ACOUSTIC STUDIO

Ryde Hospital Redevelopment Temporary Works

Review of Environmental Factors – Acoustic Report

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Executive Summary

Health Infrastructure is proposing a series of temporary works at Ryde Hospital at 1 Denistone Road, Denistone. The HI project reference is HI23123.

Acoustic Studio has carried out an assessment of the noise and vibration impacts to support the Review of Environmental Factors (REF) for the proposal by applying relevant standards, guidelines and criteria for the operational aspects of the proposal. The findings of the assessment are summarised as follows:

New Plant and Equipment - Noise from proposed new plant and equipment can all be controlled with standard noise mitigation. This will typically allow for:

- internally lined duct to fans that terminate at the façade.
- acoustic screening to external condenser units.

Loading Dock – The noise impact from the proposed temporary loading dock has been assessed as follows:

- Loading dock noise emissions are predicted to comply with the relevant noise criteria to surrounding off campus noise sensitive noise receivers. Traffic noise impact from vehicles accessing the loading dock from Denison Road will remain unchanged from existing conditions. Therefore, no noise mitigation measures are required.
- Noise impact to existing hospital campus buildings - As part of the temporary works, façade/window treatment upgrades will be included to the Trigg House (which includes inpatient accommodation) as shown in Figure 4. This will reduce the noise impact from the temporary loading dock location to noise levels that target internal continuous and intermittent noise levels within the recommendations of the NSW Health Engineering Services Guide.

External Noise Intrusion – Noise intrusion to the proposed temporary buildings has been considered and assessed with the following findings:

- Traffic noise intrusion –appropriate internal noise levels from traffic noise intrusion can be achieved with standard façade constructions having the following performances.
    - Glazing systems with a minimum performance of R_w 30.
    - Façade systems with a minimum performance of R_w 40.
- **Construction noise intrusion** - The hospital main works (Stage 1 and 2) will be in construction when the Temporary Buildings are in operation. It is expected that there will be extended periods where windows will need to be kept closed to mitigate construction noise such that it does not impact the users. The main works project will also implement noise and vibration control strategies to minimise impact on surrounding noise sensitive receivers including the existing hospital and temporary buildings.

1 Introduction

Health Infrastructure is proposing a series of temporary works at Ryde Hospital at 1 Denistone Road, Denistone. The HI project reference is HI23123.

The purpose of the temporary works is to ensure that the ongoing operation of the hospital is not impacted during construction of the Ryde Hospital Redevelopment.

A W Edwards (AWE) has engaged Acoustic Studio (ACS) to provide acoustic advice during the early temporary works stage of the Project.

1.1 Main Works – Previous SSDA

ACS has previously completed a Noise and Vibration Impact Assessment for Stage 2 State Significant Development Application (SSDA) Main Project, which included noise monitoring at the most reasonably affected noise sensitive receivers surrounding the site to establish relevant criteria, and an assessment of operational noise plus construction noise and vibration impacts associated with the Main Works Project that have potential to impact on these noise sensitive receivers.

The assessment was prepared in support of the planning application of the Main Works Project and addresses the requirements outlined in the Secretary's Environmental Assessment Requirements issued for the project.

The assessment is detailed in the following document:

[1] RYDE HOSPITAL REDEVELOPMENT, *Noise and Vibration Impact Assessment for Stage 2 State Significant Development (SSD) Application (Acoustic Studio ref:20230727 SVM3410.0008.Rep dated 27th July 2023).*

