weakest building element (typically glazing) will provide a minimum of 20 dB(A) sound reduction. Therefore, external levels are based on an internal noise level plus 20 dB.

2.2 Site Details

Table 2 and Figure 2 from the NVIA [1] (extracted below), show the project site with respect to surrounding noise sensitive receivers.

Receiver	Impact	Location/ Direction	Distance from site (m)		
			Car Park	MHU	ED
Residential	Airborne	N/NW (Catchment 1)	140	200	155
	Airborne	E/NE (Catchment 1)	130	240	170
	Airborne	S/SE (Catchment 2)	30	110	120
	Airborne	W/SW (Catchment 2)	50	140	250
Existing Hospital Campus Buildings	Airborne + Vibration	NW	10	60	50
	Airborne + Vibration	SE	10	10	10
	Airborne + Vibration	SW	10	60	140
Commercial	Airborne	S/SE	30	100	110

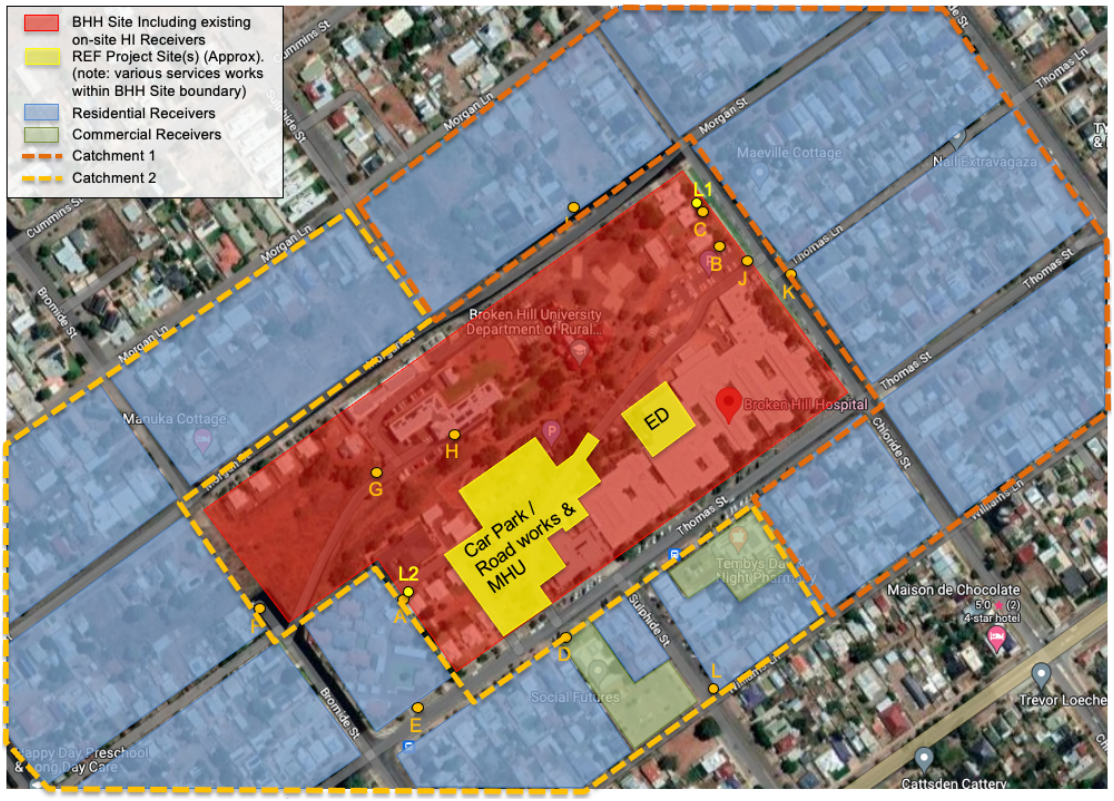

Figure 2 Site and nearby noise sensitive receivers (extract from NVIA[1])

2.3 Construction Noise Impact Assessment

Construction noise predictions remain the same as the assessment in the original NVIA [1], however the relevant Noise Management Levels are 6 to 12 dB lower for OOHW Period 1 (as shown in Table 1).

The noise predictions presented below assume that no noise mitigation measures have been implemented. If the noise mitigation measures described in the "Comment" column and the Project Mitigation Measures in the NVIA[1] are applied, then the predicted noise levels are likely to be reduced.

Table 3 Predicted equipment/plant noise levels at the nearest surrounding community receiver locations. Levels predicted to exceed the NMLs during standard hours are shown in orange; exceedances during out of hours works in blue; predictions to exceeding the "Highly Noise Affected" threshold (>75dBA) are shown in red; and those predicted to exceed Saturday Afternoon RBLs by more than 30dB "Outside Standard Hours" are shown in purple.

