Bathurst Hospital Redevelopment

Acoustic Report for

State Significant Development Application

23/01/2025 **Ref: 301351221**

PREPARED FOR:

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TSA Management

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Stantec

CONSULTANT DECLARATION

PROJECT DETAILS	
Project name	Bathurst Hospital Redevelopment
Application number	SSD-64733959
Address of subject land	361-365 Howick Street, Bathurst
Lot / DP	Lot 100 in DP 1126063
APPLICANT DETAILS	
Applicant name	Health Administration Corporation
Applicant address	1 Reserve Road, St Leonards, NSW 2065
REPORT DETAILS	
Name of report this declaration relates	Acoustic Report for State Significant Development Application
Report reference no.	AC-RE-001-SSDA
Report date	25/09/2024
Company name (inc. ABN / ACN)	Stantec Australia
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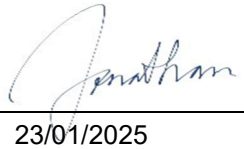
DECLARATION BY CONSULTANT	
Name	Jonathan Salim
Registration no.	1486 | 4455213
Organisation registered with	Australian Acoustic Society | Engineers Australia
Declaration	The undersigned declares that Acoustic Report for State Significant Development Application: • has been prepared in accordance with the following **policy, guidelines, or** legislative requirements: - Secretary's Environmental Assessment Requirements (SEARs) issued for the project (SSD-64733959), dated 21/11/2023 - Bathurst Regional Council DCP 2014 - Noise Policy for Industry (NPI) 2017 - NSW Road Noise Policy 2011 - Interim Construction Noise Guideline (ICNG July 2009) - Assessing vibration: A technical Guideline, February 2006 - AS 2436 – 2010 "Guide to noise and vibration control on construction, demolition and maintenance sites" • contains all available information relevant to the environmental assessment of the development, activity or infrastructure to which the [consultant report] relates; • does not contain information that is false or misleading; • identifies and addresses the relevant Planning Secretary's environmental assessment requirements (SEARs) for the project; • identifies and addresses the relevant statutory requirements for the project, including any relevant matters for consideration in

	environmental planning instruments to which the Acoustic Report for State Significant Development Application relates; • contains a consolidated summary of the proposed or necessary mitigation measures
Signature	
Date	23/01/2025

Revision Schedule

Revision No.	Date	Description	Prepared by	Quality Reviewer	Project Manager Final Approval
001	05/07/2024	First issue	Jonathan Salim	Meisha Stevens	Meisha Stevens
002	15/10/2024	Issue following EU Comments	Jonathan Salim	Meisha Stevens	Meisha Stevens
003	23/01/2025	Issue following drawings update	Jonathan Salim	Meisha Stevens	Meisha Stevens

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Contents

1. Executive Summary

This Noise & Vibration Impact Assessment has been prepared by Stantec Australia to accompany a detailed State Significant Development Application (**SSDA**) for the proposed redevelopment/expansion works at Bathurst District Hospital located at 361-365 Howick Street, West Bathurst NSW 2795. The site is legally described as Lot 100 in Deposited Plan 1126063 - 361-365 Howick Street, West Bathurst and the site for the purposes of this SSDA is located within the eastern and western side of the existing Bathurst Hospital, adjacent to Mitre and Commonwealth Street.

This report has been prepared to address the Secretary's Environmental Assessment Requirements (**SEARs**) issued for the project (SSD-64733959).

This report concludes that with the proposed mitigation measures outlines in Sections 6.1.1, 6.2.2, 7.4 and 7.5 of this report, the operational and construction noise generated from the hospital redevelopment/expansion is expected to be able to comply with the **SEARs** criteria and warrants approval.

2. Introduction

This acoustic report has been prepared by Stantec on behalf of Health Infrastructure for the redevelopment of the Bathurst Hospital at 361-365 Howick Street, Bathurst.

The site is located at 361-365 Howick Street, Bathurst, in the Bathurst Local Government Area. It is occupied by Bathurst Health Service, a Level C referral facility in the Western NSW Local Health District.

This report accompanies a State Significant Development Application that seeks approval for the construction and operation of a new-build expansion, refurbishment and repurposing works to the existing Bathurst Health Service main hospital building. Proposed works will include:

- A new-build, three-storey health services building expansion (including 1 plant level) to include overnight inpatient accommodation and non-admitted care services and a new hospital front-of house and entrance
- A new-build, two-storey expansion to the Emergency department and Operating Theatres (plus 1 plant level)
- A new-build, single-storey expansion to the existing Cancer Service building – Daffodil Cottage
- Refurbishment and repurposing to areas of the existing hospital
- Site establishment, demolition of some existing structure, cut and fill and remediation works
- Vehicular circulation and car parking improvements
- Tree removal
- Landscape works
- Alteration and amplification of existing hospital plant and services infrastructure
- For a detailed project description, refer to the Environmental Impact Statement prepared by Ethos Urban.

This report has been prepared in response to the requirements contained within the Secretary's Environmental Assessment Requirements (**SEARs**) dated 21 November 2023 and issued for the SSDA (SSD-64733959). Specifically, this report has been prepared to respond to the SEARs requirement issued below.

Item	Description of requirement	Section reference (this report)
12. Noise and Vibration	Provide a noise and vibration assessment prepared in accordance with the relevant NSW Environment Protect Authority (EPA) guidelines. The assessment must detail construction and operational noise and vibration impacts on nearby sensitive receivers and structures and outline the proposed management and mitigation measures that would be implemented.	Section 6

This report is based on our understanding of the proposed project, application of the relevant state guidelines and professional experience within the acoustic field. This report shall not be relied upon as providing any warranties or guarantees.

3. Project Overview

3.1 Site Description

The site for the purposes of this SSDA is located at Bathurst District Hospital located at 59 Mitre St, West Bathurst NSW 2795. The site is legally described as Lot 100 in Deposited Plan 1126063 (SSD-64733959). The proposed site has an is identified in Figure 1 below. The site is located within the Bathurst Regional Council local government area (LGA).

The site is bound by Durham Street to the north-east, Mitre Street to the south-east, Howick Street to the south-west, and the Commonwealth Street to the north-west.

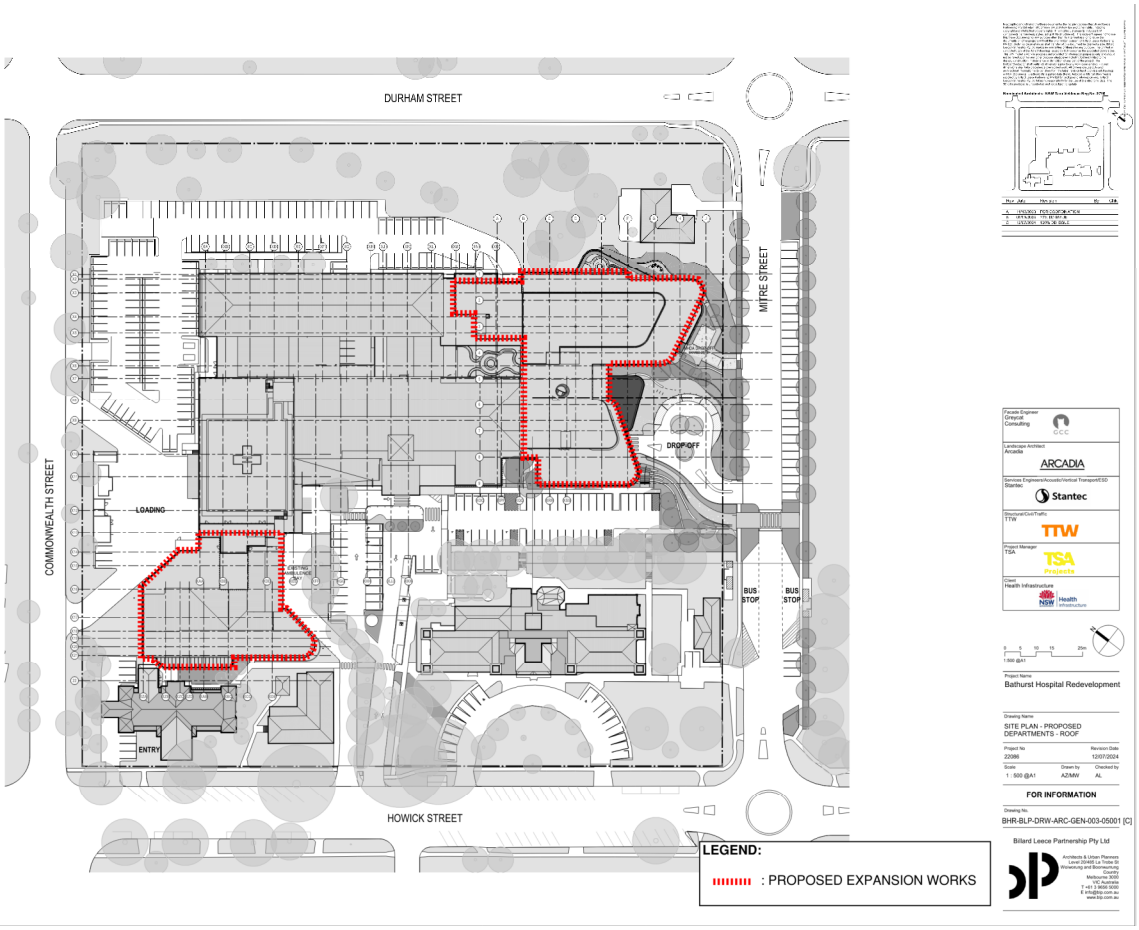


Figure 1 Aerial identification of the site

Refer to Figure 2 for the location of the proposed building location, measurement positions and surrounding receivers.

Figure 2: Overview of the site and measurement locations (Source: nearmap.com)

3.2 Acoustic Issues

The acoustic issues relating to the development are as follow:

- Construction noise and vibration from the proposed development to the surrounding receivers
- Mechanical noise emission from the new building to the surrounding receivers
- Mechanical noise emission from the existing mechanical plant from the surrounding buildings onto the proposed development site
- Traffic generation noise from vehicles accessing the carpark / loading dock area.

4. Noise Survey

4.1 Instrumentation

The following equipment was used for the noise surveys:

- Hand-held sound spectrum analyzer B&K 2250, S/N 2709742
- Sound Calibrator B&K Type 4231, S/N 2709826
- Bruel and Kjear Noise Logger B&K 2250 S/N 3011864
- Bruel and Kjear Noise Logger B&K 2250 S/N 3011850

All equipment was calibrated before and after the measurements and no significant drift was found. All equipment carries current traceable calibration certificates that can be provided upon request.

4.2 Unattended Noise Survey Results

This assessment will consider the method for determining the RBL background for each period of the day in accordance with the NSW Noise Policy for Industry (NPI). The NPI defines background and ambient noise for the daytime, evening and night-time periods as follows:

Day: is defined as 7:00am to 6:00pm, Monday to Saturday and 8:00am to 6:00pm Sundays & Public Holidays.

Evening: is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays.

Night: is defined as 10:00pm to 7:00am, Monday to Saturday and 10:00pm to 8:00am Sundays & Public Holidays.

4.2.1 Background and Ambient Noise Monitoring

Two noise loggers were placed in position L1 and L2 as shown in Figure 2 to measure the background and ambient noise that is representative of the surrounding receivers. Both monitors were installed from the 4th to the 10th of August 2023.

The results of the unattended background noise survey are shown in Table 1 below (for the day, evening and night periods). Note that any extraneous data or rain affected data has been excluded from the calculations.

Table 1: Unattended noise measurements

Location	Equivalent Continuous Noise Level $L_{Aeq,period}$ – dB(A)			Background Noise Level RBL – dB(A)		
	Day	Evening	Night	Day	Evening	Night
L1	59	58	52	46	43	39
L2	54	56	50	41	39	36

Table 2: Unattended traffic noise measurements

Location	Equivalent Continuous Noise Level $L_{Aeq,period}$ - dB(A)	
	Day ($L_{Aeq,\ 15\ Hour}$)	Night ($L_{Aeq,\ 9\ Hour}$)
L1	58	52
L2	54	49