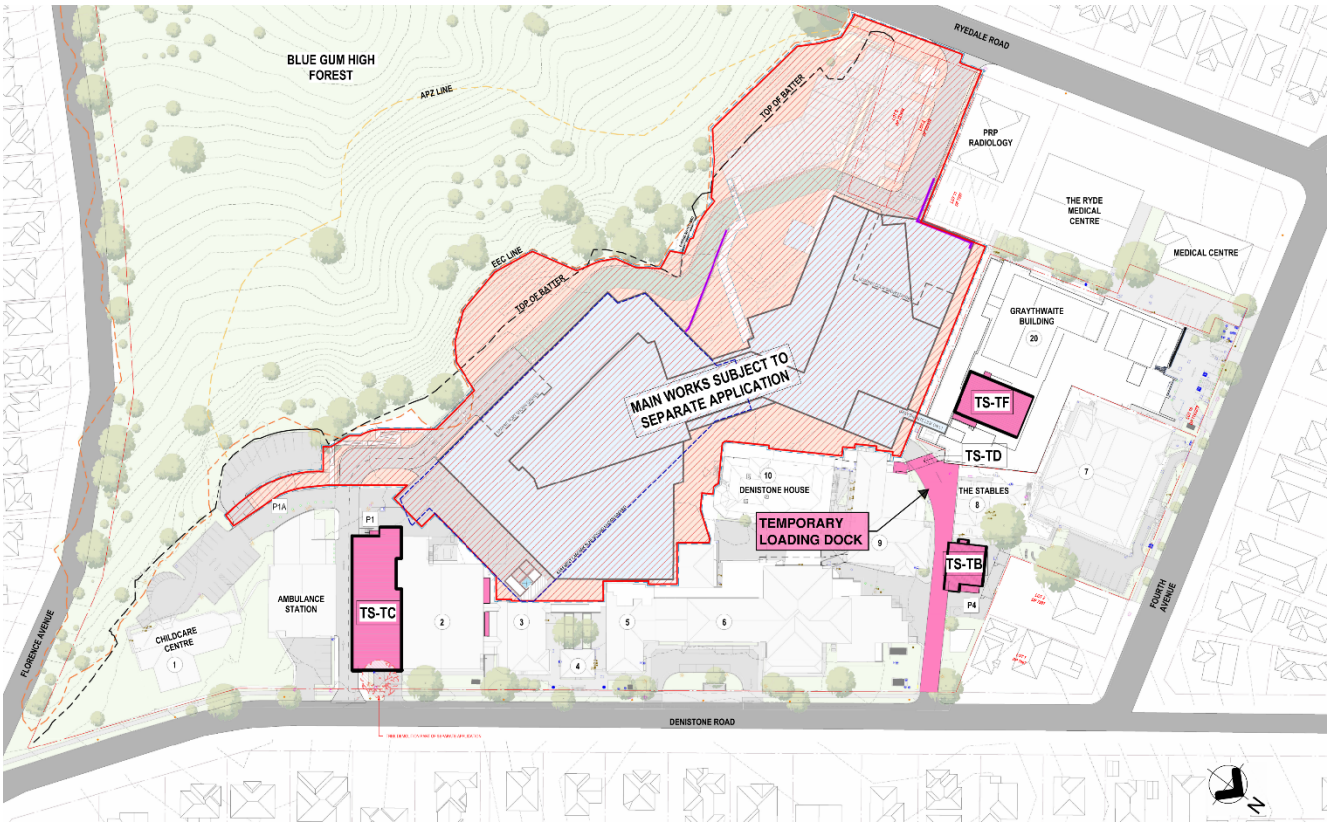
1.2 Description of Temporary Works and Structures

Specifically, the proposed temporary works and resulting structures at Ryde Hospital will comprise:

- Construction of temporary intensive and critical care building **[TS-TC]**.
- Provision of a temporary loading dock located off Denistone Avenue.
- Alterations to the Graythwaite Building rooftop and basement to facilitate new office space, kitchen and storage areas **[TS-TF]**.
- Establishment of two construction zones to accommodate office space, workshops and storage **[TS-TB]**.
- Construction of a pedestrian ramp that connects between Trigg House and the Graythwaite Building **[TS-TD]**.
- Connection and augmentation of in-ground services and utilities, as required.

Figure 1 below shows the temporary works and structures described above and its location within Ryde Hospital site.

Figure 1 Ryde Hospital site with indication of temporary works areas and structures



Source: AWE

1.3 Hours of Operation

Temporary works and structures, as shown in Section 1.2, plus associated services are expected to operate at times shown in Table 1 below. It is noted that the pedestrian ramp [TS-TD] does not require an operational noise assessment as part of this REF noise and vibration report and, as such, is not shown in table below or assessed herein.

Table 1 Hours of operation for proposed temporary works and structures

Temporary Works REF Component	Building ID	Reference Name in this REF Report	Hours of Operation
New intensive and critical care building	[TS-TC]	**ICU/IPU**	24/7
Relocated loading dock off Denistone Avenue	n/a	**Loading Dock**	Between 5am and 10pm
New kitchen level (Graythwaite Building – Roof)	[TS-TF Roof]	**Kitchen**	5am to 8pm
New linen and storage (Graythwaite Building - GF)	[TS-TF GF]	**Linen and Storage**	7am to 3:30pm[1]
New office space, workshops and storage	[TS-TB]	**Office/Engineering**	8am to 6pm

Notes:

1. 24/7 access for wards person / environmental service wis required, with last collection of dirty linen before 11pm

1.4 REF scope for Temporary Works

The scope of the noise and vibration REF assessment is limited to noise impacts associated with the temporary works described in Section 1.2 and **includes**:

Operational noise associated with:

- New mechanical plant and equipment associated with the temporary buildings.
- Temporary loading dock operations off Denison Road.

Assessment of the following are **excluded from this REF**:

- Construction noise and Vibration associated with the temporary works construction stage.
- Traffic movements (other than movement related to the temporary loading dock).
- Main Works covered in SSDA 1, SSDA 2 or under separate applications.
- Any existing operations that remain unchanged.

