MANAGING DIRECTORS
MATTHEW PALAVIDIS
VICTOR FATTORETTO

DIRECTORS
MATTHEW SHIELDS
BEN WHITE

Prince of Wales, Nelune Comprehensive Cancer Centre and Australian Advanced Treatment Centre (NCCC & AATC) - Stage 2

DA Noise Impact Assessment

SYDNEY
A: 9 Sarah St Mascot NSW 2020
T: (02) 8339 8000
F: (02) 8338 8399

SYDNEY MELBOURNE BRISBANE CANBERRA
LONDON DUBAI SINGAPORE GREECE

www.acousticlogic.com.au
ABN: 11 068 954 343

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1 INTRODUCTION

This report details the noise impact assessment for the proposed NCCC & AATC, Stage 2, Project and the potential for noise and vibration impact to surrounding receivers.

The assessment will include potential impacts during the construction period of the project as well as the suitable criteria for noise once the projects is constructed and operating under normal conditions.

The report has been conducted in response to the following conditions within the Director Generals Requirements:

1. ***DGR 5 – Noise and Vibration***
   Identify the main noise generating sources and activities at all stages of construction, and any noise sources during operation, including the new radiotherapy bunker and cumulative impact of all plant and equipment operating simultaneously. Identify effected residential premises and outline measure to minimise and mitigate the potential noise impacts on surrounding occupancies of land.
   Relevant Polices and Guidelines
   -NSW Industrial Noise Policy (EPA)
   -Environmental Noise Control Manuel (sleep disturbance)
   - Environmental Noise Guideline (DECCW)
   Relevant Australian Standards

2. ***DGR 9 – Operation Management***
   Address noise from plant and equipment; radiation chemical and biological hazards; emergency and evacuation procedures; lighting and signage associated with the proposed development.

This assessment will include the assessment of the relevant acoustic impacts, including noise and vibration, identified within the DGR requirements above. The assessment includes the acoustic impacts during the construction period of the project as well as the normal operation of the project once construction is completed.

2 SITE LOCATION

The proposed NCCC & AATC Project is located within the Randwick Hospital precent on corner of High Street and Avoca Street. Stage 2 of the NCCC & AATC is constructed on the site of the site of the existing Institute of Oncology Treatment wing to the west of the Stage One development.

The Stage 2 building comprises nine levels divided into the following tenancies:

- Four additional levels of NCCC & AATC;
- Two levels of AATC development; and
- Three base building shell floors for future expansion.

Figure 1 below details the proposed site location as well as the potentially affected surrounding receivers within the vicinity of the site.