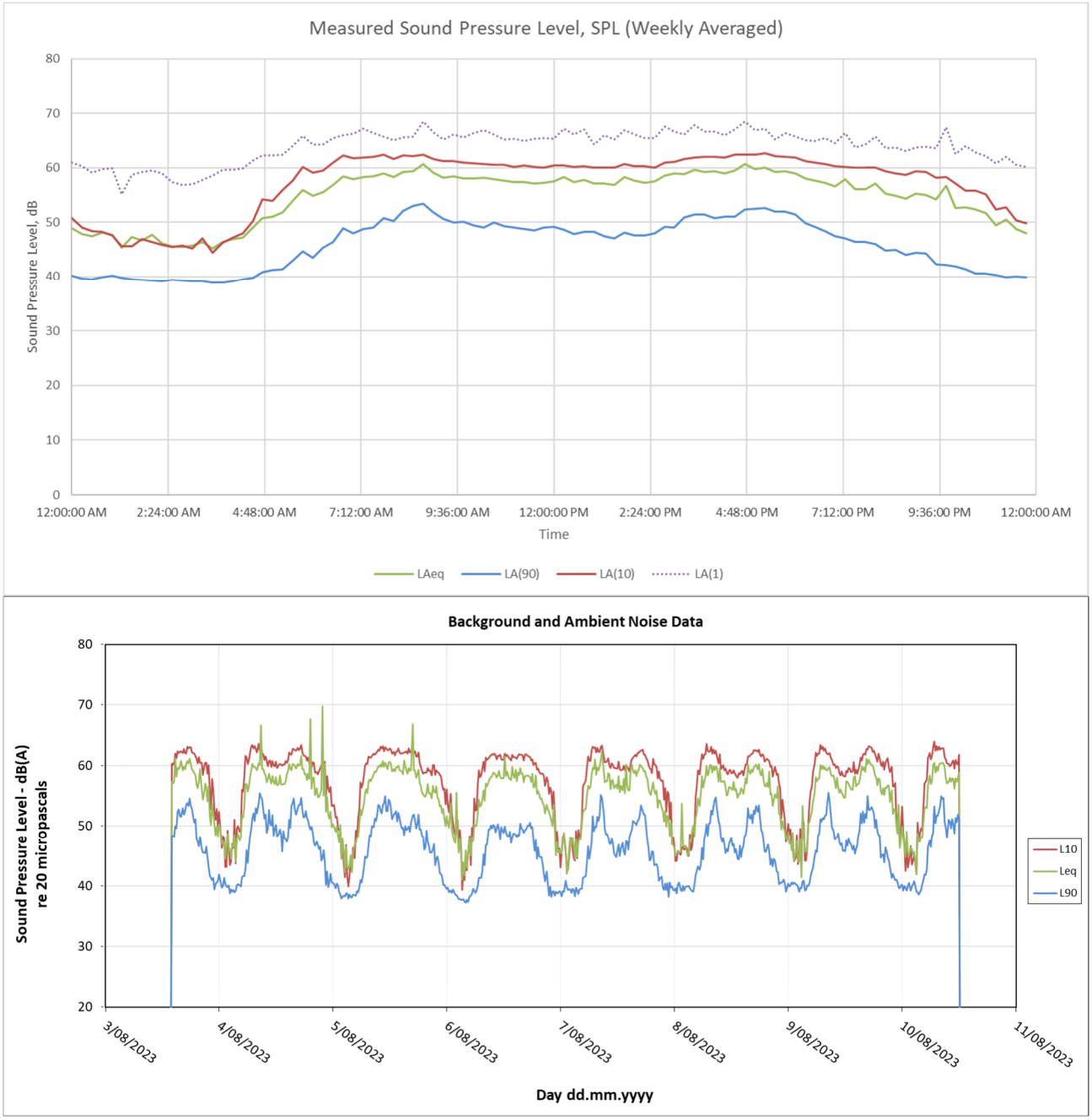


Figure 3: Logger data L1

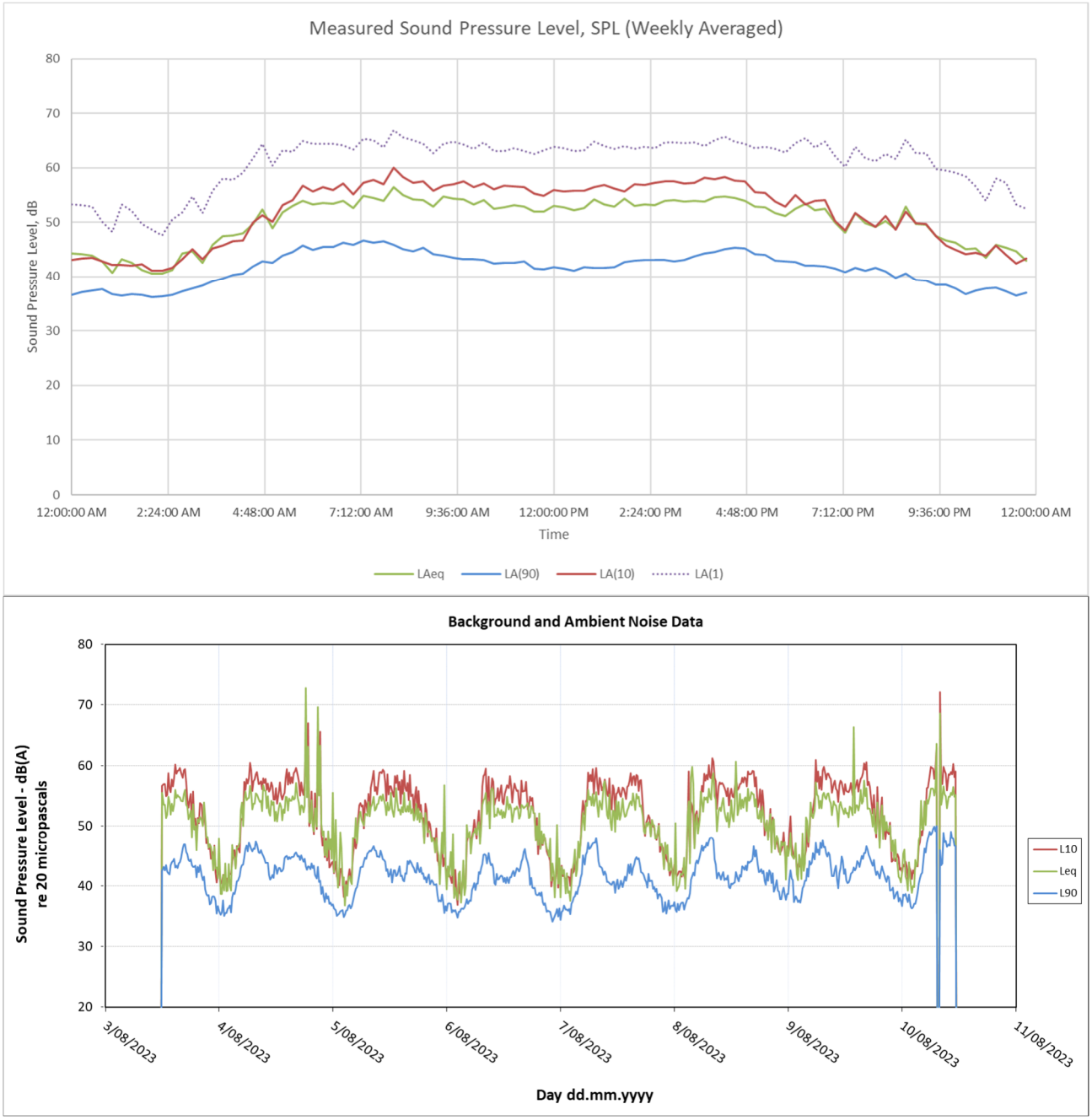


Figure 4: Logger data L2

4.3 Attended Noise Survey Results

Attended noise measurements of 15-minute period were conducted on site to characterize the acoustic environment for the noise intrusion into the development and to determine any noise impact on the surrounding receivers. A summary of the attended noise measurements taken at the site are shown on Table 3. Refer to Figure 2 for the measurement locations.

Table 3: Attended noise measurements

Measurement Location	Measurement Time	$L_{Aeq, 15mins}$, dB(A)	$L_{A90, 15mins}$ dB(A)	Comments
P1	03/08/2023 – 01:07pm	69	50	Ambient noise dominated by traffic along Durham Street.
P2	03/08/2023 – 12:47pm	55	45	Ambient noise dominated by wildlife and traffic along Mitre Street.
P3	03/08/2023 – 12:42pm	53	53	Ambient noise dominated by wildlife and traffic along Howick and Mitre Street.
P4	03/08/2023 – 01:23pm	61	43	Ambient noise dominated by wildlife and traffic along Durham Street.

5. Noise Criteria

5.1 Bathurst Regional Council Local Environment Plan (LEP) 2014

Relevant Planning Documents of Bathurst Regional Council Legislation have been reviewed for any noise requirements or criteria.

The Bathurst Regional Council LEP 2014 sets the Land Zoning as shown in Figure 5 as per information extracted from the maps provided by Bathurst Regional Council LEP 2014 and the NSW Government legislation web service. The proposed site and surrounding developments are categorised as SP2 (Hospital), RE1 (Public Recreation), R1 (General Residential), and R2 (Low Density Residential).

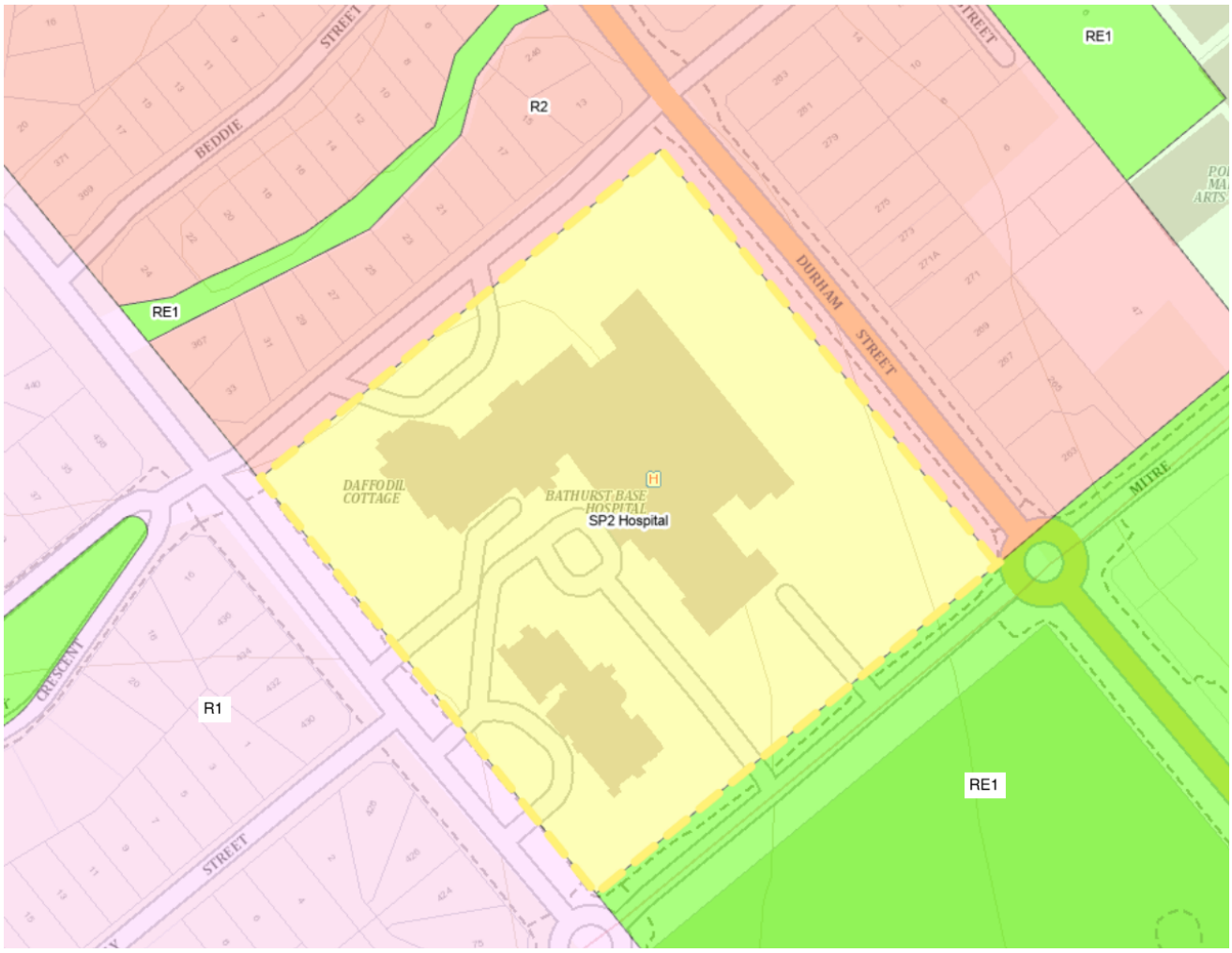


Figure 5: Land Zoning of the site and surroundings.

5.2 Noise Emission Criteria

5.2.1 Bathurst Regional Council Development Control Plan (DCP) 2014

The site is located on land to which the Bathurst Regional Council DCP 2014 applies. Notwithstanding, Development Control Plans do apply to State Significant Development. Despite this, the Bathurst Regional DCP 2014 does not set establish any specific acoustic requirements for hospital development. Therefore, the external noise emission from the proposed development will be derived from NSW Environment Protection Authority (EPA) Noise Policy for Industry (NPI)

5.2.2 NSW Noise Policy for Industry (NPI)

The NSW Environment Protection Authority (EPA) sets out criteria in its Noise Policy for Industry (NPI) to control the noise emission from industrial noise source or continuous steady state noise. The external noise due to the mechanical services from the proposed development will later be addressed to ensure the compliances with NSW EPA's NPI guidelines.

The calculation is based on the results of the ambient and background noise unattended monitoring, addressing two components:

- Controlling intrusive noise into nearby residences (Intrusiveness Criteria)
- Maintaining noise level amenity for particular land uses (Amenity Criteria)

Once both criteria are established the most stringent for each considered assessment period (day, evening, night) is adopted as the Project Noise Trigger Level (PNTL).

Intrusiveness Criteria

The NSW EPA NPI states the following:

"The intrusiveness of an industrial noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the Laeq descriptor), measured over a 15-minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB(A)."

The intrusiveness criterion can be summarised as L_{Aeq}, 15 minute ≤ RBL background noise level plus 5 dB(A).

Table 4: NSW NPI intrusiveness criteria (Receivers along Durham Street)

Period	Noise Descriptor – dB(A)	Noise Criteria – dB(A)
Day (7:00am to 6:00pm)	$L_{Aeq,15min}$ ≤ RBL + 5	51
Evening (6:00pm to 10:00pm)	$L_{Aeq,15min}$ ≤ RBL + 5	48
Night (10:00pm to 7:00am)	$L_{Aeq,15min}$ ≤ RBL + 5	44

Table 5: NSW NPI intrusiveness criteria (Receivers along Howick Street)

Period	Noise Descriptor – dB(A)	Noise Criteria – dB(A)
Day (7:00am to 6:00pm)	$L_{Aeq,15min}$ ≤ RBL + 5	46
Evening (6:00pm to 10:00pm)	$L_{Aeq,15min}$ ≤ RBL + 5	44
Night (10:00pm to 7:00am)	$L_{Aeq,15min}$ ≤ RBL + 5	41

Amenity Criteria

The NSW NPI states the following:

> "To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.1 of the NPI. Meeting the acceptable noise levels in table 2.1 will protect against noise impacts such as speech interference, community annoyance and to some extent sleep disturbance. These levels represent best practice for assessing industrial noise sources, based on research and a review of assessment practices used overseas and within Australia."

The applicable parts of Table 2.1: Recommended L_{Aeq} Noise Levels from Industrial Noise Sources – dB(A) which are relevant to the project are reproduced below:

Table 6: NSW NPI amenity criteria for external noise levels

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended $L_{Aeq,period}$ Noise Level, dB(A)	Project Amenity Noise Level[1], $L_{Aeq,\ 15mins}$, dB(A)
Residential	Urban[2]	Day	60	58
		Evening	50	48
		Night	45	43
Commercial	All	When in use	65	63
Hospital	All	Noisiest 1 hr (internal)	35	33
		Noisiest 1 hr (external)	50	48
Passive recreation (Park)	All	When in use	50	48
Active recreation (Park)	All	When in use	55	53

Notes:

1. Project amenity noise level is Recommended Noise Level minus 5 dB(A) plus 3 dB(A) to convert from period level to a 15-minute level.
2. Urban area as defined in EPA NSW NPI Table 2.3

'Modifying Factor' Adjustments

The NSW NPI also states:

> "Where a noise source contains certain characteristics, such as tonality, impulsiveness, intermittency, irregularity or dominant low-frequency content, there is evidence to suggest that it can cause greater annoyance than other noise at the same noise level."

In order to take into account the potential annoying character of the noise an adjustment of 5 dB(A) for each annoying character aspect and cumulative of up to a total of 10 dB(A), is to be added to the measured value to penalise the noise for its potentially greater annoyance aspect.

Table 4.1 of Chapter 4 of the NSW DECCW NPI (see Table 7 below) provides procedures for determining whether an adjustment should be applied for greater annoyance aspect.

Table 7: Table 4.1 from the NSW DECCW NPI – Modifying factor corrections

Factor	Assessment / Measurement	When to Apply	Correction[1]	Comments
Tonal Noise	One-third octave or narrow band analysis	Level of one-third octave band exceeds the level of the adjacent bands on both sides by: - **5 dB** or more if the centre frequency of the band containing the tone is above 400 Hz - **8 dB** or more if the centre frequency band containing the tone is 160 to 400 Hz inclusive - **15 dB** or more if the centre frequency of the band containing the tone is below 160 Hz	5 dB[2]	Narrow-band frequency analysis may be required to precisely detect occurrence.
Low Frequency Noise	Measurement of C-weighted and A-weighted level	Measure / assesses C- and A-weighted levels over same time period. Correction to be applied if the difference between the two levels is 15 dB or more	5 dB[2]	C-weighting is designed to be more responsive to low-frequency noise, especially at higher overall levels
Impulsive Noise	A-weighted fast response and impulsive response	If difference in A-weighted maximum noise levels between fast response and impulse response is greater than 2 dB	Apply difference in measured levels as the correction, up to a maximum of 5 dB.	Characterised by a short rise time of 35 milliseconds (ms) and decay time of 1.5 s.
Intermittent Noise	Subjectively assessed	Level varies by more than 5 dB	5 dB	Adjustment to be applied for **night-time only.**
Duration	Single-event noise duration may range from 1.5 min to 2.5 h	On event in any 24-hour period	0 to – 20 dB(A)	The acceptable noise level may be increased by an adjustment depending on duration of noise.
Maximum Adjustment	Refer to individual modifying factors	Where two or more modifying factors are indicated	Maximum correction of 10dB(A)[2] (excluding duration correction)	

Notes:

1. Corrections to be added to the measured or predicted levels.
2. Where a source emits tonal and low-frequency noise, only one 5 dB correction should be applied if the tone is in the low-frequency range.

Sleep Disturbance

The NPI establishes sleep disturbance criteria for residential receivers in close proximity to industrial noise sources during the night-time period, such as vehicle movements and car door slams on private roads. The criteria for protecting the amenity of surrounding residential receivers regarding sleep disturbance is:

- $L_{Aeq,15min}$ 40 dB(A) or prevailing RBL plus 5dB, whichever is greater, and/or
- L_{AFmax} 52 dB(A) or prevailing RBL plus 15dB, whichever is greater

Table 8 summarises the sleep disturbance criteria for the proposed development.

Table 8: Sleep Disturbance Criteria

Period	Sleep Disturbance Criteria	
	L_{AFmax} – dB(A)	$L_{Aeq,\ 15min}$ – dB(A)
Residential along Howick Street		
Night (10:00pm to 7:00am)	52	41
Residential along Durham Street		
Night (10:00pm to 7:00am)	54	44

5.2.3 Project Noise Trigger Levels (PNTL)

The following criteria is applicable for the external noise emissions from the development, as detailed below inTable 9. These project noise trigger levels are in accordance with the requirements of the NSW NPI, and shall be assessed to the most affected point on or within the residential boundary.