PART 1 - Establishing Criteria

2 Key Acoustic Issues

2.1 External Noise and Vibration Emissions from Project

Potential noise impacts associated to the operations of the proposed temporary works are:

- Environmental Noise Emissions from proposed temporary works
  Noise emissions from the temporary buildings operations needs to be managed to limit environmental noise impacts on nearby residences and onto other hospital buildings currently operating in Campus. In particular, this applies to:
  - Temporary buildings mechanical services new external plant and/or new internal plant ventilating directly to outdoors (e.g. exhaust fans).
  - Temporary loading dock operations (e.g. loading and unloading of trucks).
- Vibration Impacts from proposed temporary works
  - Vibration impacts from the loading dock operations are to be assessed at the nearest sensitive receivers on-campus (e.g. wards).

    Notes in regards to other vibration impacts from proposed temporary works:
    - After review of proposed building services plant associated with the temporary buildings, it is anticipated that vibration impacts from new plant are not to be an issue surrounding residential receivers due to the small types/sizes and the distance (minimum 15 metres) between the closest item of plant and nearest residential dwellings in Denistone Road and Fourth Avenue.
    - Vibration impacts from the operations of the loading dock are anticipated not to be an issue for nearest residentials, due to the distance (minimum 15 metres) between the temporary loading dock and nearest residential dwellings in Denistone Road and Fourth Avenue.

2.2 External Noise Intrusion within Project Areas

External noise intrusion impacts to the proposed temporary buildings will consider:

- Existing noise at the site such as existing road traffic.
- Noise from the main works construction when the temporary buildings are in operation.
- Loading dock operation

3 Applicable Standards and Guidelines

The following acoustic standards and guidelines have been considered in establishing noise and vibration criteria and assessment for this project.

[1] City of Ryde Development Control Plans (DCP) and Local Environment Plan (LEP),

[2] NSW EPA Noise Policy for Industry (NSW NPI) 2017.

[3] NSW EPA Road Noise Policy (RNP) 2011.

[4] NSW Department of Environment and Conservation (DEC) “Assessing Vibration: A Technical Guideline” (AVTG) 2006.

[5] NSW Protection of the Environmental Operations (POEO) Act 1997.

[7] Australian Standard “AS 1055 : Acoustics – Description and Measurement of Environment Noise” 1997.

[8] NSW Health “Engineering Services Guide (ESG)”, March 2023.

[9] “Australasian Health Facility Guidelines” December 2012 Revision v.4.0.

4 Sensitive Receivers

Figure 2 below shows the location of the proposed temporary works and sensitive receivers in the context of the Ryde Hospital site and surrounding area.

Figure 2 Ryde Hospital site with indication of REF temporary works locations and surrounding receivers

Table 2 Summary of key noise and vibration impacts for REF assessment, most-affected sensitive receivers and its proximity to proposed works

Receiver (External)	Assessed Impact	Zone/Use [Address]	Relative Location from Works	Worst-case Distance to Works (m)
Most-affected Residential Dwelling	Noise – Office/Engineering TS-TB (Mechanical Plant)	Zone 3 [45 Fourth Ave]	North	15
	Noise – Kitchen TS-TF (Mechanical Plant)	Zone 3 [45 Fourth Ave]	North-East	40
	Noise – ICU/IPU TS-TC (Mechanical Plant)	Zone 3 [60 Denistone Rd]	East	20
	Noise – Loading Dock (Rolling Traffic)	Zone 3 [47A Fourth Ave]	North	10
	Noise – Loading Dock (Operations)	Zone 3 [45 Fourth Ave]	North	25
Graithwaite Rehabilitation Centre	Noise – Kitchen TS-TF (Mechanical Plant)	Medical [37 Fourth Ave]	West	10
	Noise – Linen/Storage TS-TF (Mechanical Plant)	Medical [37 Fourth Ave]	West	5
	Noise – Loading Dock (Operations)	Medical [37 Fourth Ave]	West	40
Existing Ryde Hospital Buildings	Noise – Office/Engineering TS-TB (Mechanical Plant)	Hospital [Denistone Ave]	West	5
	Noise – Kitchen TS-TF (Mechanical Plant)	Hospital [Denistone Ave]	West	5
	Noise – Linen/Storage TS-TF (Mechanical Plant)	Hospital [Denistone Ave]	West	5
	Noise – ICU/IPU TS-TC (Mechanical Plant)	Hospital [Denistone Ave]	North	5
	Noise – Loading Dock (Rolling Traffic)	Hospital [Denistone Ave]	South	5
	Noise – Loading Dock (Operations)	Hospital [Denistone Ave]	South	5
	Vibration – Loading Dock (Operations)	Hospital [Denistone Ave]	South	5
Commercial Premises	Noise – Kitchen TS-TF (Mechanical Plant)	Medical [247 Ryedale Rd]	West	50
	Noise – ICU/IPU TS-TC (Mechanical Plant)	Child Care Centre [58 Denistone Rd]	East	20
	Noise – ICU/IPU TS-TC (Mechanical Plant)	Child Care Centre [1 Denistone Rd]	South-East	30

5 Noise Survey

A noise survey and an acoustic assessment has previously been carried out as part of the Noise and Vibration Impact Assessment report prepared for Main Works SSDA Stage 2 [1] for the Project.