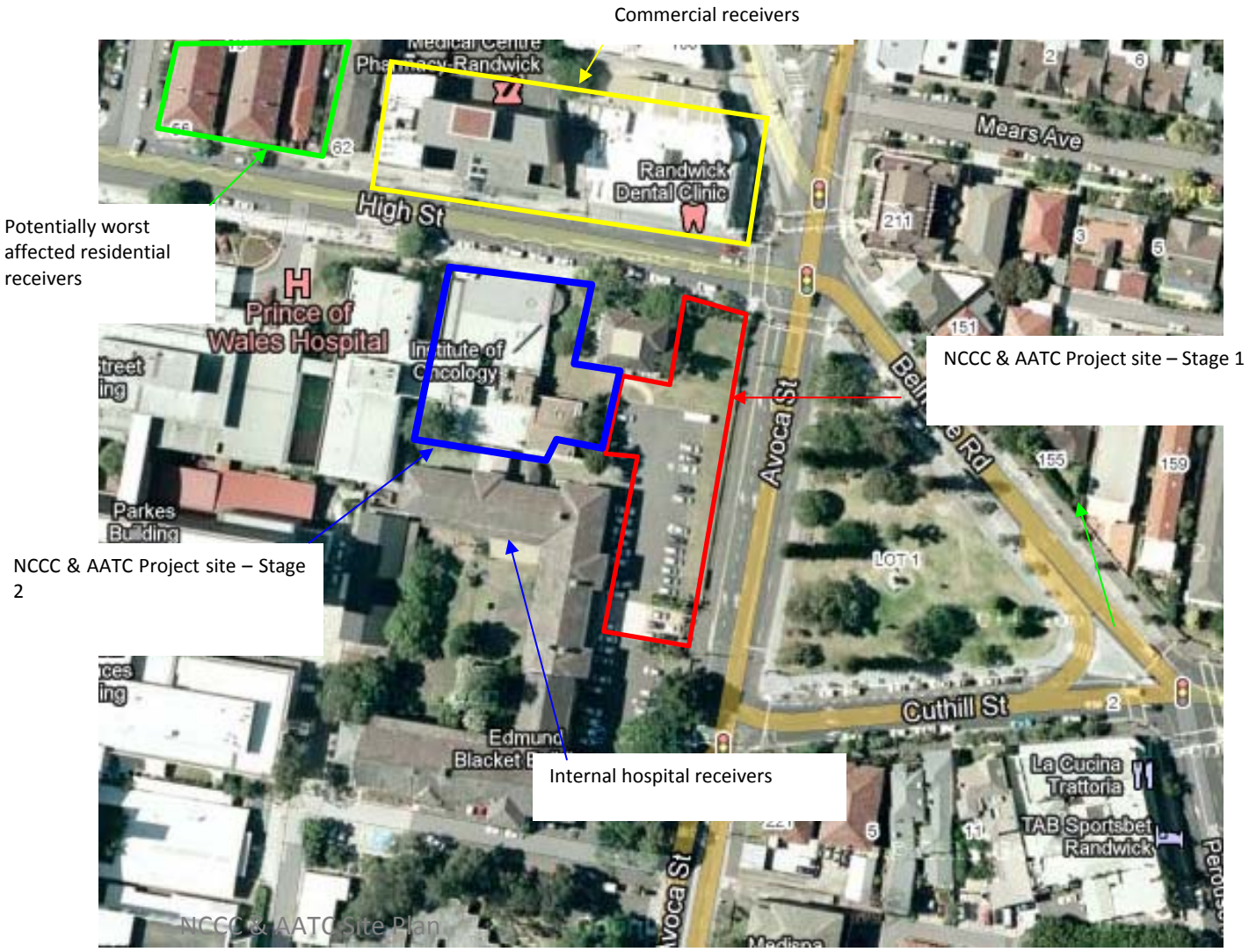


Figure 1 – Site Location and Surrounding Receivers

3 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

This section of the report presents a specification for the processes, which will be followed to manage noise and vibration associated with the proposed construction activities (including demolition, excavation and construction) which are required as part of the Stage 2, NCCC & AATC Project. The assessment has been conducted to investigate the potential for noise and vibration impact to surrounding receivers within close proximity including residential receivers and other Prince of Wales Hospital buildings.

The principal objective of this study is to undertake an evaluation of works to be performed during the operation of the various activities during construction (including demolition and excavation) and develop a management plan to ensure noise and vibration:

1. Does not impact on the internal receivers within the adjacent hospital receivers.

2. Is minimised to surrounding residential receivers in compliance with the relevant EPA and Australian Standards.

3. Does not exceed OH&S standards at surrounding receivers.

4. Is monitored when potentially high noise and vibration generating activities are being used.

This assessment will formulate/present the relevant noise and vibration criteria which construction activities are required to comply with. Additionally effective mitigation measures will be recommended where possible to ensure criteria is achieved and impacts are minimised to surrounding receivers.

The principal issues, which will be addressed in this report, are:

- Identification of the noise and vibration standards which will be applicable to this project.

- Formulation of a strategy for construction activities to comply with the standards identified in the above point.

- Development at demolition and excavation methods which will minimise the impact on surrounding receivers.

3.1 PROJECT OBJECTIVES

The objective of this management plan is to set up a protocol to ensure noise and vibration emissions from the construction works associated with the NCCC & AATC Project comply with applicable standards, recommend required management controls and treatments are adopted where required and detail the required monitoring to ensure standards are met.

3.2 PROJECT DESCRIPTION AND POTENTIALLY EFFECTED PROPERTIES

The proposed NCCC & AATC Stage 2 Project includes the demolition of a portion of the existing Radiology Oncology building and excavation of material including infill and soft sand stone. The expected activities can be expected to include:

1. Partial demolition of existing buildings.
2. Removal of infill material.
3. Excavation of soft sand stone.
4. Construction of the proposed development NCCC & AATC for Stage 2.

Based on the site location of the NCCC & AATC Project the potentially affect receivers which may be affected include:

1. Adjacent areas of the Prince of Wales Hospital.
2. Surrounding residential areas.

3.3 CONSTRUCTION NOISE CRITERIA

It is proposed to utilise Australian Standard AS2436:1981 *"Guide to noise control on construction, maintenance and demolition sites"*, which is the standard commonly applied by Councils for the regulation of construction noise, the New South Wales Construction Noise Guideline developed by The NSW Environmental Protection Authority (EPA) and OH&S requirements are presented in this section of the report.

3.3.1 Australian Standard AS2436:1981 "Guide to noise control on construction, maintenance and demolition sites

The Australian Standard AS2436 states that where all reasonable and available measures have been taken to reduce construction noise, mitigation strategies may be put in place to reduce levels noise levels to within a reasonable and acceptable level.

