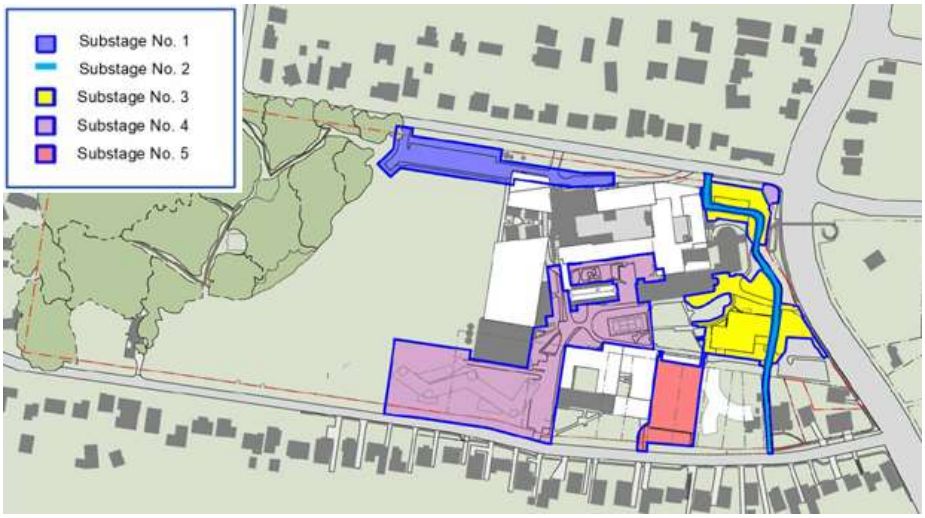
CONSTRUCTION NOISE & VIBRATION MANAGEMENT PLAN

State Significant Development
Loretto Normanhurst



Prepared For:

Mr Marc Cohen

COWYN BUILDING GROUP

Prepared By:

NG Child & Associates

26 November 2021

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SUMMARY OF KEY POINTS

Introduction: This document presents a Noise & Vibration Management Plan for redevelopment works at Loretto Normanhurst.

Document Format: The initial section ("Background & Reference Information") of the document presents a range of background and reference information regarding acoustic aspects of the development, including details of the original acoustic assessment and report, established site reference data, and general acoustic management requirements. The second section ("Noise & Vibration Management Plan") sets out the Noise & Vibration Management Plan for site works and construction activities associated with the development.

Development Activities: The development activities covered by this Plan include site works, demolition, construction and landscaping.

Regulations & Guidelines: The development is subject to a number of guidelines and regulations, including those set out in the NSW DECC (EPA) Interim Construction Noise Guideline, and the NSW Noise Policy for Industry (2017).

Potentially Noise Sensitive Receivers: Noise generated by site work and construction activities associated with the development has the potential to impact on properties, including residential properties, situated near the development site.

Background Noise Levels: Existing background noise levels in the vicinity of the development site were measured and reported in the original (December 2021) Acoustic Report. These background noise levels are described in this report and have been adopted for use in the Noise & Vibration Management Plan.

Noise Assessment: A detailed noise assessment based on the activities that will be undertaken and the equipment that will be used during the development has been undertaken, and a summary of this has been included for convenient reference in this document. Noise associated with the development was generally found to have no excessive, non-compliant or adverse impact on the residential receivers closest to the site, however some activities including site clearing, demolition and excavation will have the potential to cause exceedances of established construction noise guidelines, and appropriate control and mitigation measures have been developed. No exceedances are predicted for the other construction activities.

Noise Mitigation: A range of prospective noise mitigation measures, developed to help minimise the levels of noise to be generated during the development process, have been identified in Section 4 of the Plan.

Noise Monitoring: Noise monitoring procedures, developed to help ensure that noise performance during the development process complies with all relevant guidelines, regulations and protocols, are identified in Section 5 of this Plan.

Vibration: No significant issues are anticipated regarding vibration however appropriate precautionary and contingency measures have been included in the Plan.

Community Consultation: A community consultation strategy designed to help ensure that activities to be undertaken during the development process do not cause undue concern to neighboring residential stakeholders is outlined in Section 6. The strategy includes an initial letter describing the development and the noise management processes that have been put in place and providing contact details in the event of any issues or concerns.

Complaints Management: A procedure to provide for community consultation and to deal effectively and constructively with any complaints received regarding noise generated during site works and construction activities associated with the development is described in Section 7.