6 Project Noise and Vibration Targets

6.1 Operational Noise

6.1.1 Noise Impacts on Surrounding Receivers - Off Campus

Noise emission criteria for the project has previously been established in the SSDA report referred to in Section 5

The environmental noise criteria is largely be based on determining the Project Noise Trigger Levels (PTNL) as outlined in the NPI. The PNTL external noise emission targets are detailed in Table 17 of the SSDA Stage 2 report [1] and are reproduced in Table 3 below.

Table 3 NSW NPI Project Noise Trigger Levels for external noise emissions from proposed development

Receiver (external – at the nearest receiver boundaries)	Period	Project Noise Trigger Level (PNTL) dBLAeq,15min in dB(A)
Residential (Zones 1, 2 and 3)	Day	46
	Evening	43
	Night	38
Residential (Zone 4)	Day	48
	Evening	43
	Night	35
Medical Premises	When in use	43
Commercial Premises	When in use	58

Source: Noise and Vibration Impact Assessment report prepared for Main Works SSDA Stage 2 [1].

Sleep Disturbance (Residential Receivers)

The relevant sleep disturbance screening criteria is shown in Table 4 below.

Table 4 Sleep Disturbance Screening Criteria

Assessment Location	Period	Noise Levels at Receiver Boundary Sleep Disturbance Criteria	
		$L_{Aeq,15min}$ dB(A)	L_{AFmax} dB(A)
All	Night (10pm to 7am)	40	52

6.1.2 Noise Impacts on Existing Hospital – On Campus

Redevelopment of any site must consider all neighbouring receivers, including within the same site.

In the case of the Ryde Hospital project, the redevelopment site is an extension of the existing campus and, as such, sensitive receivers include some existing "On Campus" buildings. It is noted, though, that compliance with the NPI PTNL in Table 3 is discretionary.

A target noise level of 50 to 55 dB(A) is recommended at external occupied and trafficable areas surrounding existing Ryde hospital buildings. This is based on observations of pre-existing conditions made by Acoustic Studio during site inspections and noise surveys at the Ryde Hospital Campus. This target also applies to external areas for the new building.

6.2 Vibration

The relevant criteria for human exposure to continuous and impulsive vibration are detailed in Table 5. Vibration levels are assessed through the consideration of the summation of effects for vibration levels at frequencies from 1 to 80 Hz for all axes.

Table 5 Preferred and maximum weighted rms values for continuous and impulsive vibration velocity (mm/s) 1-80 Hz

Location	Assessment Period	Daytime		Night-time	
		z-axis	x & y axis	z-axis	x & y axis
Continuous Vibration					
Critical areas	Day or night time	0.10	0.072	0.20	0.14
Residences	Day time	0.20	0.14	0.40	0.28
Offices, schools, educational institutions and places of worship	Night time	0.14	0.10	0.28	0.2
Workshops	Day or night time	0.40	0.28	0.80	0.56
Impulsive Vibration					
Critical areas	Day or night time	0.10	0.072	0.20	0.14
Residences	Day time	6.0	4.2	12.0	8.4
Offices, schools, educational institutions and places of worship	Night time	2.0	1.4	4.0	2.8
Workshops	Day or night time	13.0	9.2	26.0	18.4

Source: AVTG [4].

Human exposure to intermittent vibration is assessed using the Vibration Dose Value (VDV). The VDV accumulates the vibration energy experienced over an extended period (daytime and night-time periods) from intermittent events. Table 6 sets out the acceptable VDV values for intermittent vibration.

Table 6 Acceptable vibration dose values for intermittent vibration ($m/s^{1.75}$)

Location	Daytime		Night-time	
	Preferred Value	Maximum Value	Preferred Value	Maximum Value
Critical areas	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Source: AVTG [4].

PART 2 - Assessment

7 Operational Noise and Vibration Assessment

7.1 Operating Hours

Operational hours for temporary buildings are as shown in Table 1

7.2 Building Services

Mechanical plant and equipment associated with the operation of the development is to be controlled to ensure external noise emissions are not intrusive and do not impact on the amenity of neighbouring receivers in accordance with the relevant criteria in Section 6 of this report.