Table 9: Project noise trigger levels

Period	Descriptor	PNTL dB(A)
Residential receivers along Durham Street		
Day (7:00am to 6:00pm)	$L_{Aeq,15min}$	51
Evening (6:00pm to 10:00pm)	$L_{Aeq,15min}$	48
Night (10:00pm to 7:00am)	$L_{Aeq,15min}$	43
	L_{AFmax}	54
Residential receivers along Howick Street		
Day (7:00am to 6:00pm)	$L_{Aeq,15min}$	46
Evening (6:00pm to 10:00pm)	$L_{Aeq,15min}$	44
Night (10:00pm to 7:00am)	$L_{Aeq,15min}$	41
	L_{AFmax}	52
Commercial receivers		
When in use	$L_{Aeq,15min}$	63
Passive Recreation (Park)		
When in use	$L_{Aeq,15min}$	48
Active Recreation (Park)		
When in use	$L_{Aeq,15min}$	53

Where necessary, noise mitigation measures will be incorporated in the design to ensure that noise levels comply with the recommended noise emission criteria noted above.

5.3 Traffic Generation Noise Criteria

Road traffic noise impact is assessed in accordance with the introduced NSW Road Noise Policy (Office of Environment and Heritage July 2011) which supersedes the *NSW Environmental Criteria for Road Traffic Noise* (ECRTN, Department of Environment Climate Change and Water 1999). The criterion (Table 3 – Road Traffic Noise Assessment Criteria for Residential Land Uses) divides land use developments into different categories and lists the respective criteria for each case. The category that is relevant to the proposed use of the site is shown below in Table 10.

Table 10: NSW Road Noise Policy – Traffic noise assessment criteria

Road Category	Type of project/land use	Assessment Criteria – dB(A)	
		Day (7am – 10pm)	Night (10pm – 7am)
Arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,1\ hour}$ 60 (external)	$L_{Aeq,1\ hour}$ 55 (external)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq,1\ hour}$ 55 (external)	$L_{Aeq,1\ hour}$ 50 (external)

In the event that the traffic noise at the site is already in excess of the criteria noted above, the NSW RNP states that the primary objective is to reduce the existing level through feasible and reasonable measures to meet the criteria above.

If this is not achievable, Section 3.4.1 Process for applying the criteria – Step 4 states that for existing residences affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise should be limited to 2dB above that of the corresponding 'no build option'.

5.4 Construction Noise Criteria

Noise criteria for construction sites are established in accordance with the Interim Construction Noise Guideline (*ICNG July 2009*) by NSW Environment Protection Authority (EPA). It is important to note that the recommended criteria are for planning purposes only. Numerous other factors need to be considered when assessing potential noise impacts from construction works.

However, in undertaking the assessment of potential noise intrusion associated with the proposed construction activities, Chapter 4 of the NSW EPA ICNG (July 2009) were specifically referenced. The noise limits are presented in Table 11, and are applicable to the development.

Table 11: NSW ICNG Construction noise criteria

Time of Day	Management Level $L_{Aeq,15min}$ *	How to Apply
Recommended Standard Hours: Mon – Fri (7am – 6pm) Sat (8am – 1pm) No work on Sunday & Public Holidays	Noise Affected RBL + 10dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq,15min}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residences of the nature of works to be carried out, the expected noise levels and duration as well as contact details.
	Highly Noise Affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur in, taking into account: • Times identified by the community when they are less sensitive to noise (such as before and after school, for works near schools, or mid-morning or mid-afternoon for works near residences) • If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside Recommended Standard Hours	Noise Affected RBL + 5dB	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see section 7.2.2. of NSW EPA ICNG (July 2009).

NOTE: Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Source: Chapter 4 (Table 2 Sec 4.1.1) of NSW EPA ICNG

Table 12 presents the noise management level for other noise sensitive land used in accordance with NSW EPA ICNG.

Table 12: Noise management level for other noise sensitive land uses (other than residences)

Land Use	Management level, $L_{Aeq(15mins)}$. Applies when the property are being used.
Hospital wards and operating theatres	Internal noise level , 45dB(A)
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level , 65dB(A)
Passive recreation areas (characterised by contemplative activities that generate little noise and where benfefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level , 60dB(A)

5.5 Construction Vibration Criteria

The NSW Environment Protection Authority (EPA) developed a document, "Assessing vibration: A technical Guideline" in February 2006 to assist in preventing people from exposure to excessive vibration levels within buildings. The guideline does not however address vibration induced damage to structures or structure-borne noise effects. Vibration and its associated effects are usually classified as continuous, impulsive or intermittent.

5.5.1 Human Comfort – Continuous and Impulsive Vibration Criteria

Structural vibration in buildings can be detected by occupants and can affect them in many ways including reducing their quality of life and also their working efficiency. Complaint levels from occupants of buildings subject to vibration depend upon their use of the building and the time of the day.

Maximum allowable magnitudes of building vibration with respect to human response are shown in Table 13. It should be noted that the human comfort for vibration criteria are more stringent than the building damage criteria.

Table 13: Preferred and maximum weighted RMS values for continuous and impulsive vibration

Location	Assessment period[1]	Preferred values		Maximum values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Continuous vibration					
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night time	0.007	0.005	0.014	0.010
Impulsive vibration					
Residences	Daytime	0.30	0.21	0.60	0.42
	Night time	0.10	0.071	0.20	0.14

Human Comfort – Intermittent Vibration Criteria

Disturbance caused by vibration will depend on its duration and its magnitude. This methodology of assessing intermittent vibration levels involves the calculation of a parameter called the Vibration Dose Value (VDV) which is used to evaluate the cumulative effects of intermittent vibration. Various studies support the fact that VDV assessment methods are far more accurate in assessing the level of disturbance than methods which is only based on the vibration magnitude.

Table 14: Acceptable Vibration Dose Values for Intermittent Vibration (m/s1.75)

Location	Daytime (7:00am to 10:00pm)		Night-time (10:00pm to 7:00am)	
	Preferred value	Maximum value	Preferred value	Maximum value
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and place of worship	0.40	0.80	0.40	0.80

5.5.2 Structural Damage – Vibration Criteria

Ground vibration criteria are defined in terms of levels of vibration emission from construction activities which will avoid the risk of damaging surrounding buildings or structures. It should be noted that human comfort criteria are normally expressed in terms of acceleration whereas structural damage criteria are normally expressed in terms of velocity.

Most commonly specified structural vibration levels are defined to minimize the risk of cosmetic surface cracks and are set below the levels that have the potential to cause damage to the main structure. Structural damage criteria are presented in German Standard DIN4150-Part 3 “Structural vibration in buildings – Effects on structures” and British Standard BS7385-Part 2: 1993 “Evaluation and Measurement for Vibration in Buildings”. Table 15 indicates the vibration limits presented in DIN4150-Part 3 to ensure structural damage doesn’t occur.

Table 15: Guideline value of vibration velocity, vi, for evaluating the effects of short-term vibration

Line	Type of Structure	Vibration velocity, vi, in mm/s			
		Foundation			Plane of floor of uppermost full storey
		At a frequency of			
		Less than 10Hz	10 to 50Hz	50 to 100*Hz	All Frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that, because of their particular sensitivity to vibration, do not correspond to those listed in lines 1 and 2 and are of great intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

*For frequencies above 100Hz, at least the values specified in this column shall be applied

5.5.3 Vibration Objectives

Table 16 indicates the vibration criteria for the nearest residential and commercial properties to the development.

Table 16: Construction vibration criteria summary

Location	Period	Human Comfort Vibration Objectives			Building damage Objectives – Velocity (mm/s)
		Continuous mm/s^2 (RMS)		Intermittent $m/s^{1.75}$ (VDV)	
		z-axis	x- and y-axis		
Residential	Daytime	10 - 20	7 - 14	0.20 - 0.40	5
	Night time	7 - 14	5 - 10	0.13 - 0.26	5
Commercial	Any time	20 - 40	14 - 28	0.40 – 0.80	20

6. Operational Noise Impact Assessment

6.1 Mechanical Noise Emissions

Noise sources from general operation of the development site typically include mechanical services noise from air-conditioning equipment, car park exhaust fans. These noise sources have been used to predict the noise impact at on-site residential noise sensitive receivers. These noise-sensitive receivers include the following (Refer to Figure 2):

- Residential receivers across Durham Street
- Residential receivers across Howick Street
- Other hospital receivers within Bathurst Hospital Campus

The following noise sources are associated with the site operation, and details about expected noise levels from these sources are given in the ensuing sub-sections. Noise sources from general operations at the site typically include mechanical services noise from air-conditioning equipment and exhaust fans located on the rooftop plant of the proposed development. These noise sources have been used to predict the worst-case scenario to nearby residential receivers.

The proposed development has the following mechanical noise sources:

- Rooftop Chillers
- Rooftop AHUs
- Carpark exhaust fans
- Stair pressurized fans

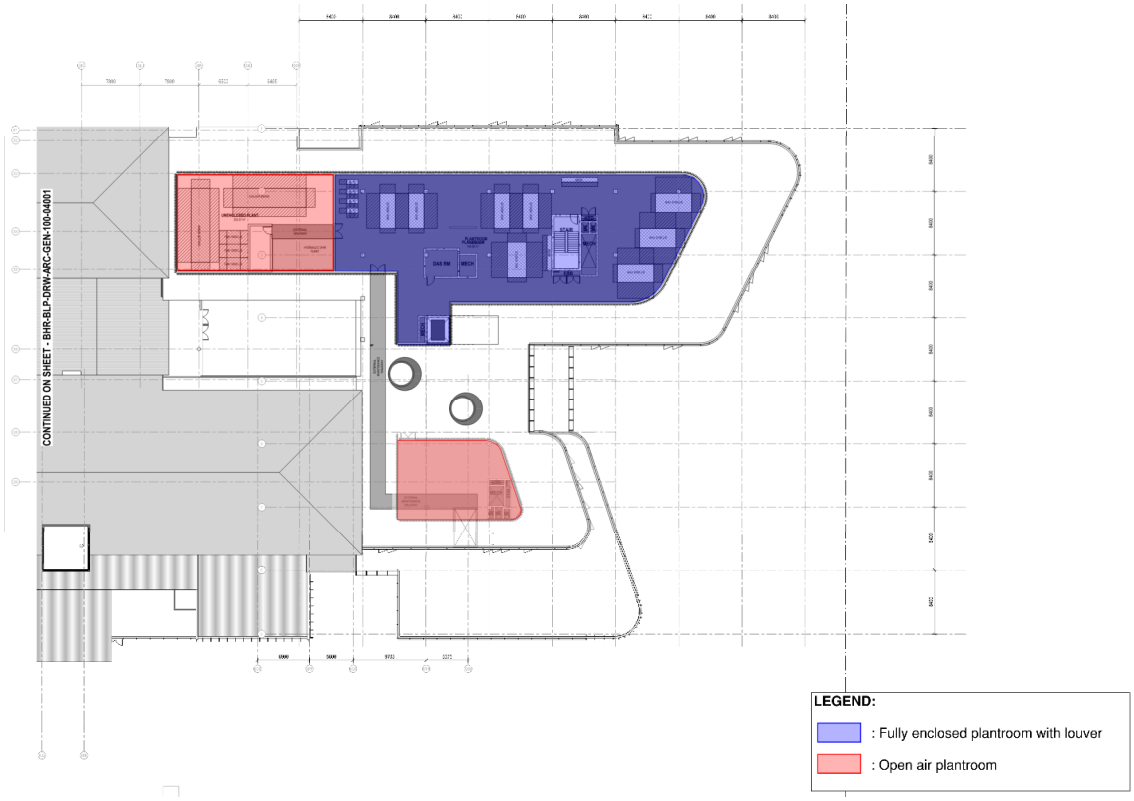


Figure 6: New mechanical plant layout (Rooftop) – Eastern Corner

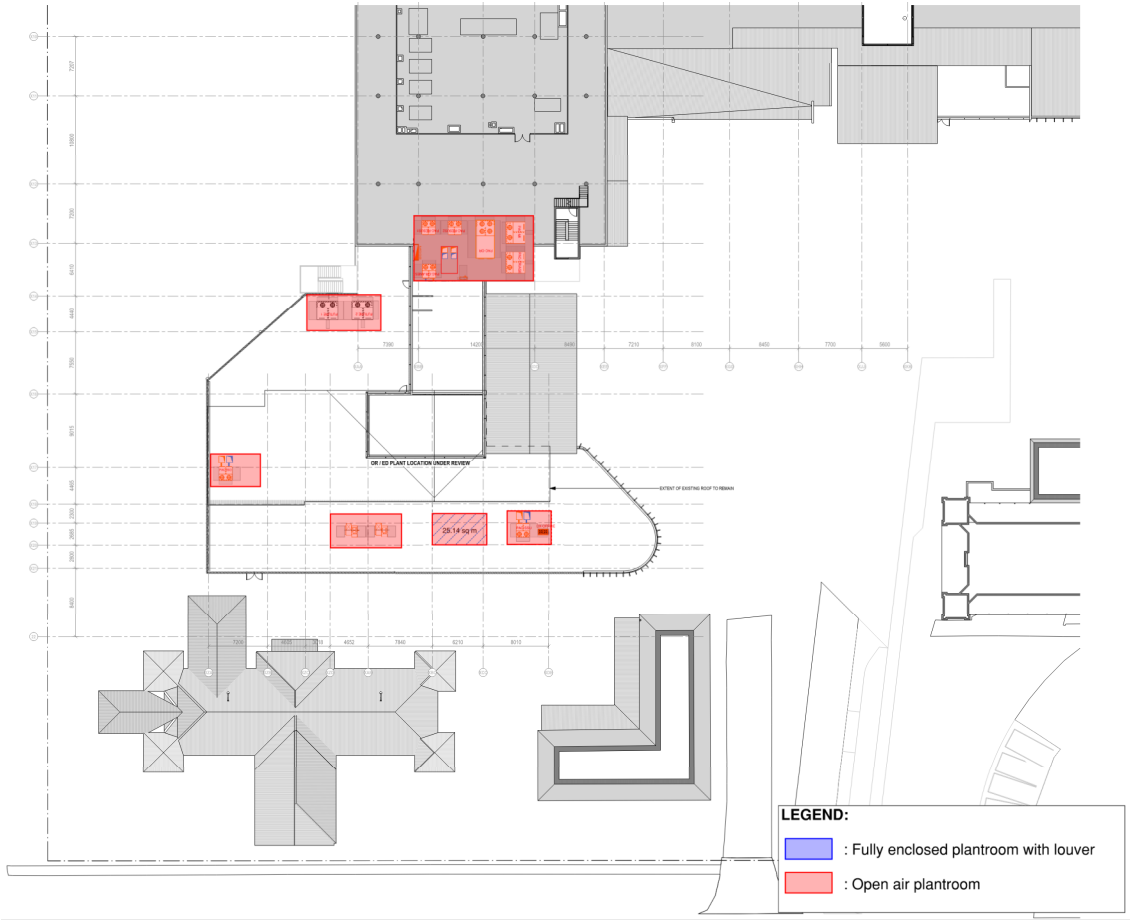


Figure 7: New mechanical plant layout (Rooftop) – Western Corner

To assess the worst-case scenario, it is assumed that the air conditioning units associated with the proposed development are running at any time throughout a 24hr period. With all, night time is the most stringent period for the noise generated by the operation of the mechanical plant, therefore this criterion was used as the noise target at the boundary of the nearest sensitive receivers for the project.

Due to the early stage of works the mechanical plant for the project haven't been selected. Therefore, typical sound power levels for the mechanical plant associated with similar development have been used for this assessment. Table 17 presented the sound power levels for the mechanical plant used for this assessment. Typical mechanical unit spectrums have been used, and the assessment will need to be amended once specific units have been selected.

Table 17: Sound power levels for mechanical plant

Item	Path	SWL re 10^{-12} W dB								
		63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4 KHz	8 KHz	Overall dB(A)
Chiller	Overall	93	94	97	98	97	94	90	85	101
Typical fans	Inlet	103	94	104	104	102	99	97	95	107
	Outlet	100	96	103	103	100	99	97	94	106
	Inlet	44	64	69	70	78	76	74	68	82

Item	Path	SWL re 10^{-12} W dB								
		63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4 KHz	8 KHz	Overall dB(A)
AHU (6,100L/s)	Outlet	47	67	71	78	83	81	78	72	87
AHU (4,500L/s)	Inlet	44	64	69	70	78	76	74	68	82
	Outlet	47	67	71	78	83	81	78	72	87
30-40kW PAC Unit	Overall	92	93	93	92	90	86	82	76	94

6.1.1 Assessment to the NSW EPA Noise Policy for Industry (NPfI)

Calculation of noise from the site operations was based on the typical worst-case scenario during the assessment periods including day, evening and night time. The location of noise sources and description are presented in Figure 6.