Noise Associated with Plant, Equipment and Operations: Noise associated with the specific plant, equipment and operations anticipated to be involved in the development works has been considered in Section , and Appendices B & C.

High Noise Generating Works: Potential high noise generating works are considered in Section 9.

Training: A basic but appropriate approach to the training of site workers and sub-contractors regarding noise management and minimisation is discussed in Section 10.

Review and Improvement: A review process aimed at ensuring that the Noise & Vibration Management Plan is updated and improved as required during the course of the development project is described in Section 11.

Contact Details: Contact details for the Contractor and Environmental Consultant involved in the preparation and delivery of this Plan are provided in Section 12.

Noise Management Action Plan: A simplified summary plan providing prompts for the key actions required as part of this overall Noise Management Plan is provided in Section 13.

Plan Summary: A one-page summary of the overall Plan has been included for convenient reference in Section 14.

The assessment undertaken as a basis for this Noise Management Plan has indicated that noise levels forecast to be generated by activities to be undertaken and equipment to be used during site works and construction activities associated with the redevelopment works at Loretto Normanhurst will typically comply with relevant construction noise standards, guidelines and regulations.

This Plan has been developed to help ensure that this outcome is achieved, including the establishment of appropriate noise management, mitigation and control strategies.

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Principal, NG Child & Associates

26 November 2021

1 INTRODUCTION

Cowyn Building Group is involved in redevelopment works at Loretto Normanhurst as summarised below:

Concept development application for the redevelopment of Loreto Normanhurst School including:

Concept Proposal:

- earthworks and demolition of buildings, structures and trees;
- 10 building envelopes for new and extended buildings for a boarding accommodation building, extensions to the senior and primary schools, gymnasium, performing arts centre and three car parks and sports facilities;
- a staged increase of 850 students and 71 staff;
- a through site road, up to 236 additional car parking spaces, five pick-up/drop-off spaces, two bus bays and bicycle parking; and
- landscape masterplan.

Stage 1 Works:

- earthworks and demolition of buildings, structures, removal of 105 trees, landscaping and temporary relocation of the uniform office;
- staged construction of:
  - a two to five storey boarding accommodation building for 216 students (125 rooms) and two 3-bedroom staff apartments;
  - two single storey car parks with sports courts at roof level, amendment of existing parking areas and an increase of 123 parking spaces;
  - a through site road, five pick-up/drop-off spaces, two bus bays and bicycle parking;
  - a stand-alone electrical substation;
- staged increase of 500 students; and
- hard and soft landscaping works including expansion of the existing oval.

The development has been approved by the Independent Planning Commission (the Commission) as the declared consent authority under Clause 8A of the State Environmental Planning Policy (State and regional Development 2011 and Section 4.5(a) of the Environmental Planning and Assessment Act 1979, subject to a number of Consent Conditions including the preparation and implementation of an appropriate Construction Noise & Vibration Management Plan.

Cowyn Building Group has engaged NG Child & Associates to prepare the Construction Noise & Vibration Management Plan for the development, as required by the Commission's Consent Condition.

NG Child & Associates has considerable experience in the preparation of Construction Noise & Vibration Management Plans.

Noel Child of NG Child & Associates is a suitably qualified and experienced person to prepare the Plan required. His CV has been included for reference at Appendix F.

This document presents the Construction Noise & Vibration Management Plan prepared for the redevelopment works at Loretto Normanhurst.

2 SITE & ASSESSMENT DETAILS

2.1 LOCATION

The location of Loretto Normanhurst is shown highlighted in blue in Figure 2.1 below.

The direction of north is towards the top of the diagram, and an approximate indication of scale is included below.