7.2.1 General

Key plant is proposed at the following buildings:

- Office/Engineering **[TS-TB]**
- ICU/IPU **[TS-TC]**
- Kitchen **[TS-TF Roof]**
- Linen/Storage **[TS-TF GF]**

Plant will generally operate during the hours shown in Table 1. There will be items (exhaust fans on the ICU/IPU building roof, refrigeration plant for the Kitchen) that may operate 24 hours a day, 7 days a week. This has been considered in the assessment.

The most restrictive night time criterion for 24hrs plant operations is 43 dB(A) at private hospital wards façade windows and 35-38 dB(A) at the nearest boundaries of surrounding residential noise sensitive receivers shown in Table 2.

Noise data for external mechanical plant preliminary selections has been provided by the Mechanical Consultant and is shown in Table 7 below.

Table 7 Noise Levels for Mechanical Plant Preliminary Selections

Noise Source	Location	Descriptor	Overall Noise Level, in dB(A)
Air Cooled Roof Top Packaged Units (RTPU)			
RTPU-TF-01	Kitchen [TS-TF Roof]	Sound Power Level	73
RTPU-TF-02	Kitchen [TS-TF Roof]	Sound Power Level	71
Condenser Units (CU)			
CU-TB-01	Office/Engineering [TS-TB]	Sound Power Level	83
CU-TB-02	Office/Engineering [TS-TB]	Sound Power Level	79
Ventilation Fans			
TEFT-TB-L1-01	Office/Engineering [TS-TB]	Sound Pressure Level at 3 metres (inlet/outlet)	15/16
TEF-TC-01	ICU/IPU [TS-TC]	Sound Pressure Level at 3 metres (inlet/outlet)	33/-
TEF-TC-02	ICU/IPU [TS-TC]	Sound Pressure Level at 3 metres (inlet/outlet)	57/57
TEF-TC-03	ICU/IPU [TS-TC]	Sound Pressure Level at 3 metres (inlet/outlet)	44/-
DRE-TC-01	ICU/IPU [TS-TC]	Sound Pressure Level at 3 metres (inlet/outlet)	45/-
ISOE-TC-01	ICU/IPU [TS-TC]	Sound Pressure Level at 3 metres (inlet/outlet)	49/51
ISOE-TC-02	ICU/IPU [TS-TC]	Sound Pressure Level at 3 metres (inlet/outlet)	49/51
ISOE-TC-03	ICU/IPU [TS-TC]	Sound Pressure Level at 3 metres (inlet/outlet)	49/51
ISOE-TC-04	ICU/IPU [TS-TC]	Sound Pressure Level at 3 metres (inlet/outlet)	49/51
DUF-TF-RF-01	Kitchen [TS-TF Roof]	Sound Pressure Level at 3 metres (inlet/outlet)	51/-
TEF-TF-RF-01	Kitchen [TS-TF Roof]	Sound Pressure Level at 3 metres (inlet/outlet)	45/-
DSAF-TF-RF-01	Kitchen [TS-TF Roof]	Sound Pressure Level at 3 metres (inlet/outlet)	57/56
DWEF-TF-RF-01	Kitchen [TS-TF Roof]	Sound Pressure Level at 3 metres (inlet/outlet)	59/60
SAF-TF-G-01	Linen/Storage [TS-TF GF]	Sound Pressure Level at 3 metres (inlet/outlet)	54/54
SAF-TF-G-02	Linen/Storage [TS-TF GF]	Sound Pressure Level at 3 metres (inlet/outlet)	48/-
EAF-TF-G-01	Linen/Storage [TS-TF GF]	Sound Pressure Level at 3 metres (inlet/outlet)	68/67
EAF-TF-G-02	Linen/Storage [TS-TF GF]	Sound Pressure Level at 3 metres (inlet/outlet)	51/50

Source: LCI Consultants

During the finalisation of the Detailed Design phase, acoustic detailed design advice will provide to the architect and services engineers to the final selections of plant (if different from plant in Table 7) to ensure that noise emissions from plant and equipment are effectively controlled to meet the relevant criteria at the nearest receiver boundaries.

General design considerations and controls that may need to be implemented typically include, but are not limited to:

- Strategic selection and location of plant to ensure the cumulative noise contribution at the receiver boundary is achieved, and/or
- Noise control measures to be put in place to minimise noise impacts such as:
    - Noise enclosures or barriers/screening as required.
    - Acoustic louvres as required.
    - In-duct attenuation.
    - Sound absorptive panels.

The following outlines allowances that have been included based on the current proposals in Table 7. Actual treatments may change (and still achieve the relevant noise emissions targets) depending on final locations, orientation and equipment selections.