Noise emissions from the proposed development associated with noise sources identified in Figure 6, were calculated for the nearest potentially affected receiver locations. Noise emissions were determined by modelling the noise sources and receiver locations to predict the changes in the total noise from a site.

Noise levels were calculated at the nearest affected residential locations (show in Figure 2) considering the worst-case scenario of all plant and equipment operating simultaneously.

Table 18 presents the predicted noise levels at the worst case most affected noise sensitive receiver between 10pm-7am (night-time/most stringent) period without any noise mitigation measures. As presented below, the predicted noise level at the nearest receivers is expected to exceed the noise emission criteria during night-time (most stringent) period.

Table 18: Predicted noise levels at worst-case most affected receiver (without mitigation measures)

Receiver Location	Predicted Noise Level $L_{Aeq,15min}$ - dB(A)	Criteria dB(A)	Compliance (✓/✗)
Residential along Durham Street	59	43 (Night time)	✗
Residential along Commonwealth Street	54	41 (Night time)	✗

Noise Mitigation Measures

Therefore, to minimize the noise impact from the proposed development towards the nearest receivers, Stantec highly recommend for the following noise mitigation measures to be implemented. Figure 8 presents the proposed noise mitigation measures to achieve compliance with the NSW NPI for mechanical plant related noise. The following acoustic mitigation measures have been the included in the design submission for the proposed development.

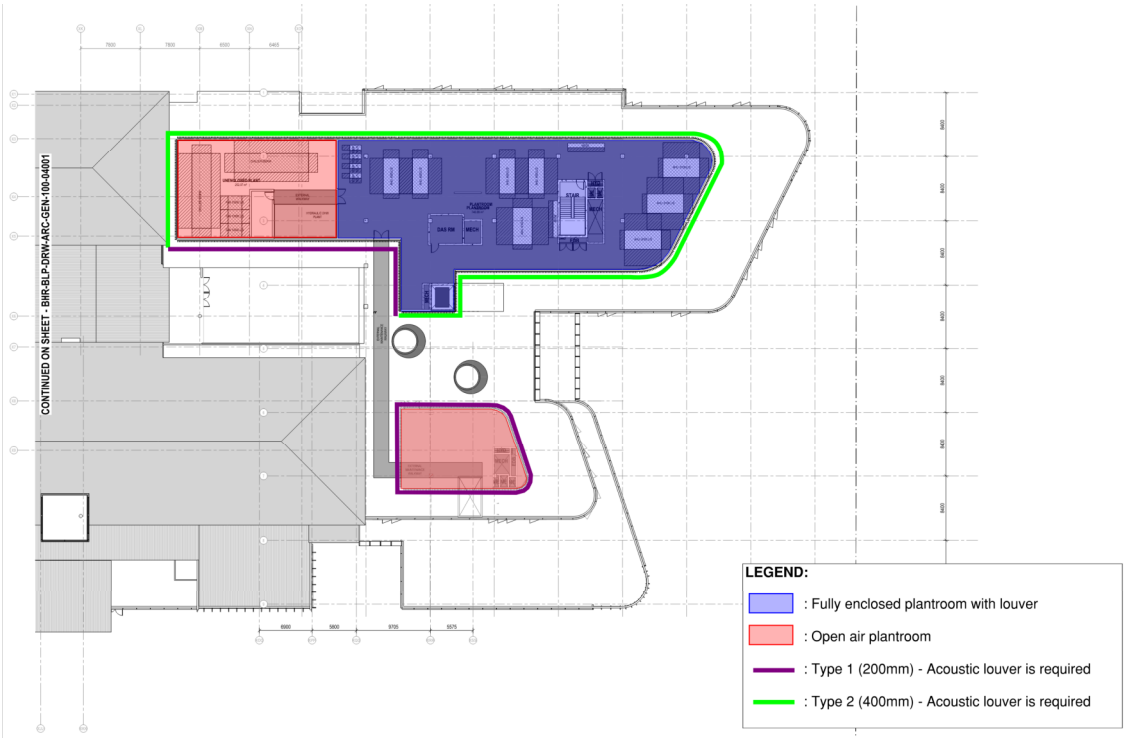


Figure 8: Proposed noise mitigation measures (Eastern Plantroom)

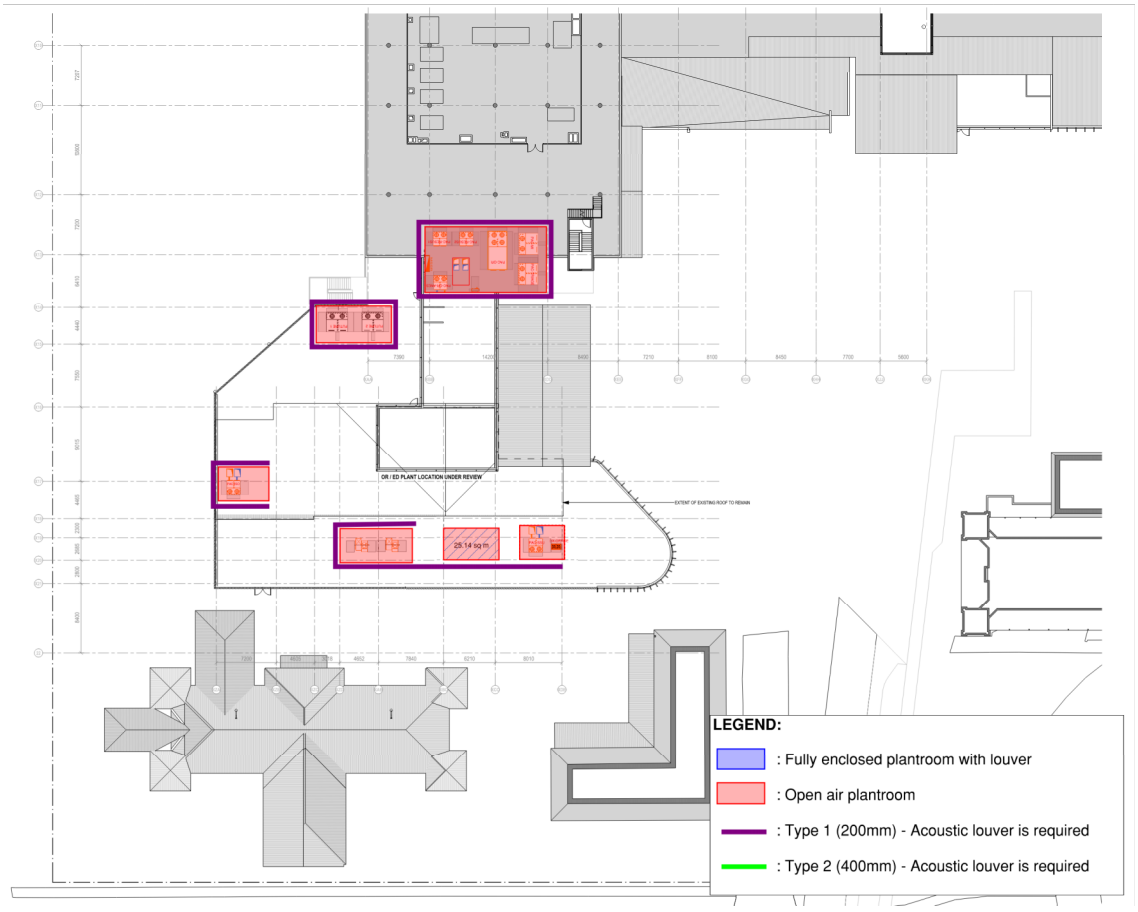


Figure 9: Proposed noise mitigation measures (Western Plantroom)

Acoustic barriers/louvers to enclose around the extent of externally located central plant. The barrier/louvers should extend a minimum of 1000mm above the height of any externally located equipment. Acoustic louvre should be used with equivalent or greater insertion loss to those presented in Table 19.

Table 19: Minimum required Insertion Loss from Acoustic Louvres for rooftop plant items

Item	Insertion Loss						
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
Acoustic Louvre Type 1 (i.e. Acran 200)	4	8	7	11	21	24	16
Acoustic Louvre Type 2 (i.e. Acran 400)	4	9	14	19	21	24	24

Furthermore, to minimise noise breakout-outs from the plantroom to adjacent spaces, Stantec also highly recommend the use of NRC0.90 acoustic insulation (e.g. Martini Absorb HD 50 or equivalent) at all ceiling areas of the plantroom. This is to minimise the reverberation time of the plant room as far as possible.

The predicted noise levels at the worst case most affected noise sensitive receiver for the night-time (most stringent) period have been presented in Table 20. As presented below, the predicted noise level at the nearest receivers is expected to comply with the noise emission criteria during night-time (most stringent) period with the proposed noise mitigation measures.

Table 20: Predicted noise levels at worst-case most affected receiver (with mitigation measures)

Receiver Location	Predicted Noise Level $L_{Aeq,15min}$ - dB(A)	Criteria dB(A)	Compliance (✓/✗))
Residential along Durham Street	40	43 (Night time)	✓
Residential along Commonwealth Street	41	41 (Night time)	✓

At this stage, selections and specific locations for mechanical equipment have potential to change; therefore this assessment and mitigation measures should be considered as preliminary. A full detailed analysis of all plant items should be carried out as the design progresses. Given the proximity of the site to the nearby noise-sensitive receivers, it is not expected that the mechanical plant items will cause any adverse impact to the surrounding receivers provided the minimum mitigation measures outlined above have been met.

Additional mitigation measures for the mechanical plant should be considered during the design development phase so as to comply with the outlined criteria at the nearest sensitive receivers. These amelioration measures could include but not limited to the following:

- Positioning mechanical plant away from nearby receivers
- Select low noise mechanical equipment
- Acoustic attenuators fitted to duct work
- Acoustic louvres or solid barriers may be required, surrounding plant items on the rooftop. This mitigation may also be influenced by internal noise criteria within the hospital development itself.
- Where possible, locate noisy plant within an enclosed space.
- Internally located equipment which exhausts at roof level should include sufficient ductwork to allow for acoustic internal lining or an attenuator for supply and exhaust to meet environmental noise criteria.

Note that this is a preliminary solution as the design is yet to be finalized. A detailed acoustic assessment will be conducted during the design stage as more information becomes available regarding performance data of specific mechanical equipment or any further mechanical design information. Acoustic treatment will be proposed to ensure compliance with the project noise trigger levels established in Section 5.2.3.

6.2 Façade Analysis

6.2.1 Noise Modelling

A 3D acoustic modelling for external noise intrusion from the surrounding roads was conducted using the software SoundPlan (Version 8.2). Noise levels from the road were calculated in accordance with the Calculation of Road Traffic Noise (CRTN) method and calibrated to attended measurements and logger data from around the site. This modelling software is recognized by regulatory authorities around Australia and is endorsed by the NSW EPA for the use in projects of this scale. The acoustic modelling was undertaken considering no specific meteorological characteristics such as dominant wind direction and speed or temperature therefore it was considered under neutral conditions.

6.2.2 Glazing Requirement

The proposed development shall implement facade glazing systems that achieve the recommended minimum acoustic performance in and glazing thickness outlined in Table 21 and Appendix C of the Noise Impact Assessment.

It is noted that uniform glazing systems across the entire façade may result in some spaces featuring internal noise levels substantially lower than the design criteria.

Recommended glazing systems are minimum requirements to satisfy the acoustic criteria, and other glazing systems with equal or better acoustic performance can be used if so required for e.g. structural or thermal reasons. Refer to Appendix C for recommended façade glazing thickness for the proposed development.

Table 21: Typical acoustic performance of glazing system

Minimum acoustic performance	Typical Single Glazed System	Typical Double Glazed System
R_W 32	6.38mm Laminated Glass	6mm/12mm air gap/6mm
Rw35	10.38mm Laminated Glass	6mm/12mm air gap/6mm
Rw39	10.5mm Vlam Hush Glass	6mm/12mm air gap/10.38mm

When choosing suitable glazing systems, it should be noted that different products perform differently at low, middle and high frequencies. As a result, special attention should be given to the sound reduction across the various frequency ranges, since poor performance especially in the lower end can lead to higher than expected internal noise levels from road traffic.

6.2.3 Façade Noise Map

Refer to Appendix A for the results of the façade noise map. These are indicative noise levels at the façade based on the measurements conducted on-site and the noise propagation modelling.

6.3 Operational Vibration Assessment

The proposed development is not expected to produce any significant vibration that may affect the surrounding receivers. Therefore, no further assessment is required.

6.4 Operational Traffic Noise Assessment

In accordance with the Traffic and Accessibility Impact Assessment revision 1 for Bathurst Health Services prepared by TTW (dated 30th July 2024), the proposed redevelopment is expected to generate an additional 133 trips during the morning peak hour and 167 trips in the afternoon peak hour.

This data has been used to calculate the expected noise increase due to traffic associated with the development. The relevant information regarding peak hour vehicle movements around the hospital has been summarized in Table 22.

Table 22: Existing and predicted traffic flow volumes (peak hour)

Trip Generations	Existing vehicles	Future Predicted	Calculated Net Increase	Calculated Noise Level Increase (dB)
AM Peak trips	324	457	133	1.5
PM Peak trips	372	539	167	1.6

As shown in Table 22 the relative increase in noise is at most 1.6dB during the peak hours, which is less than the 2dB increase criteria, therefore the proposed development is expected comply with the requirements of the NSW RNP for traffic generated noise.

7. Construction Noise & Vibration Assessment

7.1 Overview

Currently a detailed construction program is not yet full defined. This section provides general recommendations only and provides applicable criteria together with feasible and reasonable noise and vibration control practices to be observed during the construction of the proposed development.

This preliminary advice provided within this assessment shall form the basis for the Contractor's detailed Construction Noise and Vibration Management Plan (CNVMP) which shall identify any noise criteria exceedances and relevant mitigation measures once construction methods and stages are known.

7.2 Proposed Construction Hours

The following construction hours are based on Preliminary Construction Management Plan issued by TSA Riley for Bathurst Hospital Redevelopment in September 2024. The proposed construction hours are as follows:

- Monday to Friday: 7:00am to 6:00pm
- Saturday: 8:00am to 1:00pm
- Sunday and public holidays: no work
- Safety inspections are permitted from 7:00am

It is noted that the proposed construction hours are within the recommended standard construction hours outlined within the NSW Interim Construction Noise Guidelines (ICNG).

7.3 Construction Noise Assessment

A preliminary construction noise assessment has been carried out based on typical plant and machinery expected throughout the construction stages. The preliminary noise assessment has been considered at the nearest existing residential receivers.

7.3.1 Expected Construction Equipment

The noise sources likely to be associated with the works listed in the previous section of this report are presented in Table 23. The equipment noise levels have been extracted from *AS 2436:2010* Guide to *Noise and Vibration Control on Construction, Demolition and Maintenance Sites*.

Table 23: Cumulative impact - Construction equipment noise levels

Stages	Equipment	Quantity	Sound Power Level – dB(A)	Acoustical Usage Factor (%)	Usage in 15-minute period (minutes)	Time Corrected Sound Power Level ($L_{Aeq,15min}$)
Early Works & Demolition	Jackhammer	1	113	20	3	106
	Electric hand tools	5	99	70	10.5	98
	Bobcat	1	110	50	7.5	107
	Mobile Crane	1	108	20	3	101
	Truck	2	108	40	6	104
Structural Works	Powered hand tool	5	99	50	7.5	96
	Concrete pump	1	110	50	7.5	96
	Mobile crane	1	108	16	3	101
	Generator	1	110	20	15	110

Stages	Equipment	Quantity	Sound Power Level – dB(A)	Acoustical Usage Factor (%)	Usage in 15-minute period (minutes)	Time Corrected Sound Power Level ($L_{Aeq,15min}$)
	Truck	2	104	40	6	104
Fitout	Powered hand tool	10	99	50	7.5	96
	Truck	2	104	40	6	104

7.3.2 Predicted Noise Levels

The predicted noise levels have been presented in Table 24 and Table 25, and have been assessed against the construction noise criteria established in Section 5.4. Figure 10 presents the location of the Noise Catchment Area (NCA) for the most affected receivers.