Location		Residential				Existing BHH Buildings			Commercial	Comments
		N/NW	E/NE	S/SE	W/SW	NW	SE	SW	S/SE	
NML		Standard Hours - 48 OOHW 36 (7am - 8am) 39 (7am - 8am) 42 (1pm – 3pm) 42 (1pm – 3pm)				65	65	65	70	
Construction Activities		**Predicted equipment noise levels at surrounding community receivers, in $L_{eq,15min}$ dB(A)**								
Site Establishment	Delivery and establishment of site office(s) and boundary fencing	56	63	75	71	85	85	85	75	Primary noise contributors above NMLs are lifting machinery (i.e. crane) and delivery trucks
Services diversion and relocation	Relocation of above and inground services	62	69	81	77	91	91	91	81	Primary noise contributors above NMLs are excavators, noisy hand tools such as impact drills, and filling of skip trucks. Use the smallest excavator and hammer that is practical whilst remaining efficient (i.e. reduce noise level without significantly extending duration). Consider location of equipment and site hoarding / localised hoarding that can reduce noise up to 10 dB.
	Services Trenching									
	Lighting installation									
Relocation of roads, accessways and car parking	Concreting of Kerbs and Gutters	59	67	79	75	89	89	89	79	Primary noise contributors above NMLs demo saw, concrete mixer and pumps. Consider location of equipment and site hoarding / localised hoarding that can reduce noise up to 10 dB.
	Asphalting									
	Line Marking and Kerb Guttering									
Mental Health Unit	Site clearing and light earthworks	54	52	64	62	69	85	69	65	Primary noise contributors above NMLs are demo saw, cranes, noisy hand tools such as nail guns and circular saws, and filling of skip trucks.
	Foundation	61	58	70	68	75	91	75	71	
	Steel Structure	54	52	64	62	69	85	69	65	

Location		Residential				Existing BHH Buildings			Commercial	Comments
		N/NW	E/NE	S/SE	W/SW	NW	SE	SW	S/SE	
NML		Standard Hours - 48 OOHW 36 (7am - 8am) 39 (7am - 8am) 42 (1pm – 3pm) 42 (1pm – 3pm)				65	65	65	70	
Construction Activities		**Predicted equipment noise levels at surrounding community receivers, in $L_{eq,15min}$ dB(A)**								
	Façade & Roof Installation of façade and glazing	59	57	64	62	69	85	69	65	Impact from internal fit out works are expected to be minor due to the attenuation of building. Windows and doors of new building to be kept close, where possible.
	Façade & Roof Roofing	59	57	64	62	69	85	69	65	
	Fit out	38	36	43	41	48	64	48	44	Consider minimising usage or alternative quieter methods and localised hoarding that can reduce noise up to 10 dB.
	Landscaping	63	61	68	66	73	89	73	69	Consider locations, loading / parking bays and lifting points to minimise noise impact on surrounding receivers. Use equipment without beepers where practical (i.e. with 'quacker' alarms)
	External Works	65	63	70	68	75	91	75	71	
Emergency Department	Site clearing and light earthworks	61	60	58	52	71	85	62	59	Primary noise contributors above NMLs are demo saw, cranes, and filling of skip trucks.
	Ambulance Bay Canopy Relocation	55	54	52	46	65	79	56	53	
	Expansion Foundation	67	66	64	58	77	91	68	65	Impact from internal fit out works are expected to be minor due to the attenuation of building. Windows and doors of new building to be kept close, where possible.
	Steel Structure	61	60	58	52	71	85	62	59	
	Façade & Roof Installation of façade and glazing	61	60	58	52	71	85	62	59	Consider minimising usage or alternative quieter methods and localised hoarding that can reduce noise up to 10 dB.
	Façade & Roof Roofing	61	60	58	52	71	85	62	59	