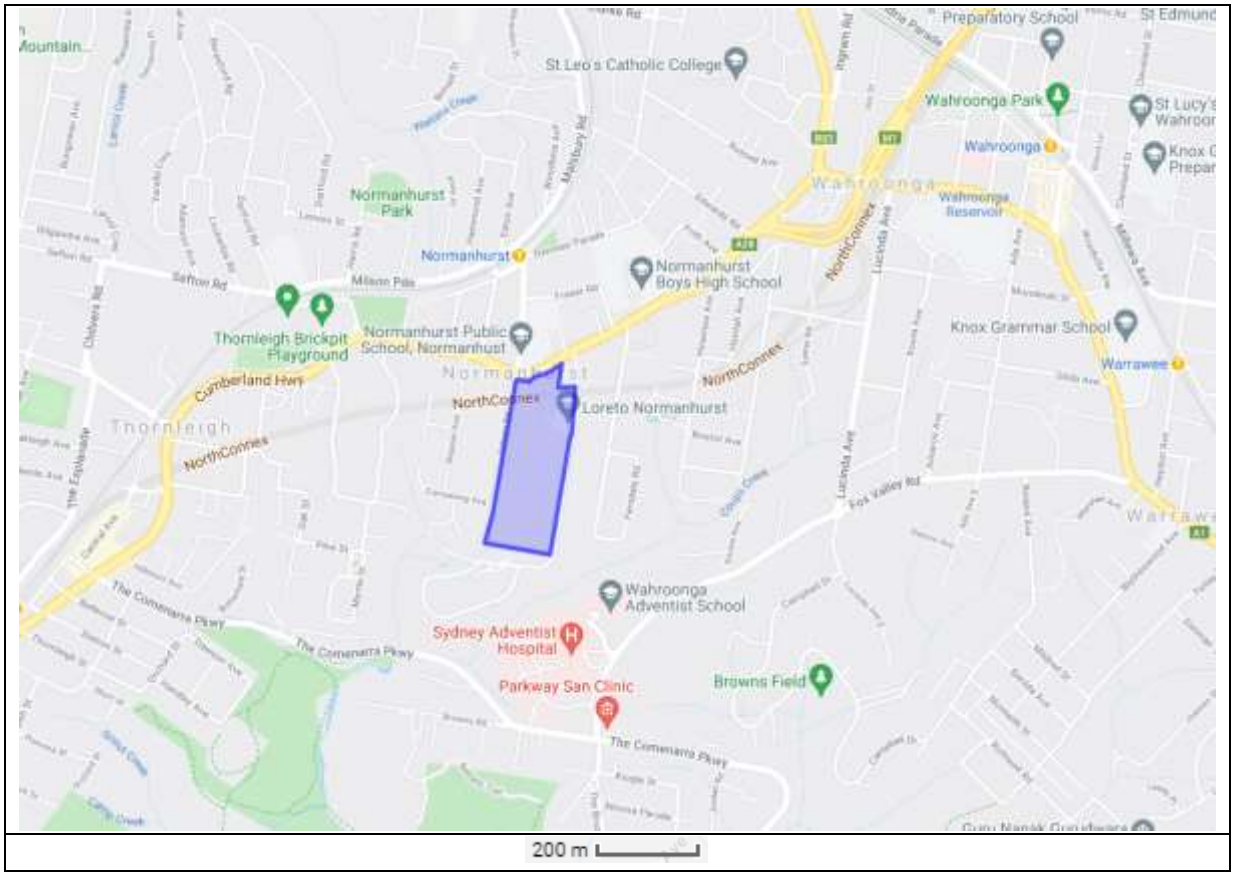

Figure 2.1 – Road Map Loretto Normanhurst

A recent (October 6th, 2021) satellite photograph of the site area is provided in Figure 2.2, on the following page.

Figure 2.2 – Satellite Photograph of Loretto Normanhurst (October 6th, 2021)

The site comprises an overall land area of approximately thirteen hectares, with vehicular ingress and egress from and to Pennant Hills Road.

The closest major road is Pennant Hills Road, which borders the site to the immediate north.

A recent photograph of the site from Pennant Hills Road is provided in Figures 2.3 below.

Figure 2.3 – Loretto Normanhurst Site Viewed from Pennant Hills Road

2.2 LAND DETAILS & ZONING

The site falls within the local government area of Hornsby Shire Council.

Zoning details applicable to the site and nearby areas are provided in Figure 2.4, on the following page, based on information available from the current Hornsby Local Environment Plan.

The Loretto Normanhurst site is shown at the lower centre of Figure 2.4, outlined in red.

The overall site comprises the following parcels of land:

> 4, 6, 14, 16, 30-62, 24-28 Mount Pleasant Avenue, 89 and 91-93 Pennant Hills Road Normanhurst.
>
> Lot 5 DP 1218765, Lot 16 DP 6612, Lots 20-23 and 25-36 DP 6612, Lot 1 DP 34834, Lot 1 DP 114580, Lot 3 DP 1217496, Lot 1 – Lot 3 DP 1218765, Lot B DP 327538, Lot 1 DP 809066, Lot C DP 366271, Lot D DP 366271, Lot 4 DP 1218765 and Lot 1 DP 136156.