For the control and regulation of noise from construction sites AS2436:1981 *"Guide to noise control on construction, maintenance and demolition sites"* nominates the following:

- That reasonable suitable noise criterion is established,
- That all practicable measures be taken on the building site to regulate noise emissions, including the sitting of noisy static processes to locations of the site where they can be shielded, selecting less noisy processes, and if required regulating construction hours, and
- The undertaking of noise monitoring where non-compliance occurs to assist in the management and control of noise emission from the demolition, excavation and construction site.

3.3.2 Environmental Protection Authority (EPA) Construction Noise Guideline

The NSW Environmental Protection Authority (EPA) has developed the Interim Construction Noise Guideline in the aid of reducing the impact of construction associated noise.

The guideline reflects on feasible and reasonable mitigation strategies, management controls and public liaising in the effort to reach realistic comprises between construction sites and potential noise affected receivers.

3.3.3 EPA Construction Noise Guideline - Quantitative Assessment Method

The guideline refers to a quantitative assessment method in which construction noise is assessed on a case by case basis with regard to various activities to be conducted on site. This assessment method was developed to smaller scale projects.

Essentially this method of assessment requires that the proponent take into consideration and employ all reasonable and feasible measures to ensure that the impact on noise receivers is minimised. This is generally conducted in the following manner:

- The drafting of a noise management plan outlining all reasonable and feasible mitigation methods for the reduction of noise impact;
- The assessment of high impact equipment such as rock-hammers and piling equipment for lower noise producing methods of construction/excavation;
- The implementation of a complaints handling register and community consultation system;
- Employee (builders, contractors etc) education in effective noise reducing techniques and site etiquette; and
- The operation of plant in a quiet and efficient manner (i.e. turning off machinery when not in use).

This quantitative assessment method has been used for the basis of this report and has been used as the basis for the development of acoustic management and treatments of proposed construction activities.

In addition, the guideline specifies goals which can be used in the effort of minimising noise from construction related activities. These noise goals are presented within the table below.

Table 1 – EPA Recommended Construction Noise Goals

Governing Body	Receiver Type	External sound level Goal, $L_{eq\ 15\ min}$ dB(A)
EPA	Residential	Background + 10 dB(A)[1]
		75 dB(A)[2]

1: Where the predicted or measured LAeq (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to minimise noise. (EPA CNG, 2008).

2: Where noise is above this level, the proponent should consider very carefully if there is any other feasible and reasonable way to reduce noise to below this level. If no quieter work method is feasible and reasonable, and the works proceed, the proponent should communicate with the impacted residents by clearly explaining the duration and noise level of the works, and by describing any respite periods that will be provided. (EPA CNG, 2008).

These criteria for resultant noise from construction activities are aimed at maintaining comfort levels within the surrounding residential dwellings. Additionally, noise mitigation techniques as discussed in this report should be used if noise emissions exceed the above criteria. All work is to be carried out in accordance with AS 2436:1981 *"Guide to noise control on construction, maintenance and demolition sites"*.

3.3.4 OH&S guidelines

Regulation 49 of the Occupational Health and Safety Regulation specifies maximum levels of noise which a 'worker' may be exposed to. Acoustic treatment to the work environment or hearing protection is recommended for workers exposed to higher noise levels. These maximum OH&S noise levels are presented in the table below.

Table 2 – OH&S Maximum Noise Level Exposure

	Energy Averaged Over 8 Hour Day	Maximum Noise Level During Day
OH&S maximum noise level exposure	85 dB(A) L_{eq}	140 dB(C)$_{Peak}$

3.4 CONSTRUCTION VIBRATION CRITERIA

Construction vibration criteria associated with works on the NCCC & AATC Stage 2 Project when measured at the potentially affected receivers should not exceed the following sets of vibration criteria to ensure no architectural or structural damage to surrounding buildings and human comfort is maintained. These standards have been selected as they are widely used in the assessment of vibration associated with construction activities within Australia, namely:

- German Standard DIN 4150-3 (1999-02): *"Structural Vibration – Effects of Vibration on Structures"*; and
- British Standard BS 6472:1992 *"Guide to Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz)*.

The criteria and the application of these Standards are discussed in separate sections below.

3.4.1 German Standard DIN 4150-3 (1999-02)

German Standard DIN 4150-3 (1999-02) provides vibration velocity guideline levels for use in evaluating the effects of vibration on structures. The criteria presented in DIN 4150-3 (1999-02) are presented in the Table below.

It is noted that the peak velocity is the absolute value of the maximum of any of the three orthogonal component particle velocities as measured at the foundation, and the maximum levels measured in the x- and y-horizontal directions in the plane of the floor of the uppermost storey.