Location		Residential				Existing BHH Buildings			Commercial	Comments
		N/NW	E/NE	S/SE	W/SW	NW	SE	SW	S/SE	
NML		Standard Hours - 48 OOHW 36 (7am - 8am) 39 (7am - 8am) 42 (1pm – 3pm) 42 (1pm – 3pm)				65	65	65	70	
Construction Activities		**Predicted equipment noise levels at surrounding community receivers, in $L_{eq,15min}$ dB(A)**								
	Fit out	35	34	37	31	50	64	41	38	Consider locations, loading / parking bays and lifting points to minimise noise impact on surrounding receivers. Use equipment without beepers where practical (i.e. with 'quacker' alarms)
	Landscaping	60	59	67	61	75	89	66	68	
	External Works	62	61	69	63	77	91	68	70	
	Earthworks	60	61	78	74	88	88	88	78	
Additional Car Parking	Concreting of Kerbs and Gutters	61	62	79	75	89	89	89	79	Primary noise contributors above NMLs are piling rig and filling of skip trucks. Consider minimising usage or alternative quieter methods and localised hoarding that can reduce noise up to 10 dB.
	Asphalting									
	Line Marking and Kerb Guttering									
Rehabilitation Walkway	Construction/installation	50	51	68	64	78	78	78	68	Primary noise contributors above NMLs are cranes and noisy hand tools. Consider minimising usage or alternative quieter methods and localised hoarding that can reduce noise up to 10 dB.
PV Cells to MHU	Construction/installation	46	47	64	60	74	74	74	64	Primary noise contributors above NMLs are cranes and noisy hand tools. Consider minimising usage or alternative quieter methods and localised hoarding that can reduce noise up to 10 dB.
Landscaping	Landscape works	61	62	79	75	89	89	89	79	Primary noise contributors above NMLs are skip fill trucks and bobcat

2.4 Construction Ground Borne Noise and Vibration

As per the findings of the NVIA[1]:

- The list of plant and activities provided to Acoustic Studio by Acorn are not expected to generate vibration levels exceeding relevant criteria at any external receiver.
- Ground borne noise from the likely construction activities is not anticipated to be audible above airborne noise inside residential receivers, and will not require specific controls.

2.5 Project Noise Mitigation Measures

All reasonable and feasible noise mitigation measures will be incorporated as discussed in Section 7.5 of the NVIA[1].

2.6 Additional Mitigation Measures

Additional noise mitigations measures have been determined with consideration of the assessment in Table 3, plus how far above NMLs construction noise is predicted to be above NMLs for various activities at different receiver locations in accordance with Table 4 & Table 5.

Table 4 Additional Mitigation Measures (AMM) and Abbreviations

Measure	Abbreviation
Alternative accommodation	AA
Monitoring	M
Individual briefings	IB
Letter box drops	LB
Phone calls	PC
Specific notifications	SN

Table 5 AMM for Airborne Construction Noise

Time period		Mitigation measures $L_{Aeq(15minute)}$ noise level above background (RBL)			
		Qualitative assessment of noise levels			
		0 to 10 dBA Noticeable	10 to 20 dBA Clearly audible	20 to 30 dBA Moderately intrusive	> 30 dBA Highly intrusive
Standard	Mon-Fri (7am -6pm)	-	-	LB, M	LB, M
	Sat (8am-1pm)				
	Sun/Pub Hol (Nil)				
OOHW Period 1	Mon-Fri (6pm-10pm)		LB	M, LB	M, IB, LB, PC, SN
	Sat (7am- 8am) & (1pm-10pm)				
	Sun/Pub Hol (8am-6pm)				
OOHW Period 2	Mon-Fri (10pm-7am)	LB	M, LB	M, IB, LB, PC, SN,	AA, M, IB, LB, PC, SN,
	Sat (10pm-8am)				
	Sun/Pub Hol (6pm-7am)				

Based on the assessment, the following additional noise mitigation measures are proposed for OOHW.

- **Letter box drops** will be carried out to advise neighbouring receivers of the updated work hours and provide contact information for complaints or additional information.
- **Attended Noise Monitoring** will be carried out to verify noise levels in accordance with this assessment where predictions are 20dB or more above the NMLs.
- **Additional Scheduling, Duration and Respite Periods**
  - **Works above Highly Noise Affected Levels (75 dB(A)) and > 30 dB above RBLs at residential receivers** will not be carried out during OOHW Period 1 (i.e. activities with predictions in red or purple at residential receivers noted in Table 3).
  - Noise intensive works such as excavation and hammering or saw cutting is **not carried out during the 7:00am to 8:00am period**, and where practical, **will be avoided during the 1pm to 3:30pm periods**.
  - As per the decision statement [4], the use of any **rock excavation machinery** or any **mechanical pile drivers** or the like will be **restricted to the hours of**:
    - a. 9am to 12pm, Monday to Friday;
    - b. 2pm to 5pm, Monday to Friday; and
    - c. 9am to 12pm, Saturday.

3 Conclusion

Acoustic Studio has assessed the proposed changes to construction hours for the Broken Hill Redevelopment project.

The assessment has determined additional mitigation measures that should be considered and implemented where reasonable and feasible for OOHW Period 1 Saturday. These mitigation measures include:

- Letter box drops
- Attended Noise Monitoring
- Additional Scheduling, Duration and Respite Periods