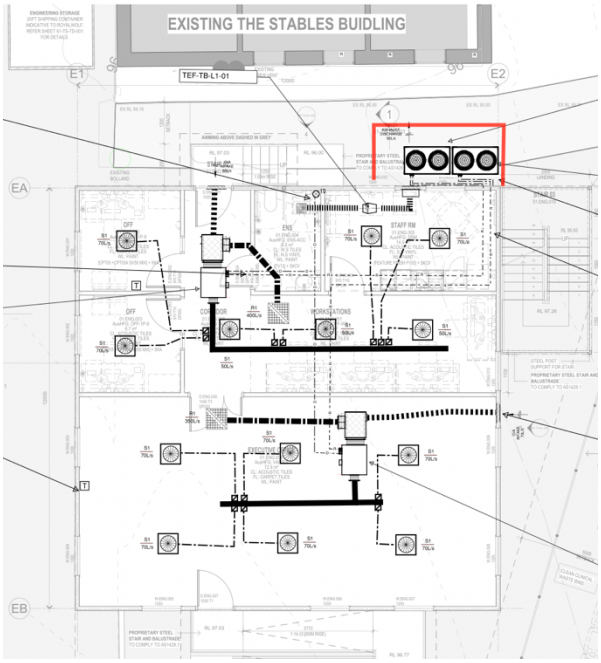
Office/Engineering Building [TS-TB]

The current condenser design considers 2 x commercial units (CUs), each with a Sound Power Level of 83 dB(A). Based on the selection and current location. The following is recommended to control noise to external receivers and existing adjacent campus buildings.

- Option 1 – acoustic louvres.
- Option 2 – solid screening such as FC sheet or equivalent backed with sound absorptive lining.

Both options should extend 500mm above the unit height.

Figure 3 Office/Engineering Building Condenser Unit Indicative Screening (shown in red)



ICU/IPU [TS-TC]

- Roof Fans - No additional noise controls are required to rooftop plant and equipment in order to achieve the relevant noise emission targets at off campus or on campus receivers.

Kitchen [TS-TF Roof]

- Roof Plant (RTPUs and Roof Fans) - No additional noise controls are required to rooftop plant and equipment in order to achieve the relevant noise emission targets at off campus or on campus receivers.
- Fans terminating at the façade – Allowance will be made for 1-2m of internally lined ductwork for fans that terminate at the façade.

Linen/Storage [TS-TF GF]

- Fans terminating at the façade – Allowance will be made for 1-2m of internally lined ductwork for fans that terminate at the façade.

7.2.2 Cumulative Noise Impact

The assessment and design consider all existing plant and equipment that will be retained for existing buildings.

The recommendations provided (and detailed designs to be developed) will ensure that the noise emissions from the temporary plant is achieved when considering the cumulative noise impact from existing and proposed plant.

During the design finalisation when final plant selections are made, acoustic detailed design advice will be provided to the architect and services engineers to ensure that noise emissions from all plant and equipment selections are effectively controls to meet the relevant criteria at the nearest receiver boundaries.

7.3 Loading dock

The temporary works will include a temporary loading dock (as shown in Figure 1) to replace the existing loading dock that will be removed as part of the main works.

7.3.1 Noise Impact Considerations

Noise impact from the loading dock has been considered as follows:

- Traffic noise from vehicles entering and exiting the site via surrounding roads.
- Noise from unloading activities at the new loading dock location affecting both on campus and off campus receivers.

Loading Dock / Waste Collection Activities and Nature of Noise Sources

The potential noise sources associated with the proposed loading dock activities and vehicle movements will be as follows:

- Noise generated by delivery truck / vehicle movements accessing the loading dock (i.e. vehicles moving slowly).
- Other vehicle operational noises (i.e. doors closing and engines starting).
- Operational noises from loading and unloading activities within the loading dock.
- Vehicle reversing alarm.
- People noise (i.e. people talking in the dock).

Table 8 below is a compilation of noise level data obtained by Acoustic Studios' previous projects with similar noise sources / vehicle activities to those of the proposed loading dock.

Table 8 Noise levels for vehicles and people associated with the proposed loading dock

Noise Source / Delivery Activities	Noise Levels at 7 metres, in dB(A)	
	$L_{Aeq, event}$	L_{AFmax}
Truck door closing	55 – 60	60 – 70
Truck engine starting	55 – 60	55 – 65
Truck accelerating	60 – 65	60 – 70
Truck moving (uniform speed)	70 – 80	75 – 85
Tuck moving (slowly)	55 – 60	55 – 60
Truck reversing alarm	70 – 80	85 – 95
People talking	45 – 50	50 – 60

7.3.2 Operational Details

We understand the following based on information provided by the Project Manager and the Hospital with regard to existing and future deliveries:

- Access to and from the loading dock will be remain as existing from Denison Road.
- There are no changes proposed to the number of movements or type of delivery vehicle from current.
- Vehicles will typically be vans, Medium and Heavy Rigid Vehicles.
- Delivery duration range from 5 minutes to 1h, with typical deliveries usually 5 minutes.
- There is typically only a maximum of one delivery for a given hour.
- The worst case delivery would be a Heavy Rigid Vehicle for one hour.
- Loading dock will not be used between 10pm and 5am.
- Between 5am and 7am there are only two sets of food deliveries with vans and MR vehicles typically 5 and 15 minutes duration.