Table 3 – DIN 4150-3 (1999-02) Safe Limits for Building Vibration

TYPE OF STRUCTURE		PEAK PARTICLE VELOCITY (mms^{-1})			
		At Foundation at a Frequency of			**Plane of Floor of Uppermost Storey**
		< 10Hz	**10Hz to 50Hz**	**50Hz to 100Hz**	**All Frequencies**
1	Buildings used in 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 or 2 and have intrinsic value (eg buildings that are under a preservation order)	3	3 to 8	8 to 10	8

3.4.2 British Standard BS 6472:1992

British Standard BS 6472:1992 develops criteria relating to levels of building vibration that may be expected to give rise to *"adverse comment"*, in the frequency range most applicable to impacts associated with construction, which is 1 to 80Hz. These threshold values are used as criteria for assessing the loss of amenity and are presented below in Table 3.

Table 4 – BS 6472:1992 Criteria to Avoid *"Adverse Comment"*

Type of Occupancy	Time of Day	Peak Particle Velocity (mms^{-1}) between 1Hz to 80Hz Likely to Cause *"Adverse Comment"*			
		Continuous Vibration		Intermittent Vibration and Impulsive Vibration Excitation with Several Occurrences per day	
		Vertical	Horizontal	Vertical	Horizontal
Residential	Day	0.3 to 0.6	0.8 to 0.6	8.4 to 12.6	24 to 36
	Night	0.2	0.6	2.8	8
Offices	Day	0.6	1.6	18	51
	Night	0.6	1.6	18	51
Workshops	Day	1.2	3.2	18	51
	Night	1.2	3.2	18	51

The limits indicate that people in buildings are significantly less susceptible to horizontal vibration than to vertical vibration. Furthermore, Section 4.1 of BS 6472 notes that situations can exist where vibration magnitudes above those generally corresponding to minimal *"adverse comment"* levels can be tolerated, particularly for temporary disturbances and infrequent and intermittent events such as those associated with construction projects.

3.5 VIBRATION CRITERIA

Based on the vibration criterion detailed in the sections above the suitable construction vibration criteria to ensure there is no structural or architectural damage to surrounding receivers includes the following:

- Other Prince of Wales Hospital buildings of sandstone construction – 5mm/s
- Other Prince of Wales Hospital buildings of concrete construction – 10mm/s
- Surrounding residential or commercial receivers – 10mm/s

3.6 CONSTRUCTION HOURS

Woking hours are subject to planning approval conditions and will be conducted within the approved construction times. Typically the hours of work at sites will be:

- 7:00am to 5:00pm Monday to Friday
- 8:00am to 5:00pm on Saturdays
- No work on Sundays, Public Holidays or Saturdays adjacent to a Public Holiday.

Works which are proposed to be conducted outside of these hours will be subject to special approval.

As there are no normal construction activities to be conducted during night time hours (without special approval) there is no requirement to conduct an assessment of sleep disturbance.

3.7 CONTROL OF CONSTRUCTION NOISE AND VIBRATION

As a part of the noise management of noise and vibration on each site the following process should be conducted when investigating the impact and construction activities.