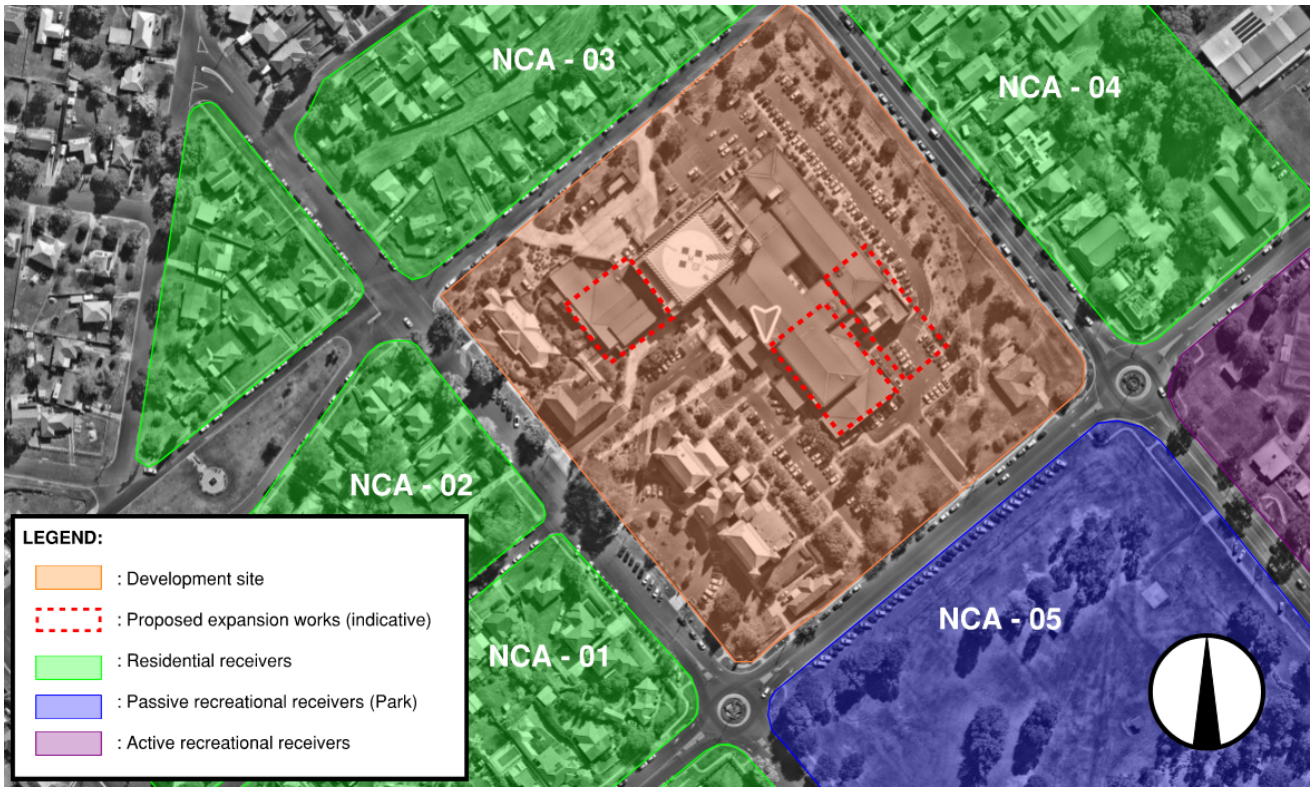


Figure 10: Location of the nearest/most affected receivers

Table 24: Predicted noise levels – Scenario 1: Early Works & Demolition

Receiver	Predicted Noise Level Range - Without Noise Mitigation $L_{Aeq,15min}$	Noise Management Level $L_{Aeq,15min}$ dB[3]	Noise Management Level Exceedance (dB) Without Noise Mitigation	Exceeds Highly Noise Affected Level? (> 75dBA)
NCA-01[2]	53 - 65	51	Up to 14	No
NCA-02[2]	55 – 67	51	Up to 16	No
NCA-03[2]	58 – 70	51	Up to 19	No
NCA-04[1]	56 – 68	56	Up to 12	No

Receiver	Predicted Noise Level Range - Without Noise Mitigation $L_{Aeq,15min}$	Noise Management Level $L_{Aeq,15min\ dB}$[3]	Noise Management Level Exceedance (dB) Without Noise Mitigation	Exceeds Highly Noise Affected Level? (> 75dBA)
NCA-05	55 – 67	60	Up to 7	No

Note:
1. Based on unattended noise measurement at L1.
2. Based on unattended noise measurement at L2.
3. Noise Management Level = RBL + 10dB

Table 25: Predicted noise levels – Scenario 2: Structural Works

Receiver	Predicted Noise Level Range - Without Noise Mitigation $L_{Aeq,15min}$	Noise Management Level $L_{Aeq,15min}$[3]	Noise Management Level Exceedance (dB)	Exceeds Highly Noise Affected Level? (> 75dBA)
NCA-01[2]	53 – 65	51	Up to 14	No
NCA-02[2]	55 – 67	51	Up to 16	No
NCA-03[2]	58 – 70	51	Up to 19	No
NCA-04[1]	56 – 68	56	Up to 12	No
NCA-05	55 – 67	60	Up to 7	No

Note:
1. Based on unattended noise measurement at L1.
2. Based on unattended noise measurement at L2.
3. Noise Management Level = RBL + 10dB

Table 26: Predicted noise levels – Scenario 3: Internal Fit-outs[4]

Receiver	Predicted Noise Level Range - Without Noise Mitigation $L_{Aeq,15min}$	Noise Management Level $L_{Aeq,15min}$[3]	Noise Management Level Exceedance (dB)	Exceeds Highly Noise Affected Level? (> 75dBA)
NCA-01[2]	38 – 51	51	-	No
NCA-02[2]	38 – 53	51	Up to 2	No
NCA-03[2]	42 – 56	51	Up to 5	No
NCA-04[1]	41 – 54	56	-	No
NCA-05	40 - 53	60	-	No

Note:
1. Based on unattended noise measurement at L1.

2. Based on unattended noise measurement at L2.
3. Noise Management Level = RBL + 10dB
4. As a conservative approach, a minimum of 20dB reduction have been assumed for the noise breakouts through the new hospital façade/

7.4 General Acoustic Recommendations for Construction

According to AS 2436 – 2010 *"Guide to noise and vibration control on construction, demolition and maintenance sites"* the following techniques could be applied to minimize the spread of noise and vibrations to the potential receivers.

7.4.1 Noise

If a process that generates significant noise levels cannot be avoided, the amount of noise reaching the receiver should be minimized. Two ways of achieving this are to either increase the distance between the noise source and the receiver or to introduce noise reduction measures such as screens.

Physical methods to reduce the transmission of noise between the site works and residences, or other sensitive land uses, are generally suited to works where there is longer-term exposure to the noise. Practices that will reduce noise from the site include:

- Increasing the distance between noise sources and sensitive receivers.
- Reducing the line-of-sight noise transmission to residences or other sensitive land uses using temporary barriers (stockpiles, shipping containers and site office transportable can be effective barriers).
- Constructing barriers that are part of the project design early in the project to introduce the mitigation of site noise.
- Installing purpose-built noise barriers, acoustic sheds and enclosures.

7.4.2 Screening

On sites where distance is limited, the screening of noise may be beneficial, and this should be taken into account during the planning stages.

If structures such as stores, site offices and other temporary buildings are situated between the noisiest part of the site and the nearest dwellings, some of the noise emission from the site can be reduced. If these buildings are occupied, sound insulation measures may be necessary to protect workers inside the buildings.

A hoarding that includes a site office on an elevated structure offers superior noise reduction when compared with a standard (simple) hoarding. The acoustic performance is further enhanced when the hoarding is a continuous barrier.

Storage of building materials or the placement of shipping containers between the noise source and any noise-sensitive area may also provide useful screening and the same is true of partially completed or demolished buildings. A noisy, stationary plant can be placed in a basement, the shell of which has been completed, provided reverberant noise can be controlled. Where compressors or generators are used in closed areas, it is necessary to ensure that the exhaust gases are discharged directly to the outside air and that there is good cross-ventilation to prevent the build-up of poisonous carbon monoxide fumes and to allow an adequate air supply to maintain efficiency when operating the equipment.

Where such noise barriers are not practical, a worthwhile reduction in noise can be obtained by siting the plant behind and as close as possible to mounds of earth, which may effectively screen any noise-sensitive areas from the plant. These can often be designed into the construction schedule or site arrangement for future landscaping.

Water pumps, fans and other plant equipment that operate on a 24-hour basis may not be an irritating source of noise during the day but may be problematic at night. They should therefore be effectively screened by either situating them behind a noise barrier or by being positioned in a trench or a hollow in the ground provided this does not generate reverberant noise. In such cases, however, adequate ventilation should also be ensured. Long, temporary earth embankments can provide quite an effective noise screen for mobile equipment moving, for example, on a haulage road. When the earthworks are complete, the earth mounds should be removed if possible, with smaller, quieter excavators. A noise barrier may be a more reliable method of noise control than the imposition of restrictions on throttle settings.

In many cases it may not be practical to screen earthmoving operations effectively, but it may be possible to partially shield a construction plant or to build-in at the early stages protective features required to screen traffic noise. Where earth noise barriers are not practical due to lack of space, consideration should be given to the possibility of constructing temporary screens from wood or any equivalent material in surface density.

The usefulness of a noise barrier will depend upon its length, its height, its position relative to the source and to the receiver, and the material from which it is made. A barrier designed to reduce noise from a moving source should extend beyond the last property to be protected to a distance of not less than ten times the shortest measurement from the property to the

barrier. A barrier designed to reduce noise from a stationary source should, where possible, extend to a distance beyond the direct line between the noise source and the receiver to a distance equal to ten times the effective barrier height, which is the height above the direct line between source and receiver.

If the works are predominately within nominally closed structures, careful consideration should be given to reducing noise breakout at any openings.

7.4.3 Crane (diesel operated)

An appropriate silencer on the muffler and acoustic screen around the engine bay are recommended to attenuate the noise emission.

7.4.4 Reversing and warning alarms

Community complaints often involve the intrusive noise of alarms commonly used to provide a safe system of work for vehicles operating on a site. Beeper reversing alarm noise is generally tonal and may cause annoyance at significant distances from the work site.

There are alternative warning alarms capable of providing a safe system of work that are equal to or better than the traditional 'beeper', while also reducing environmental noise impacts. The following alternatives should be considered for use on construction sites as appropriate:

(a) Broadband audible alarms incorporating a wide range of sound frequencies (as opposed to the tonal frequency 'beep') are less intrusive when heard in the neighborhood.

(b) Variable-level alarms reduce the emitted noise levels by detecting the background noise level and adjusting the alarm level accordingly.

(c) Non-audible warning systems (e.g. flashing lights, reversing cameras) may also be employed, providing safety considerations, are not compromised.

(d) Proximity alarms that use sensors to determine the distance from objects, such as people or structures, and generate an audible alarm in cabin for the driver.

(e) Spotters or observers.

The above methods should be combined, where appropriate.

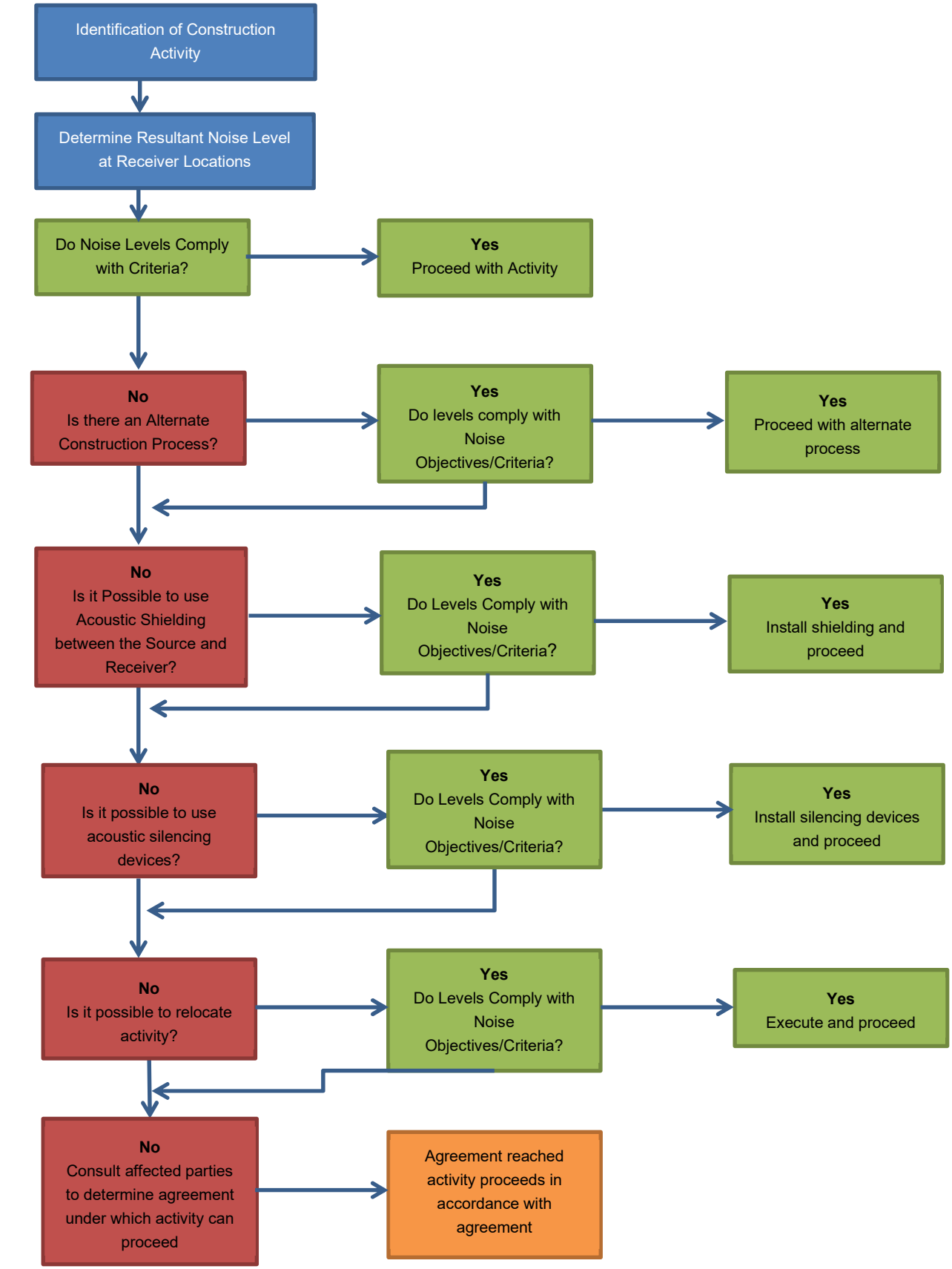


Figure 11: Noise mitigation management flow chart

7.5 Noise & Vibration Monitoring Strategy

7.5.1 General Methodology

Noise and vibration levels should be monitored from time to time to ensure that noise generated as a result of remediation and construction activities does not disturb local businesses.

Monitoring may be in the form of regular checks by the builder or indirectly by an acoustic consultant engaged by the builder and in response to any noise or vibration complaints. Where noise and vibration criteria are being exceeded or in response to valid complaints, noise and / or vibration monitoring should be undertaken. This would be performed inside the premises of the affected property and on site adjacent to the affected receivers.

Monitoring is to be undertaken by an experienced noise and vibration monitoring professional or an acoustic consultant. The results of any noise or vibration monitoring are to be provided to the relevant party or person in a timely manner allowing the builder to address the issue and respond to the complaints.

Noise and vibration monitoring can take two forms:

- Short term monitoring
- Long-term monitoring

Short-term monitoring

Short-term monitoring consists of attended monitoring when critical stages of the construction are occurring. This normally provides real-time assistance and guidance to the subcontractor on site letting them know when the noise and vibration criteria are exceeded allowing the selection of alternative method on construction or equipment selection to minimise noise and vibration impacts.

Long-term monitoring

Similarly, long-term monitoring uses noise and vibration loggers providing real-time alerts to the builder / site manager when the noise and vibration criteria are exceeded.

Typically, the noise and vibration loggers stay on site for a period of several months for the critical construction stages of the project. Sometimes the period of construction noise and vibration monitoring is dictated by the local authorities through the DA conditions.

Both methods are complementary and normally used simultaneously providing a significant of amount of data via the long-term monitoring but also providing information on the sources of noise and vibration generating exceedances via the short-term or attended monitoring.

7.5.2 Noise & Vibration Monitoring Program

The following monitoring program is proposed for this project:

Table 27 - Proposed noise and vibration monitoring locations details

Sensitive Receiver Details	Proposed Monitoring Type and Phase
R1 and R2	Noise - All Phases
	Vibration - Civil & Basement Works

The monitoring program as shown above is to be carried out during the likely noisiest stages as agreed with the acoustic engineer and contractor.