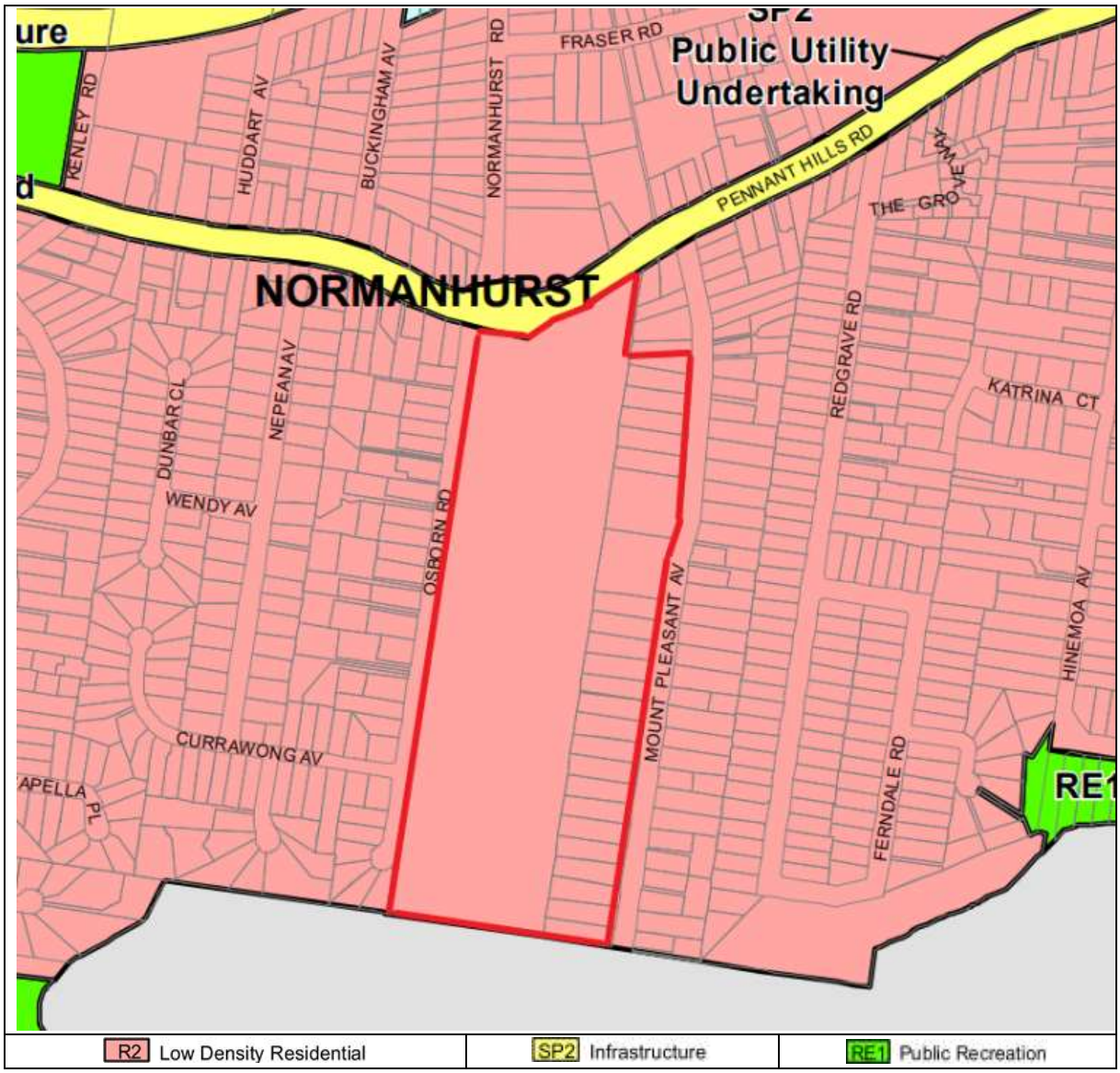

Figure 2.4 – Zoning Details

The site is zoned R2, “Low Density Residential”.

The site is adjoined to the west, east and south, and opposite Pennant Hills Road to the north by similarly zoned properties.

Portions of land zoned SP2 “Infrastructure”, including both Pennant Hills Road and the Strathfield/Hornsby Rail Corridor are present to the north of the site.

Areas of land zoned RE1 “Public Recreation” are present in the general vicinity of the site.