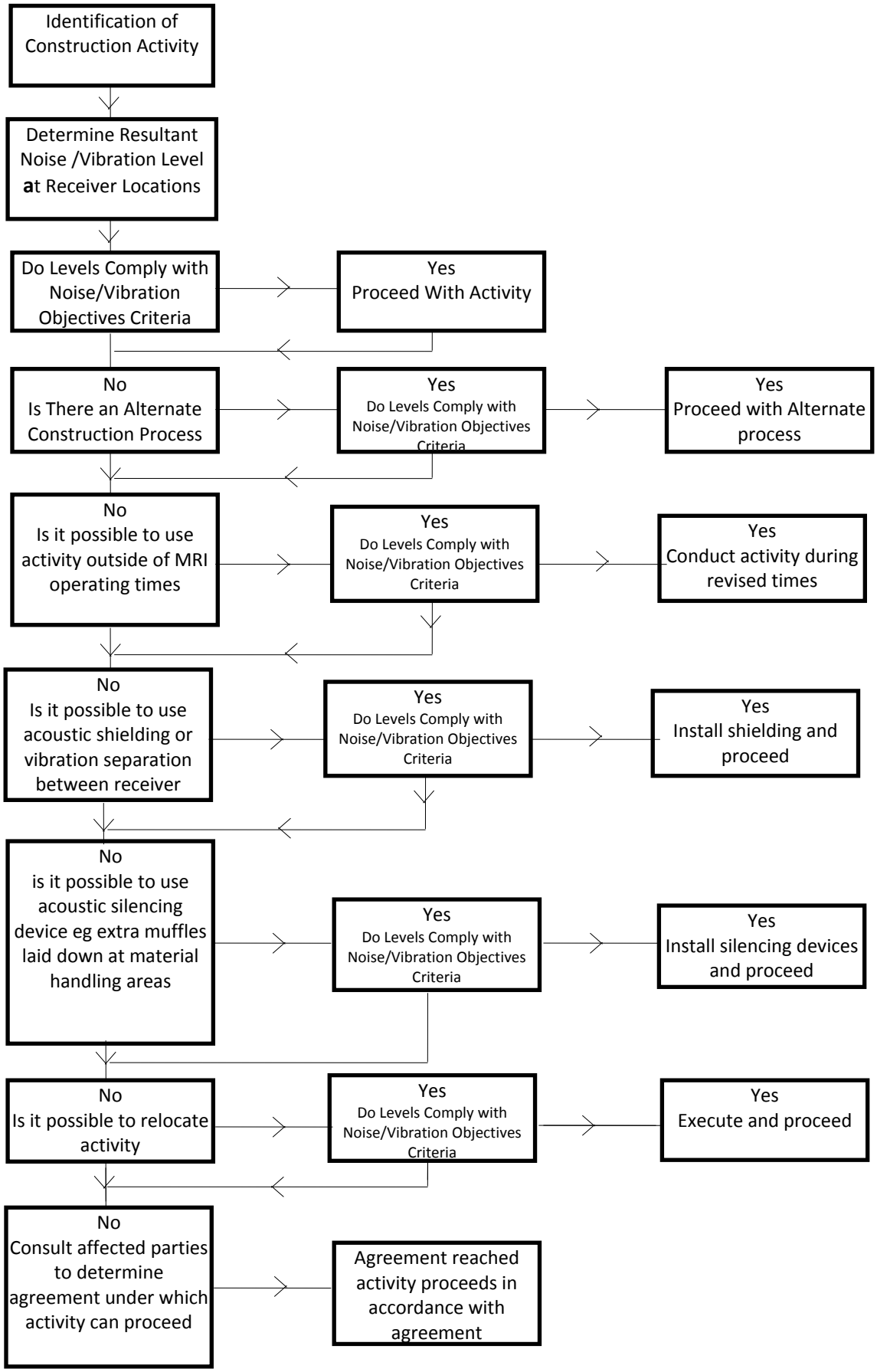


Figure 1 – Process Flowchart

3.8 NOISE AND VIBRATION CONTROL METHODS

The determination of appropriate noise control measures will be dependant on the particular activities and construction appliances. This section provides an outline of available methods.

3.8.1 Selection of Alternate Appliance or Process

Where a particular activity or construction appliance is found to generate excessive noise levels, it may be possible to select an alternative approach or appliance. For example; the use of a hydraulic hammer on certain areas of the site may potentially generate high levels of noise. By carrying this activity by use of pneumatic hammers, bulldozers ripping and/or milling machines lower levels of noise will result.

3.8.2 Acoustic Barrier

Barriers or screens can be an effective means of reducing noise. Barriers can be located either at the source or receiver.

The placement of barriers at the source is generally only effective for static plant (tower cranes). Equipment which is on the move or working in rough or undulating terrain cannot be effectively attenuated by placing barriers at the source.

Barriers can also be placed between the source and the receiver.

The degree of noise reduction provided by barriers is dependant on the amount by which line of sight can be blocked by the barrier. If the receiver is totally shielded from the noise source reductions of up to 15dB(A) can be effected. Where only partial obstruction of line of sight occurs, noise reductions of 5 to 8dB(A) may be achieved. Where no line of sight is obstructed by the barrier, generally no noise reduction will occur.

As barriers are used to provide shielding and do not act as an enclosure, the material they are constructed from should have a noise reduction performance that is approximately 10dB(A) greater than the maximum reduction provided by the barrier. In this case the use of a material such as 10mm or 15mm thick plywood (radiata plywood) would be acceptable for the barriers.

3.8.3 Silencing Devices

Where construction process or appliances are noisy, the use of silencing devices may be possible. These may take the form of engine shrouding, or special industrial silencers fitted to exhausts.

3.8.4 Material Handling

The installation of rubber matting over material handling areas can reduce the sound of impacts due to material being dropped by up to 20dB(A).

3.8.5 Treatment of Specific Equipment

In certain cases it may be possible to specially treat a piece of equipment to dramatically reduce the sound levels emitted.

3.8.6 Establishment of Site Practices

This involves the formulation of work practices to reduce noise generation. A noise plan will be developed for this project outlining work procedures and methods for minimising noise.

3.8.7 Regular Noise Checks of Equipment

To determine the requirement for silencing devices on machinery it is proposed to undertake fortnightly noise check. Noise levels of all machines on site will be measured and if they are found to be higher than nominated for that equipment type, items such as mufflers and engine shrouds will be examined to ensure they are in good working order.

A record of these measurements will be kept on a form similar to that shown in Appendix 1. This measure is expected to maintain noise at constant levels, and prevent any increases.