7.3.3 Assessment Methodology

Based on the above, noise level resulting from loading dock vehicle movements has been calculated at the boundary of the most affected sensitive receivers as follows:

- Off Campus noise sensitive receivers:
  - at 45 and 47A Fourth avenue, adjacent to the loading dock driveway.
  - opposite the driveway leading into the loading dock along Denison Road.
- Existing Hospital Campus Buildings

The calculation takes into account the following:

- Distance attenuation.
- Ground reflection.
- Noise shielding from intervening structures.

As a worst-case scenario the following assumptions have been made in regards to the loading dock noise assessment for a 15 minute period:

- Day Time (7am to 6pm)
  - 1 x van or heavy vehicle
- Evening (6pm to 10pm) – no deliveries
- Night (10pm to 5am) - no deliveries
- Shoulder Period Night/ Day (5am -7am)
  - 1 x van or heavy vehicle

7.3.4 Assessment Results

Off Campus Noise Sensitive Receivers

The summary of noise impacts from the temporary loading dock are assessed as follows:

- Traffic noise impact from vehicles accessing the loading dock from Denison Road will remain unchanged.
- Based on the results of from Table 9, loading dock noise emissions are predicted to satisfy NSW NPI operational noise criteria during day, evening and night-time periods.

Table 9 Loading dock noise assessment at off campus noise sensitive receivers.

Assessment Location	$L_{Aeq,15min}$ Noise Levels at Receiver Boundary, in dB(A)	
	Day (7am to 6pm)	Night / Day Shoulder Period (5am to 7am)
Adjacent to loading dock driveway (Fourth Avenue)	37	37
Opposite loading dock driveway (Denison Road)	26	26

Consideration has also been given to potential sleep disturbance for loading dock use between 5am and 7am.

The results of the noise assessment for the night time period are compared against the Sleep Disturbance Screening Criteria as shown in Table 10.

Table 10 Predicted noise levels at the nearest residential receiver due to loading dock activities and Sleep Disturbance Screening Criteria. Noise levels exceeding the criteria are shown in red

Assessment Location	Noise Levels at Receiver Boundary Sleep Disturbance Criteria	
	40 dB(A) $L_{Aeq,15min}$	52 dB(A) L_{AFmax}
Opposite loading dock driveway along Denison Road	42	70

The sleep disturbance study shows that the predicted L_{AFmax} noise levels exceed the Sleep Disturbance Screening Criteria by up to 18 dB(A); so further investigation of the noise events and a detailed analysis has been undertaken to assess the extent of impacts on sleep at the Denison Road receivers.

Acoustic Studio has carried out a study to cover the extent to which the noise levels exceed the background noise level and the number of times that is likely to happen during the night time period. Other factors considered are:

- how frequently the high noise event will occur (only one heavy vehicle per night / day shoulder period),
- the time of the night when they will occur (between 5am and 7am which is the day/night shoulder period),
- shoulder periods such as early morning periods when there is a clear change in the noise environment,
- building envelope at the residential receivers providing worst-case noise attenuation of 10 dB(A) with windows open.

Based on the above, an external noise level of 70 dB(A) L_{max} may occur when a truck is leaving or exiting from the loading dock during a delivery.

As noted in the RNP:

"One or two noise events per night, with maximum internal noise levels of 65–70 dB(A), are not likely to affect health and wellbeing significantly."

This indicates that such night-time noise levels are unlikely to cause awakening from sleep or affect health and wellbeing of receivers.

The above assessments have considered the worst case maximum noise level from a truck passing residential dwellings when on Denison Road on approach / leaving the Loading Dock. Further assessment identifies that the predicted absolute noise levels are unlikely to generate sleep awakening.