2.3 PROPOSED DEVELOPMENT

The proposed development is summarised below:

Concept development application for the redevelopment of Loreto Normanhurst School including:

Concept Proposal:

- earthworks and demolition of buildings, structures and trees;
- 10 building envelopes for new and extended buildings for a boarding accommodation building, extensions to the senior and primary schools, gymnasium, performing arts centre and three car parks and sports facilities;
- a staged increase of 850 students and 71 staff;
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Stage 1 Works:

- earthworks and demolition of buildings, structures, removal of 105 trees, landscaping and temporary relocation of the uniform office;
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  - two single storey car parks with sports courts at roof level, amendment of existing parking areas and an increase of 123 parking spaces;
  - a through site road, five pick-up/drop-off spaces, two bus bays and bicycle parking;
  - a stand-alone electrical substation;
- staged increase of 500 students; and
- hard and soft landscaping works including expansion of the existing oval.

The development is described in the plans and drawings included on subsequent pages, as follows:

Figure 2.5 Cover Sheet

Figure 2.6 Site Plan

Figure 2.7 Site Plan Ramps & Shelters

Figure 2.8 Demolition Plan

Figure 2.9 Through Site Link

Figure 2.10 Lower Level Plan (Car Park)

Figure 2.11 Upper Level Plan (Tennis Courts)