3.8.8 Combination of Methods

In some cases it may be necessary that two or more control measures be implemented to minimise noise.

3.8.9 Saw Cutting

Introduction of a saw cut to manage vibration impacting on surrounding receivers from construction activities.

3.9 NOISE AND VIBRATION MONITORING

Noise and vibration monitoring will be undertaken to determine the effectiveness of measures which are been implemented. The results of monitoring can be used to devise further control measures.

The minimum requirement for noise and vibration monitoring includes the one vibration monitor within the adjacent hospital buildings during the excavation phase of the Stage 2 project.

3.10 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

Potential noise and vibration impacts are reviewed below.

3.11 NOISE IMPACTS

Obviously, noise impacts on nearby development will be dependant on the activity and where on the site the activity is undertaken. Excavation works tend to be the loudest typical activity. Work close to the eastern and northern boundaries will have greatest impacts on surrounding residential residents.

The potentially worst case activities are identified and discussed below:

- Excavation and Demolition phase – Primary noise emissions occur during excavation and demolition, with equipment items typically having sound power levels (SWL) of approximately 117dB(A)$L_{10(15min)}$. Excavators (dozers with bucket, saws or hammers) and piling works are typically the loudest activity during construction. Noise levels of between 60-70 dB(A) at the boundaries of residential & commercial receivers on High Streets may be generated.

- During erection of structure, the use of hand tools (angle grinders, jack hammers etc.) and concrete pumps are the loudest typical activity (sound power levels of approximately 105dB(A)$L_{eq(15min)}$). Noise levels of between 55-65 dB(A) at the boundaries of residential & commercial receivers on High and Avoca Streets at the boundary of residential receiver may be generated.

- Obviously, once construction of the building shell is complete, noise from hand tools will be relatively low, as the new building construction will provide considerable noise attenuation for internal fitout. Once the building shell is largely complete, use of hand tools in internal areas is unlikely to be inaudible at the surrounding receivers.

- Noise levels generated by the construction activities will generally comply with the noise management levels at the boundaries of residential and commercial receivers. Some exceedances (depending on type of activity and location) may occur during limited operation of specific equipment. A detailed construction management plan will be required to be provided once a building contractor is appointed as part of the construction approval process.

3.12 VIBRATION IMPACTS

Excavation and demolition are the primary vibration generating activities.

- Vibration impacts on the identified residential and commercial receivers are unlikely to exceed the criteria outlined in this report.

- As part of the construction programme, vibration monitoring/measurements will be required to ascertain specific levels from individual plant items impacting receivers within the Prince of Wales Hospital.

- Where practicable, excavation in rock should be done using rock saws as opposed to pneumatic hammers.

- If piling is required, use of augured or vibro-piling should be used rather than impact piling.

3.13 IMPACT TO SURROUNDING PRINCE OF WALES HOSPITAL BUILDINGS

As part of the NCCC & AATC, Stage 2 project detailed communication and investigations into the surrounding operations of other hospital building will be conducted. Suitable noise and vibration management controls will be adopted as part of the construction of the project to ensure no structural, architectural or operation issues occur during the construction phase of the project.

The proposed acoustic criteria and resulting treatments and controls will be approved with the Prince of Wales Hospital prior to construction works commencing.

3.14 NOISE AND VIBRATION MANAGEMENTS

This section of the report identified the potentially worst case noise and vibration generating activities and presents possible strategies to ensure noise and vibration levels when measured at the worst affected receiver comply with the relevant criteria.

The table below presents the construction activities and discussed the potential management/treatments required to be conducted.

Table 5 – Recommended Noise and vibration Controls

EQUIPMENT /PROCESS	Receiver	Discussion
Hydraulic Hammering	Surrounding commercial and residential receivers	Hammering to be conducted during approved construction hours. All equipment to be kept in good working order.
	Other Prince of Wales Hospital Buildings	Acoustic controls to be approved with the hospital prior to works commencing and may include the following: 1. Saw cutting of the perimeter of the area to be excavated prior to hammering within close proximity of buildings. Once excavation reaches the depth of the saw cut an additional saw cut should be conducted. 2. Alternative methods to hammering, such as ripping and the like, should be adopted where possible.
	Ripping	Ripping of material should be maximised where possible.
Drill pilling equipment	Surrounding commercial and residential receivers	No acoustic controls required for impacts to surrounding residential and commercial receivers.
	Other Prince of Wales Hospital Buildings	No acoustic controls required for impacts to surrounding hospital building receivers.
Concrete Saw Cutting	Surrounding commercial and residential receivers	No acoustic controls required for impacts to surrounding residential and commercial receivers.
	Other Prince of Wales Hospital Buildings	No acoustic controls required for impacts to surrounding hospital building receivers.
Excavators – Including all excavators up to and including 35 tons	Surrounding commercial and residential receivers	No acoustic controls required for impacts to surrounding residential and commercial receivers.
	Other Prince of Wales Hospital Buildings	Acoustic controls to be approved with the hospital prior to works commencing and may include the following: 1. Acoustic treatments to the windows of neighbouring hospital building may be required.
Truck (including the loading of materials into trucks)	All Receivers	No acoustic controls required
Bobcat	All Receivers	No acoustic controls required
General Construction including - Angle Grinders, Electric Saw, Drilling, Hammering etc	Surrounding commercial and residential receivers	No acoustic controls required for impacts to surrounding residential and commercial receivers.
	Other Prince of Wales Hospital Buildings	No acoustic controls required for impacts to surrounding hospital building receivers.
Concrete Pumps	Surrounding commercial and residential receivers	No acoustic controls required for impacts to surrounding residential and commercial receivers.
	Other Prince of Wales Hospital Buildings	No acoustic controls required for impacts to surrounding hospital building receivers.