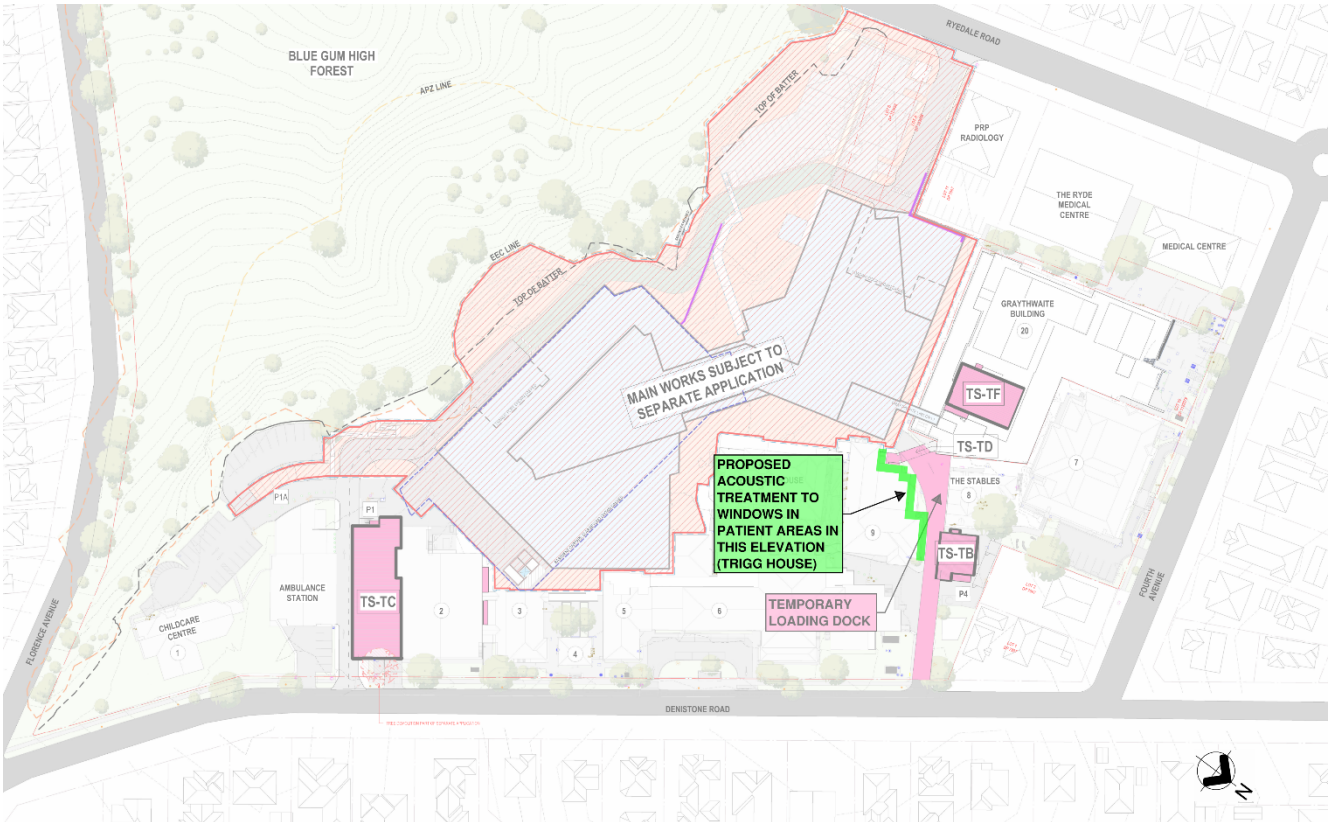
Based on the noise impact and sleep disturbance assessments, the loading dock noise emissions due to vehicle movements are predicted to satisfy all relevant criteria during day, evening and night-time periods and will not cause sleep disturbance.

Existing Hospital Campus Buildings

Noise at nearest campus buildings adjacent to the loading dock may experience noise levels up to 65-70 dB(A)

As part of the temporary works, façade/window treatment upgrades will be included to the Trigg House (which includes inpatient accommodation) as shown in Figure 4 to reduce the noise impact from the temporary loading dock location to noise levels that target internal continuous and intermittent noise levels within the recommendations of the NSW Health Engineering Services Guide.

Figure 4 Ryde Hospital site with indication of proposed façade treatment location in vicinity of loading dock



Source: AWE

8 External Noise Intrusion

8.1 Road Traffic Noise Intrusion

Acoustic Studio has carried out a review of existing traffic noise and identified that acoustic glazing and wall constructions will be included as follows:

- Glazing systems with a minimum performance of R_w 30.
- Façade systems with a minimum performance of R_w 40.

Final details and extent of the façade that may require this type of glazing performance will be determined with input from the Acoustic Engineer as the detailed design stage is finalised and as layouts and façade details are developed.

8.2 Main Works Construction Noise Intrusion

The hospital main works (Stage 1 and 2) will be in construction when the Temporary Buildings are in operation. It is expected that there will be extended periods where windows will need to be kept closed to mitigate construction noise such that it does not impact the users.

The main works project will also implement noise and vibration control strategies to minimise impact on surrounding noise sensitive receivers including the existing hospital and temporary buildings.

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