7.6 Construction Traffic Noise Generation

In accordance with Preliminary Construction Traffic Management Plan (CTMP) for Bathurst Hospital Redevelopment by TTW issued on 26th July 2024, the construction traffic vehicle volumes at peak for a hospital of this scale are likely to be in the order of 100 vehicles per day (equivalent to 11 vehicles per hour), subject to confirmation by an appointed contractor. With most movements are expected to occur throughout the day and may involve vehicles such as concrete trucks, articulated hauliers, or delivery trucks.

Furthermore, the preliminary CTMP also highlights that based on these assumptions, the construction traffic is expected to have minimal impact on the surrounding roads as activities will be managed within the site boundary with trucks entering and exiting in a forward direction.

As per preliminary CTMP, final CTMP shall be prepared and reviewed once a Contractor have been engaged.

8. Conclusion

This Noise and Vibration Impact Assessment has been prepared NSW Health Infrastructure to support State Significant Development Application for the proposed redevelopment/expansion works at Bathurst District Hospital located at 59 Mitre St, West Bathurst NSW 2795.

This report has provided criteria, in-principle treatment and design requirements which aim to achieve the statutory criteria discussed in Section 5.

Based on analyses of the proposed massing plans, all aforementioned criteria relating to the development is able to be satisfied, including the internal noise levels within each spaces and external noise emissions at the most affected receivers. Further assessments will be conducted to provide acoustic mitigation measures such as to comply with the relevant requirements as part of the Detailed Design Phase when all plant selections and locations have been detailed.

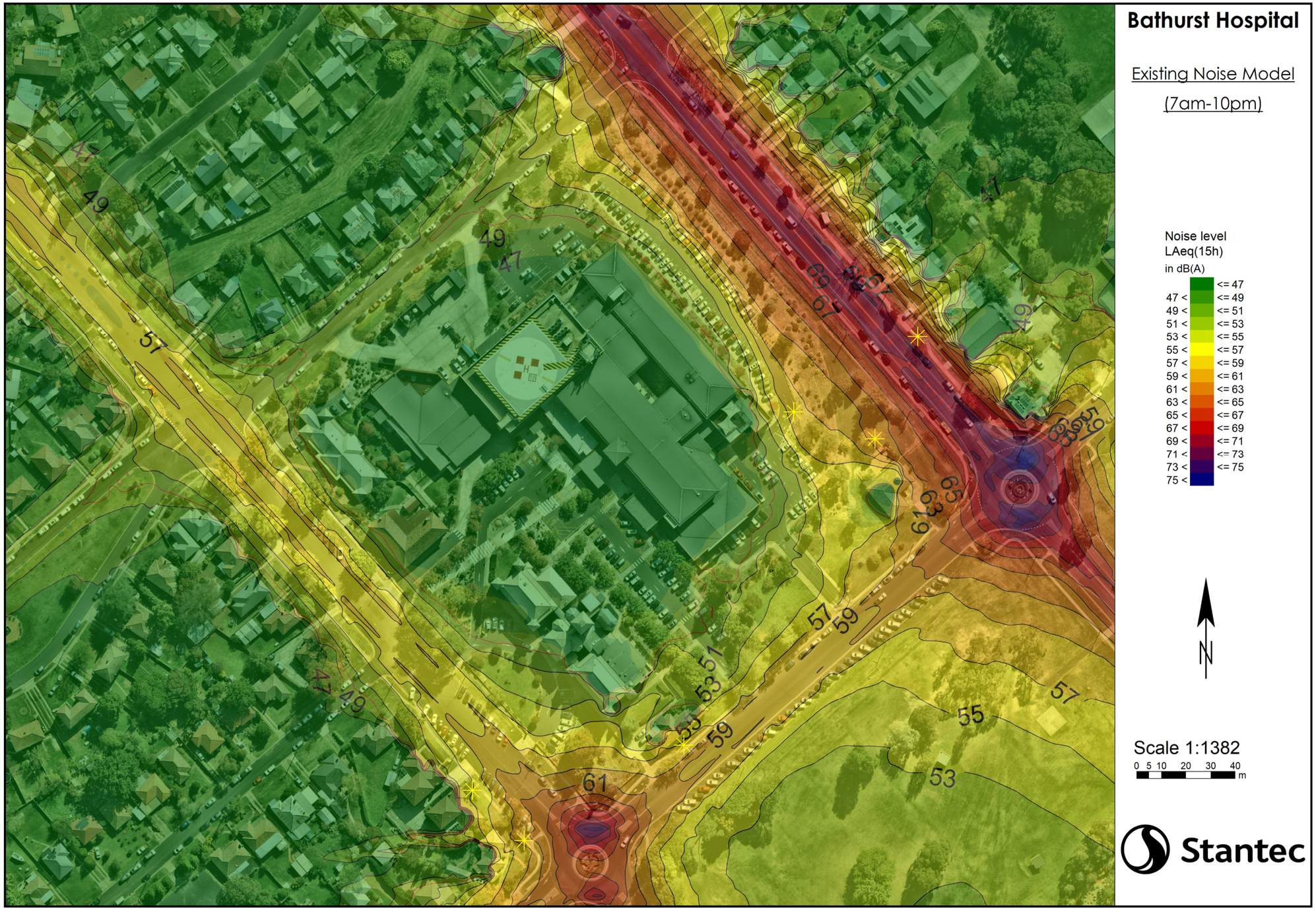
The information presented in this report shall be reviewed if any modifications to the features of the development specified in this report occur, including and not restricted to selection of air-conditioning units, layout of equipment, modifications to the building and introduction of any additional noise sources.

Appendices

Appendix A Summary of Mitigation Measures

Project Stage ***Design (D) Construction (C) Operation (O)***	**Mitigation Measures**	**Relevant Section of Report**
D / O	*Proposed noise barrier for mechanical roof top plant room*	*Section 6.1.1*
C	*Construction noise and vibration management plant*	Section 7.2 – 7.5
D / O	*Minimum façade performance to mitigate the noise break-ins to the space*	Section 6.2.3

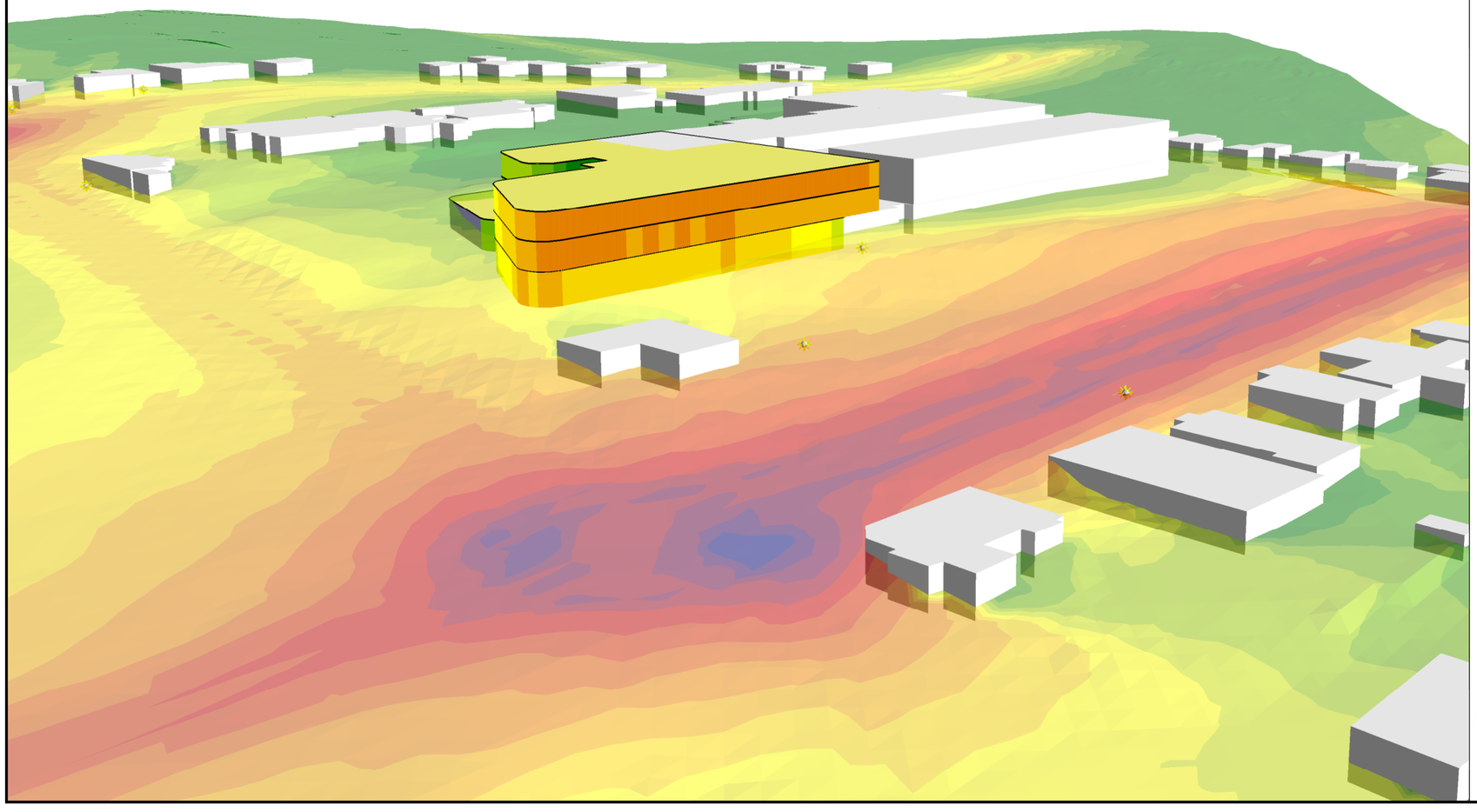
Appendix B Noise Map



Bathurst Hospital

Existing Noise Model

(7am-10pm)



Noise level
LAeq(15h)
in dB(A)

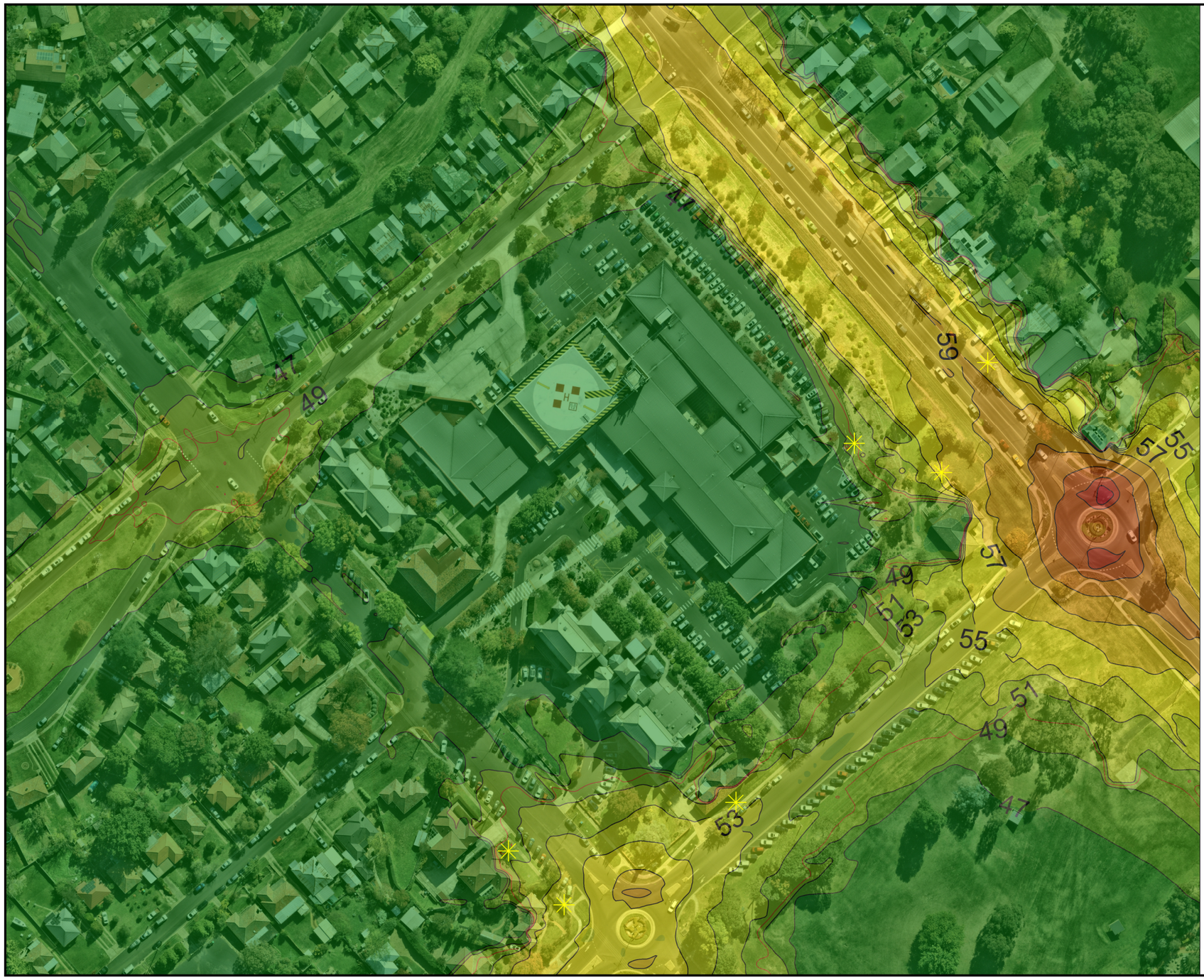
	<= 47
47 <	<= 49
49 <	<= 51
51 <	<= 53
53 <	<= 55
55 <	<= 57
57 <	<= 59
59 <	<= 61
61 <	<= 63
63 <	<= 65
65 <	<= 67
67 <	<= 69
69 <	<= 71
71 <	<= 73
73 <	<= 75
75 <	

N

Scale 1:1382

0 5 10 20 30 40 m

Stantec



Bathurst Hospital

Existing Noise Model

(10pm-7am)

Noise level
LAeq(9h)
in dB(A)

	<= 47
47 <	<= 49
49 <	<= 51
51 <	<= 53
53 <	<= 55
55 <	<= 57
57 <	<= 59
59 <	<= 61
61 <	<= 63
63 <	<= 65
65 <	<= 67
67 <	<= 69
69 <	<= 71
71 <	<= 73
73 <	<= 75
75 <	

N

Scale 1:1382

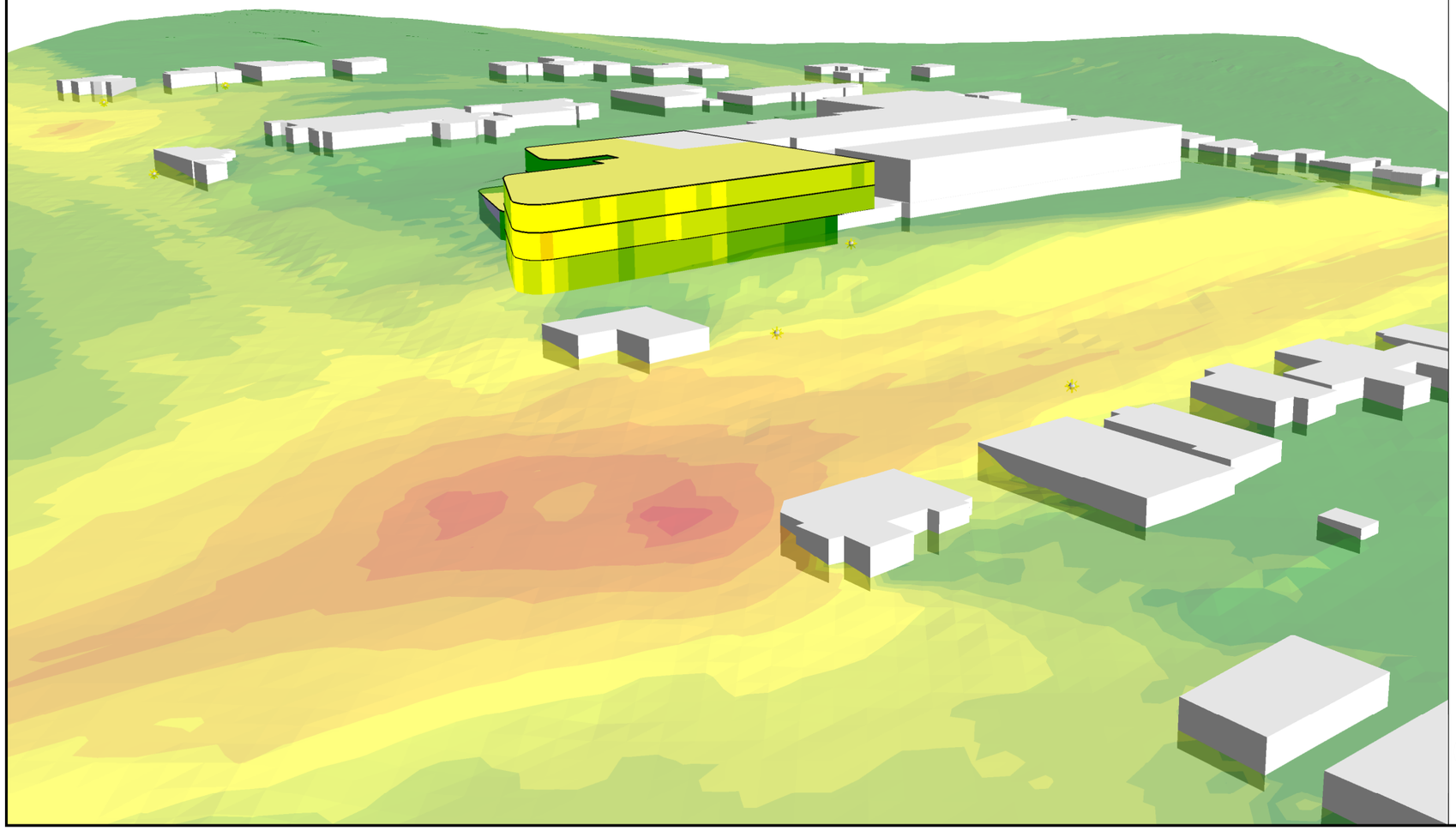
0 5 10 20 30 40 m

Stantec

Bathurst Hospital

Existing Noise Model

(10pm-7am)