3.15 COMMUNITY INTERACTION AND COMPLAINTS HANDLING

In order for any construction noise management programme to work effectively, continuous communication is required between all parties, which may be potentially impacted upon including the builder, neighbours and other areas of the Prince of Wales Hospital. This establishes a dynamic response process which allows for the adjustment of control methods and criteria for the benefit of all parties.

The objective in undertaking a consultation processes is to:

- Inform and educate the groups about the project and the noise controls being implemented;
- Increase understanding of all acoustic issues related to the project and options available;
- Identify group concerns generated by the project, so that they can be addressed; and
- Ensure that concerned individuals or groups are aware of and have access to the Complaints Register which will be used to address any construction noise related problems should they arise.

To ensure that this process is effective, regular information regarding the proposed works and period when they will be required to be conducted should be provide to neighbouring receivers (including residence and other areas of the Prince of Wales Hospital), until all issues have been addressed and the evidence of successful implementation is embraced by all parties.

3.16 DEALING WITH COMPLAINTS

Should ongoing complaints of excessive noise or vibration criteria occur measures shall be undertaken to investigate the complaint, the cause of the exceedances and identify the required changes to work practices. In the case of exceedances of the vibration limits all work potentially producing vibration shall cease until the exceedance is investigated.

The effectiveness of any changes shall be verified before continuing. Documentation and training of site staff shall occur to ensure the practices that produced the exceedances are not repeated.

If a noise complaint is received the complaint should be recorded on a Noise Complaint Form. The complaint form should list:

- The name and location of the complainant (if provided);
- The time and date the complaint was received;
- The nature of the complaint and the time and date the noise was heard;
- The name of the employee who received the complaint;
- Actions taken to investigate the complaint, and a summary of the results of the investigation;
- Required remedial action, if required;

- Summary of feedback to the complainant.

A permanent register of complaints should be held.

All complaints received should be fully investigated and reported to management. The complainant should also be notified of the results and actions arising from the investigation.

3.17 CONTINGENCY PLANS

Where non-compliances or noise complaints are raised the following methodology will be implemented.

- Determine the offending plant/equipment/process
- Locate the plant/equipment/process further away from the affected receiver(s) if possible.
- Implement additional acoustic treatment in the form of localised barriers, silencers, vibration separation etc where practical.
- Selecting alternative equipment/processes where possible

Complaints associated with noise and vibration generated by site activities shall be recorded on a Noise Complaint Form. The person(s) responsible for complaint handling and contact details for receiving of complaints shall be established on site prior to construction works commencing. A sign shall be displayed at the site indicating the Site Manager to the general public and their contact telephone number.

4 NOISE EMISSION LIMITS – NOISE GENERATED ON THE SITE (OPERATIONAL NOISE)

The NCCC & AATC, Stage 2, Project will be designed such that all operation noise, during the normal operation of the completed project will comply with the relevant EPA and Council noise level criterion.

This section of the report detailed the suitable noise level criterion, which operational noise from the project will be assessed. It is noted that the Stage 2 development includes both temporary plant and permanent plant associated with the development. All plant noise levels, including permanent and temporary plant, will be designed to comply with the relevant noise level criteria detailed in this section of the report.

The Environmental Protection Authority (EPA) Industrial Noise Policy provides guidelines for assessing noise impacts from development sites. The recommended assessment objectives vary depending on the potentially affected receivers, the time of day, and the type of noise source. The EPA's Industrial Noise Policy has two requirements which both have to be complied with, namely an amenity criterion and an intrusiveness criterion. In addition, the EPA in its Environmental Noise Control Manual states that noise controls should be applied with the general intent to protect residences from sleep arousal.