Figure 2.12 Elevations

Figure 2.13 Sections

Figure 2.14 Ramp Section Details

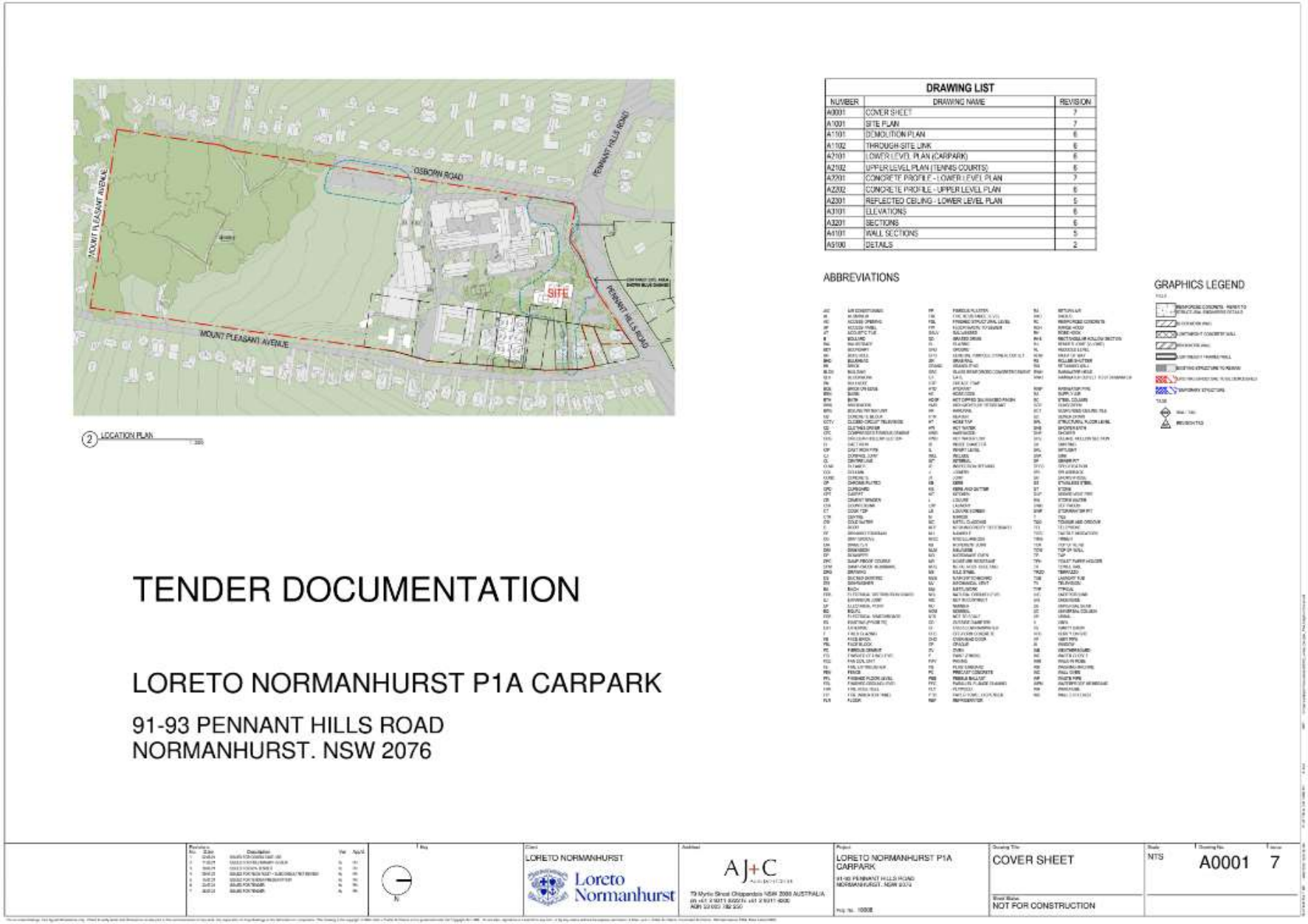


Figure 2.5 – Cover Sheet