Noise level
LAeq(9h)
in dB(A)

	<= 47
47 <	<= 49
49 <	<= 51
51 <	<= 53
53 <	<= 55
55 <	<= 57
57 <	<= 59
59 <	<= 61
61 <	<= 63
63 <	<= 65
65 <	<= 67
67 <	<= 69
69 <	<= 71
71 <	<= 73
73 <	<= 75
75 <	

N

Scale 1:1382

0 5 10 20 30 40 m

Stantec

Appendix C Recommended Façade Glazing Thickness

Nominated Architects: NSW Tara Veldman Reg No. 8799

Rev	Date	Revision	By	Chk.
F	02/02/2024	SD ISSUE		
G	15/03/2024	FOR COORDINATION		
H	03/05/2024	70% DD ISSUE		
I	14/06/2024	90% DD ISSUE		
J	12/07/2024	100% DD ISSUE		

Department Legend

- MH D&A
- MH D&A CORRIDOR
- TRAVEL

LEGEND :

- SITE BOUNDARY
- DENOTES LIGHT REFURBISHMENT
- EXISTING TO REMAIN
- 120/120/120 FRL & SMOKE
- EX. 120/120/120 FRL & SMOKE
- 60/60/60 FRL & SMOKE
- EX. 60/60/60 FRL & SMOKE
- SMOKE WALL
- FX SMOKE WALL

Facade Engineer
Greycat Consulting

Landscape Architect
Arcadia

Services Engineers/Acoustic/Vertical Transport/ESD
Stantec

Structural/Civil/Traffic
TTW

Project Manager
TSA

Client
Health Infrastructure

0 2 4 6 10m
1:200 @A1

Project Name
Bathurst Hospital Redevelopment

Drawing Name
PLAN - GENERAL ARRANGEMENT - LEVEL 00 - PART 2

Project No	Revision Date
22086	12/07/2024

Scale	Drawn by	Checked by
As indicated @A1	TL	AL

FOR TENDER

Drawing No.
BHR-BLP-DRW-ARC-GEN-100-00002 [J]

Billard Leece Partnership Pty Ltd
Architects & Urban Planners
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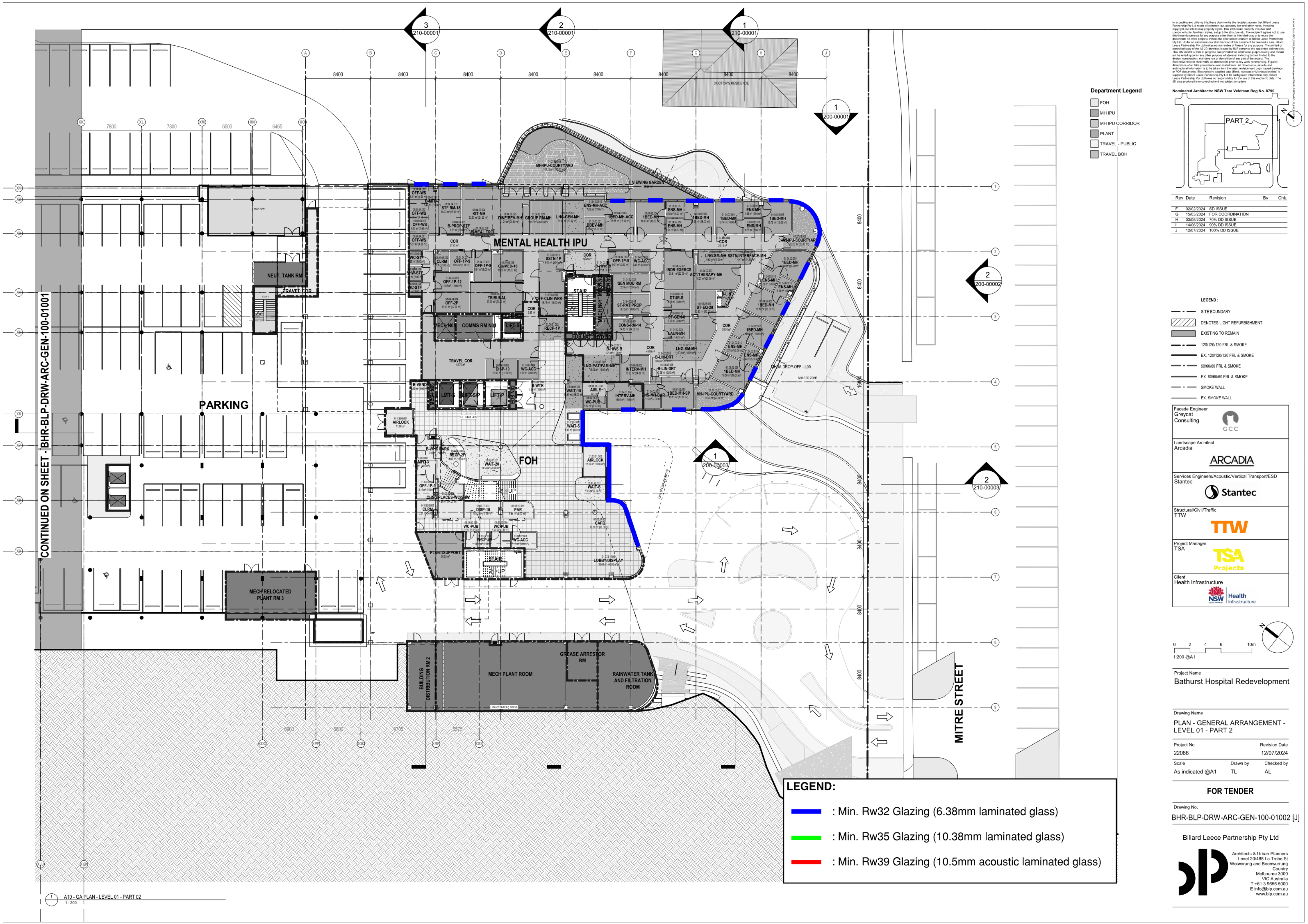
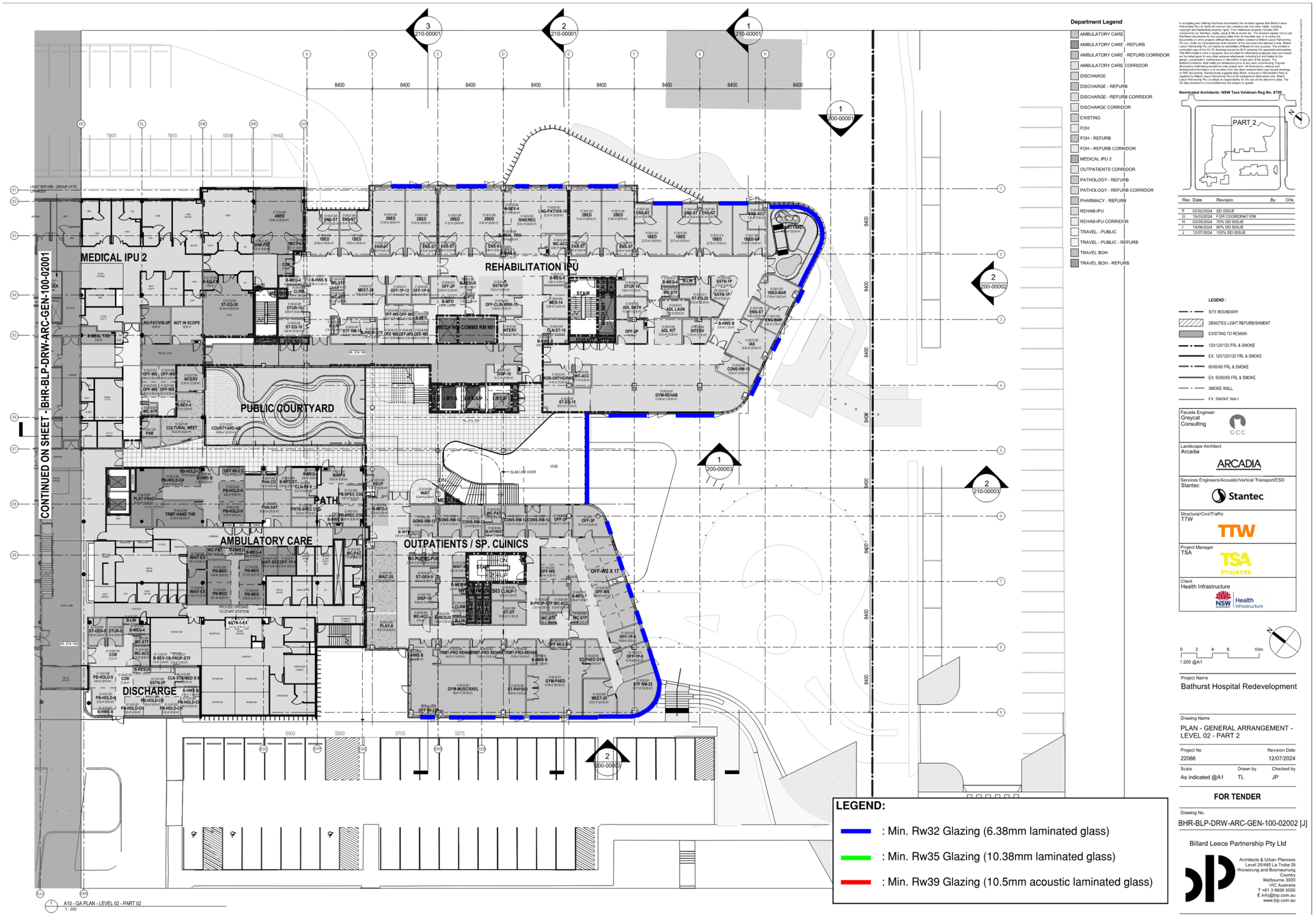
Woiworung and Boonwurrung Country
Melbourne 3000
VIC Australia
T +61 3 9658 5000
E info@blp.com.au
www.blp.com.au


MENTAL HEALTH IPU
FOH
PARKING
MITRE STREET
CONTINUED ON SHEET - BHR-BLP-DRW-ARC-GEN-100-01001
MECH PLANT ROOM
GREASE ARRESTOR RM
RAINWATER TANK AND FILTRATION ROOM
MECH RELOCATED PLANT RM 3
NEUT. TANK RM
LEGEND:
: Min. Rw32 Glazing (6.38mm laminated glass)
: Min. Rw35 Glazing (10.38mm laminated glass)
: Min. Rw39 Glazing (10.5mm acoustic laminated glass)
Department Legend
FOH
MH IPU
MH IPU CORRIDOR
PLANT
TRAVEL - PUBLIC
TRAVEL BOH
Nominated Architects: NSW Tara Veldman Reg No. 8790
PART 2
Rev | Date | Revision | By | Chk
F | 02/02/2024 | SD ISSUE
G | 15/03/2024 | FOR COORDINATION
H | 03/05/2024 | 70% DD ISSUE
I | 14/06/2024 | 90% DD ISSUE
J | 12/07/2024 | 100% DD ISSUE
Façade Engineer Greycat Consulting
Landscape Architect Arcadia
Services Engineers/Acoustic/Vertical Transport/ESD Stantec
Structural/Civil/Traffic TTW
Project Manager TSA
Client Health Infrastructure
1:200 @A1
Project Name
Bathurst Hospital Redevelopment
Drawing Name
PLAN - GENERAL ARRANGEMENT - LEVEL 01 - PART 2
Project No 22086
Revision Date 12/07/2024
Scale As indicated @A1
Drawn by TL
Checked by AL
FOR TENDER
Drawing No.
BHR-BLP-DRW-ARC-GEN-100-01002 [J]
Billard Leece Partnership Pty Ltd
A10 - GA PLAN - LEVEL 01 - PART 02
1 : 200



Department Legend

- AMBULATORY CARE
- AMBULATORY CARE - REFURB
- AMBULATORY CARE - REFURB CORRIDOR
- AMBULATORY CARE CORRIDOR
- DISCHARGE
- DISCHARGE - REFURB
- DISCHARGE - REFURB CORRIDOR
- DISCHARGE CORRIDOR
- EXISTING
- FOH
- FOH - REFURB
- FOH - REFURB CORRIDOR
- MEDICAL IPU 2
- OUTPATIENTS CORRIDOR
- PATHOLOGY - REFURB
- PATHOLOGY - REFURB CORRIDOR
- PHARMACY - REFURB
- REHAB-IPU
- REHAB-IPU CORRIDOR
- TRAVEL - PUBLIC
- TRAVEL - PUBLIC - REFURB
- TRAVEL BOH
- TRAVEL BOH - REFURB

Nominated Architects: NSW Tara Veldman Reg No. 8790

Rev	Date	Revision	By	Chk
F	02/02/2024	SD ISSUE		
G	15/03/2024	FOR COORDINATION		
H	03/05/2024	70% DD ISSUE		
I	14/06/2024	90% DD ISSUE		
J	12/07/2024	100% DD ISSUE		

LEGEND :

- SITE BOUNDARY
- DENOTES LIGHT REFURBISHMENT
- EXISTING TO REMAIN
- 120/120/120 FRL & SMOKE
- EX. 120/120/120 FRL & SMOKE
- 60/60/60 FRL & SMOKE
- EX. 60/60/60 FRL & SMOKE
- SMOKE WALL
- FX. RM/WF WALL

Facade Engineer
Greycat Consulting

Landscape Architect
Arcadia

Services Engineers/Acoustic/Vertical Transport/ESD
Stantec

Structural/Civil/Traffic
TTW

Project Manager
TSA

Client
Health Infrastructure

0 2 4 6 10m
1:200 @A1

Project Name
Bathurst Hospital Redevelopment

Drawing Name
PLAN - GENERAL ARRANGEMENT - LEVEL 02 - PART 2

Project No	Revision Date
22086	12/07/2024

Scale	Drawn by	Checked by
As indicated @A1	TL	JP

FOR TENDER

Drawing No.
BHR-BLP-DRW-ARC-GEN-100-02002 [J]