4.1 EPA INTRUSIVENESS CRITERION

The EPA guideline is intended to limit the audibility of noise emissions at residential receivers and requires that noise emissions measured using the L_{eq} descriptor not exceed the background noise level by more than 5 dB(A). Where applicable, the intrusive noise level should be penalised (increased) to account for any annoying characteristics such as tonality.

4.2 EPA AMENITY CRITERION

The EPA guideline is intended to limit the absolute noise level from all industrial noise sources to a level that is consistent with the general environment.

The EPA's Industrial noise policy sets out acceptable noise levels for various localities. Table 2.1 on page 16 of the policy indicates 4 categories to distinguish different residential areas. They are rural, suburban, urban and urban/industrial interface.

Table 6 of the INP provides the recommended ambient noise levels for the suburban residential receivers for the day, evening and night periods. For the purposes of this condition:

- Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays;
- Evening is defined as the period from 6pm to 10pm; and
- Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays.

Table 6 – Recommended Amenity Industrial Noise Levels

Type of Receiver	Time of day	Recommended Acceptable Noise Level dB(A) L_{eq}
Residential	Day	55
	Evening	45
	Night	40

4.3 SLEEP AROUSAL

To minimise the potential for sleep arousal the $L_{1\ (1\ minute)}$ noise level of any specific noise source does not exceed the background noise level (L_{90}) by more than 15 dB(A) outside a resident's bedroom window between the hours of 10pm and 7am. The L_1 noise level is the level exceeded for 1 per cent of the time and approximates the typical maximum noise level from a particular source. Where the typical repeatable existing L_1 levels exceed the above requirement then the existing L_1 levels form the basis for, sleep disturbance criteria.

4.4 MECHANICAL PLANT TREATMENTS

As detailed plant selections have not been conducted at this time a detailed acoustic assessment of noise impact can not be conducted.

A detailed mechanical noise assessment will be conducted once plant selections and services drawings have been finalised as part of the construction documentation to ensure noise levels comply with the criteria detailed in this report.

Based on experience with similar development acoustic treatments are both possible and practical using acoustic treatments such as lining of ductwork, acoustic silences, variable speed controllers,

time switches, acoustic screens etc. General requirements for a number of potential plant items on the site are expanded on below.

4.4.1 Chillers / Air Handling Units

Units can be located on roof tops with an acoustic screen or in basement areas, with acoustic treatment to intake and exhaust as necessary.

These units would predominantly operate during the day, with the potential to operate with extended hours. Acoustic treatment to these units may be required to ameliorate noise impact to the surrounding residents and to comply with the criteria specified in this report and verified at CC stage.

4.4.2 Supply / Exhaust fans

Supply and exhaust fans may be located within the underground plant rooms or in rooftop plant areas. These units typically emit high noise levels and require acoustic treatment such as silencers and internal lined ductwork. Silencer requirements would be determined once fan selections have been completed at CC stage.

4.4.3 Condenser Units

Condensing units typically emit relatively low noise levels and with careful selection, it is possible that no further acoustic treatment would be necessary.

4.4.4 Minor Plant

Other minor plant items, such as bathroom or kitchen exhaust fans, will be required. These items typically emit relatively low noise levels and may require minimal acoustic treatment of a standard nature, such as internally lining of ductwork.

5 CONCLUSION

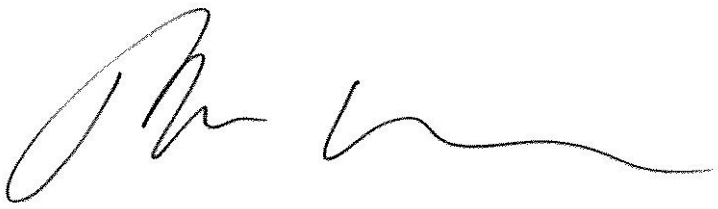
This document presents a discussion of the processes, which will be followed in order to manage noise and vibration associated with demolition, excavation and construction activities which will be required to be conducted as part of the NCCC & AATC, Stage 2 Project and the potential for noise and vibration impact to receivers within close proximity including other users within the Prince of Wales Hospital.

The report details required management controls to ensure noise and vibration complies with the relevant criteria and a monitoring regime to monitor noise and vibration impacts to potential receivers.

The report also presents the noise level criteria which the operation of the NCCC & AATC, Stage 2 Project will be designed to comply with.

We trust this information is satisfactory. Please contact us should you have any further queries.

Yours faithfully,



Acoustic Logic Consultancy Pty Ltd
Thomas Aubusson

APPENDIX ONE

CONSTRUCTION APPLIANCE COMPLIANCE CERTIFICATE

NCCC & AATC Stage 2 Project

Construction Appliance Compliance Certificate

Month .....

Year .....

Plant Item .....

Allowable Noise Level .....

Measured Noise Level .....

Complies Yes ☐ No ☐

Issuing Engineer .....

Sub-Contractor .....

Project Manager .....