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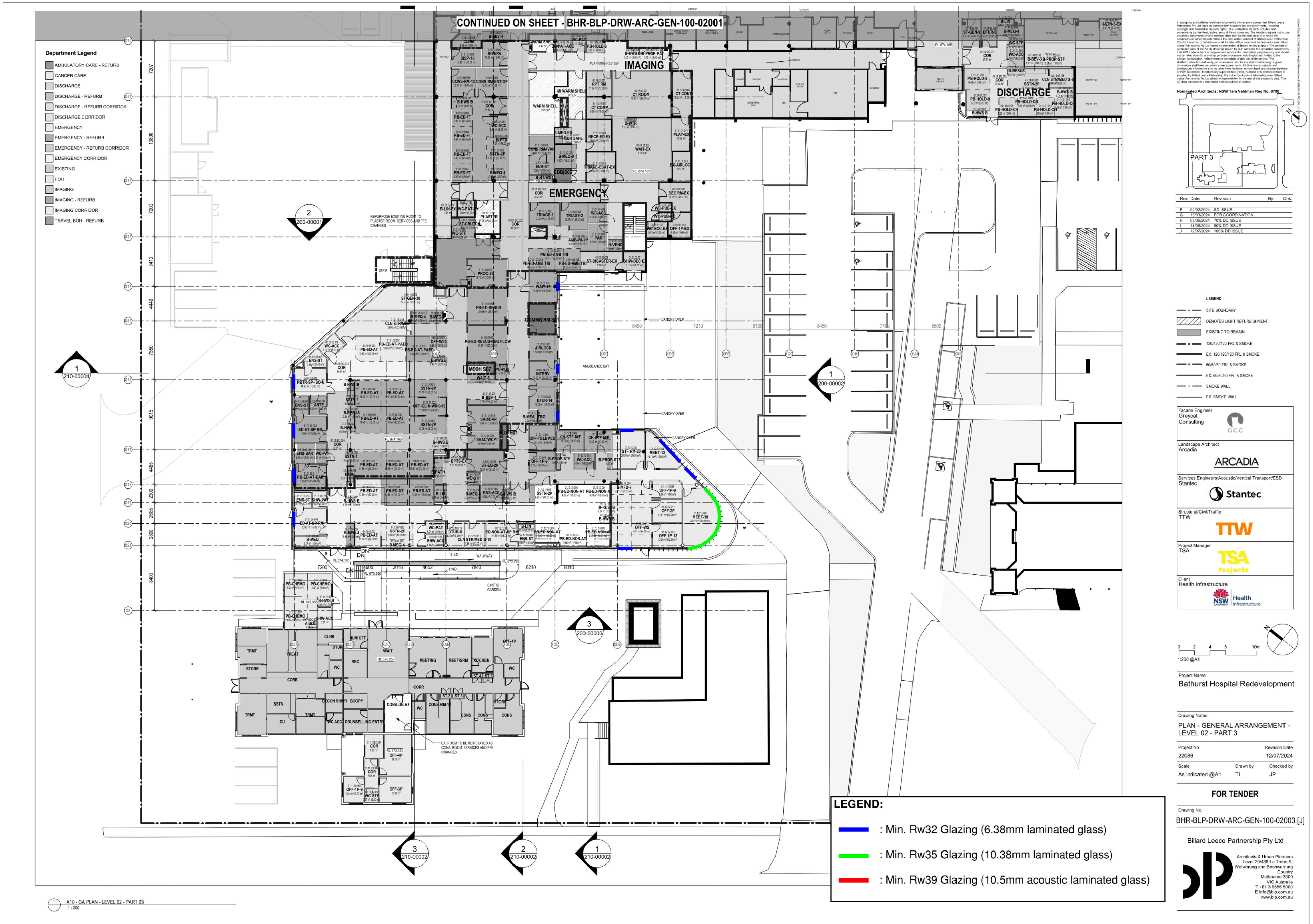
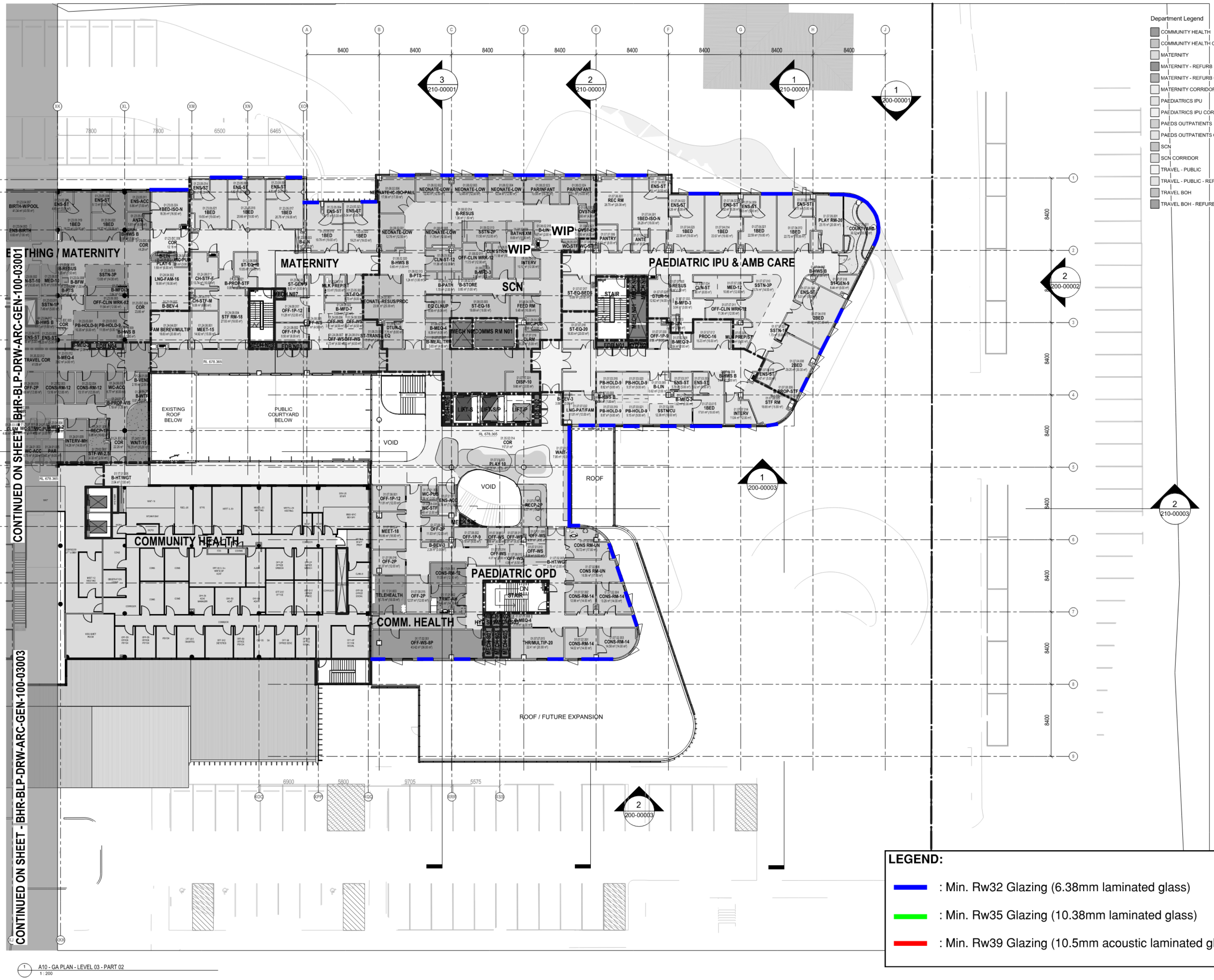
T +61 3 9658 5000
E info@blp.com.au
www.blp.com.au


CONTINUED ON SHEET - BHR-BLP-DRW-ARC-GEN-100-02001
IMAGING
EMERGENCY
DISCHARGE
Department Legend
AMBULATORY CARE - REFURB
CANCER CARE
DISCHARGE
DISCHARGE - REFURB
DISCHARGE - REFURB CORRIDOR
DISCHARGE CORRIDOR
EMERGENCY
EMERGENCY - REFURB
EMERGENCY - REFURB CORRIDOR
EMERGENCY CORRIDOR
EXISTING
FOH
IMAGING
IMAGING - REFURB
IMAGING CORRIDOR
TRAVEL BOH - REFURB
LEGEND:
: Min. Rw32 Glazing (6.38mm laminated glass)
: Min. Rw35 Glazing (10.38mm laminated glass)
: Min. Rw39 Glazing (10.5mm acoustic laminated glass)
A10 - GA PLAN - LEVEL 02 - PART 03
Nominated Architects: NSW Tara Veldman Reg No. 8790
PART 3
LEGEND :
SITE BOUNDARY
DENOTES LIGHT REFURBISHMENT
EXISTING TO REMAIN
120/120/120 FRL & SMOKE
EX. 120/120/120 FRL & SMOKE
60/60/60 FRL & SMOKE
EX. 60/60/60 FRL & SMOKE
SMOKE WALL
EX. SMOKE WALL
Facade Engineer
Greycat Consulting
Landscape Architect
Arcadia
ARCADIA
Services Engineers/Acoustic/Vertical Transport/ESD
Stantec
Structural/Civil/Traffic
TTW
Project Manager
TSA
Client
Health Infrastructure
Project Name
Bathurst Hospital Redevelopment
Drawing Name
PLAN - GENERAL ARRANGEMENT - LEVEL 02 - PART 3
Project No
22086
Revision Date
12/07/2024
Scale
As indicated @A1
Drawn by
TL
Checked by
JP
FOR TENDER
Drawing No.
BHR-BLP-DRW-ARC-GEN-100-02003 [J]
Billard Leece Partnership Pty Ltd
Architects & Urban Planners
Level 20/485 La Trobe St
Melbourne 3000
VIC Australia
www.blp.com.au



A10 - GA PLAN - LEVEL 03 - PART 02
1 : 200

LEGEND:

- : Min. Rw32 Glazing (6.38mm laminated glass) (blue)
- : Min. Rw35 Glazing (10.38mm laminated glass) (green)
- : Min. Rw39 Glazing (10.5mm acoustic laminated glass) (red)

Department Legend
- COMMUNITY HEALTH
- COMMUNITY HEALTH CORRIDOR
- MATERNITY
- MATERNITY - REFURB
- MATERNITY - REFURB CORRIDOR
- MATERNITY CORRIDOR
- PAEDIATRICS IPU
- PAEDIATRICS IPU CORRIDOR
- PAEDS OUTPATIENTS
- PAEDS OUTPATIENTS CORRIDOR
- SCN
- SCN CORRIDOR
- TRAVEL - PUBLIC
- TRAVEL - PUBLIC - REFURB
- TRAVEL BOH
- TRAVEL BOH - REFURB

Nominated Architects: NSW Tara Veldman Reg No. 8790

Rev	Date	Revision	By	Chk
G	09/02/2024	SD ISSUE		
H	15/03/2024	FOR COORDINATION		
I	03/05/2024	70% DD ISSUE		
J	14/06/2024	90% DD ISSUE		
K	12/07/2024	100% DD ISSUE		

LEGEND :
- SITE BOUNDARY
- DENOTES LIGHT REFURBISHMENT
- EXISTING TO REMAIN
- 120/120/120 FRL & SMOKE
- EX. 120/120/120 FRL & SMOKE
- 60/60/60 FRL & SMOKE
- EX. 60/60/60 FRL & SMOKE
- SMOKE WALL
- EX. SMOKE WALL

Facade Engineer: Greycat Consulting
Landscape Architect: Arcadia
Services Engineers/Acoustic/Vertical Transport/ESD: Stantec
Structural/Civil/Traffic: TTW
Project Manager: TSA
Client: Health Infrastructure

1:200 @A1

Project Name: Bathurst Hospital Redevelopment

Drawing Name: PLAN - GENERAL ARRANGEMENT - LEVEL 03 - PART 2

Project No: 22086 | Revision Date: 12/07/2024
Scale: As indicated @A1 | Drawn by: TL | Checked by: AL

FOR TENDER

Drawing No. BHR-BLP-DRW-ARC-GEN-100-03002 [K]

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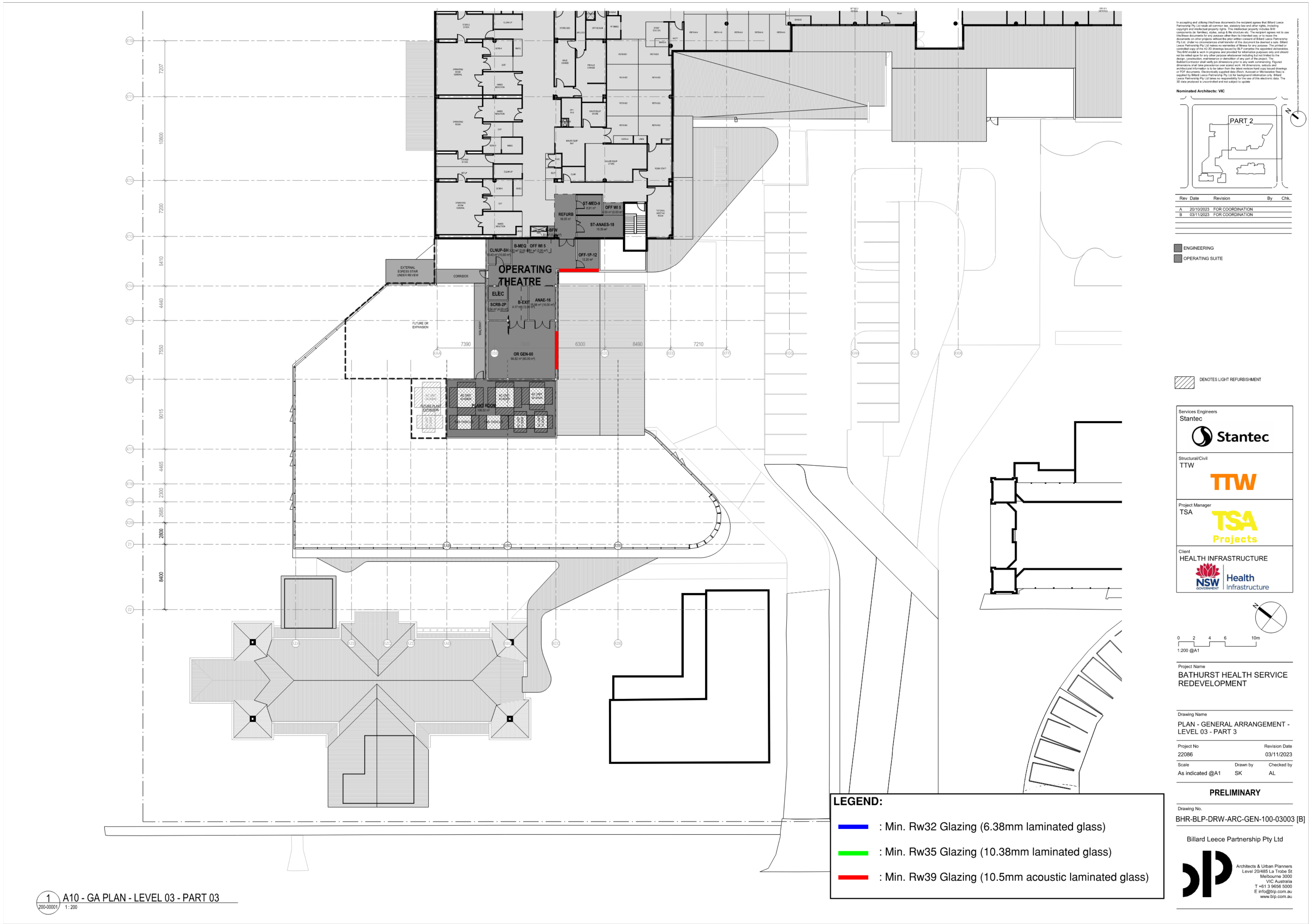

OPERATING THEATRE
PART 2
Rev Date Revision By Chk.
A 20/10/2023 FOR COORDINATION
B 03/11/2023 FOR COORDINATION
ENGINEERING
OPERATING SUITE
DENOTES LIGHT REFURBISHMENT
Services Engineers
Stantec
Structural/Civil
TTW
Project Manager
TSA
Client
HEALTH INFRASTRUCTURE
Project Name
BATHURST HEALTH SERVICE REDEVELOPMENT
Drawing Name
PLAN - GENERAL ARRANGEMENT - LEVEL 03 - PART 3
Project No
22086
Revision Date
03/11/2023
Scale
As indicated @A1
Drawn by
SK
Checked by
AL
PRELIMINARY
Drawing No.
BHR-BLP-DRW-ARC-GEN-100-03003 [B]
Billard Leece Partnership Pty Ltd
LEGEND:
: Min. Rw32 Glazing (6.38mm laminated glass)
: Min. Rw35 Glazing (10.38mm laminated glass)
: Min. Rw39 Glazing (10.5mm acoustic laminated glass)
1 A10 - GA PLAN - LEVEL 03 - PART 03
1 : 200

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