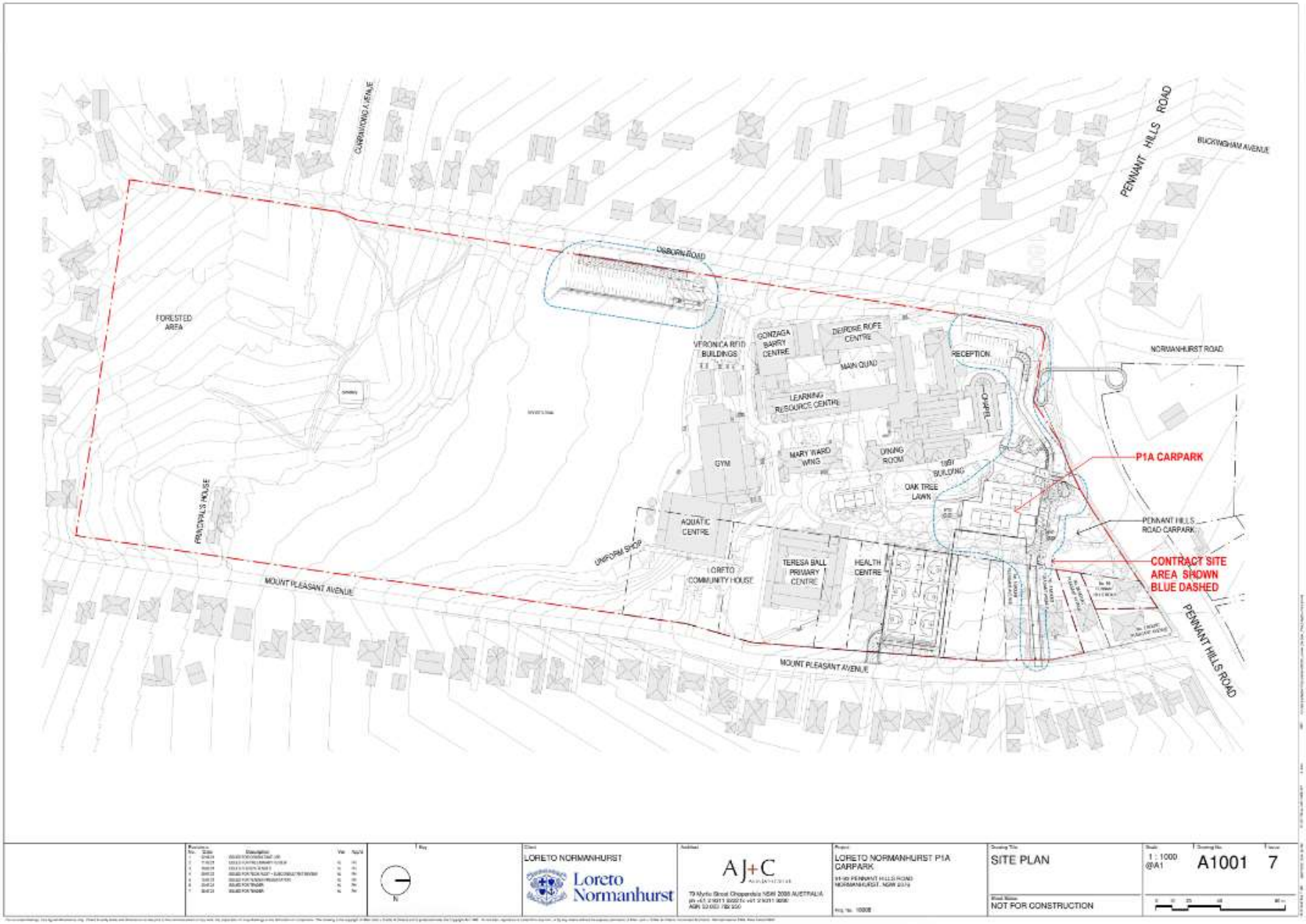


Figure 2.6 – Site Plan

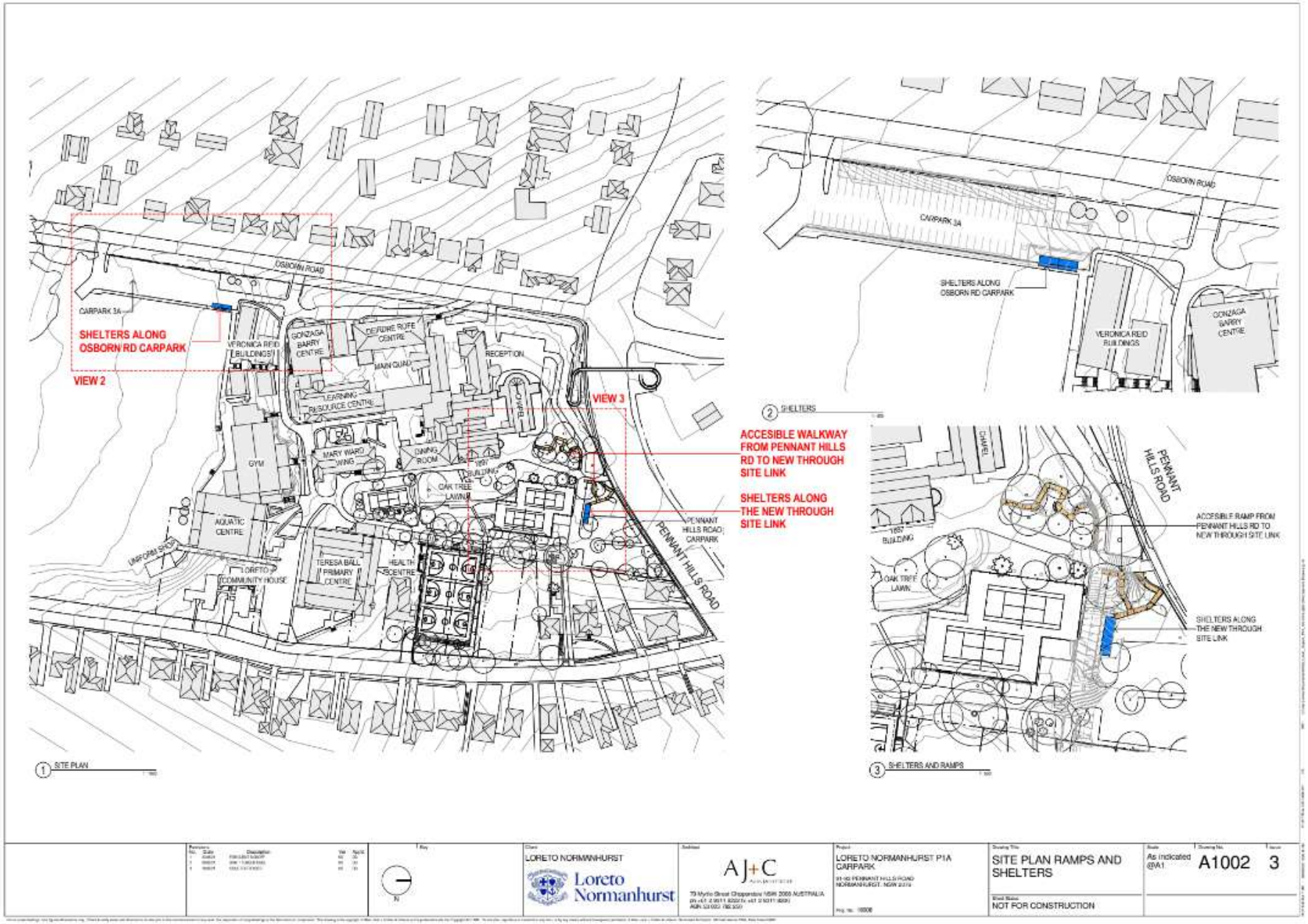


Figure 2.7 – Site Plan Ramps & Shelters

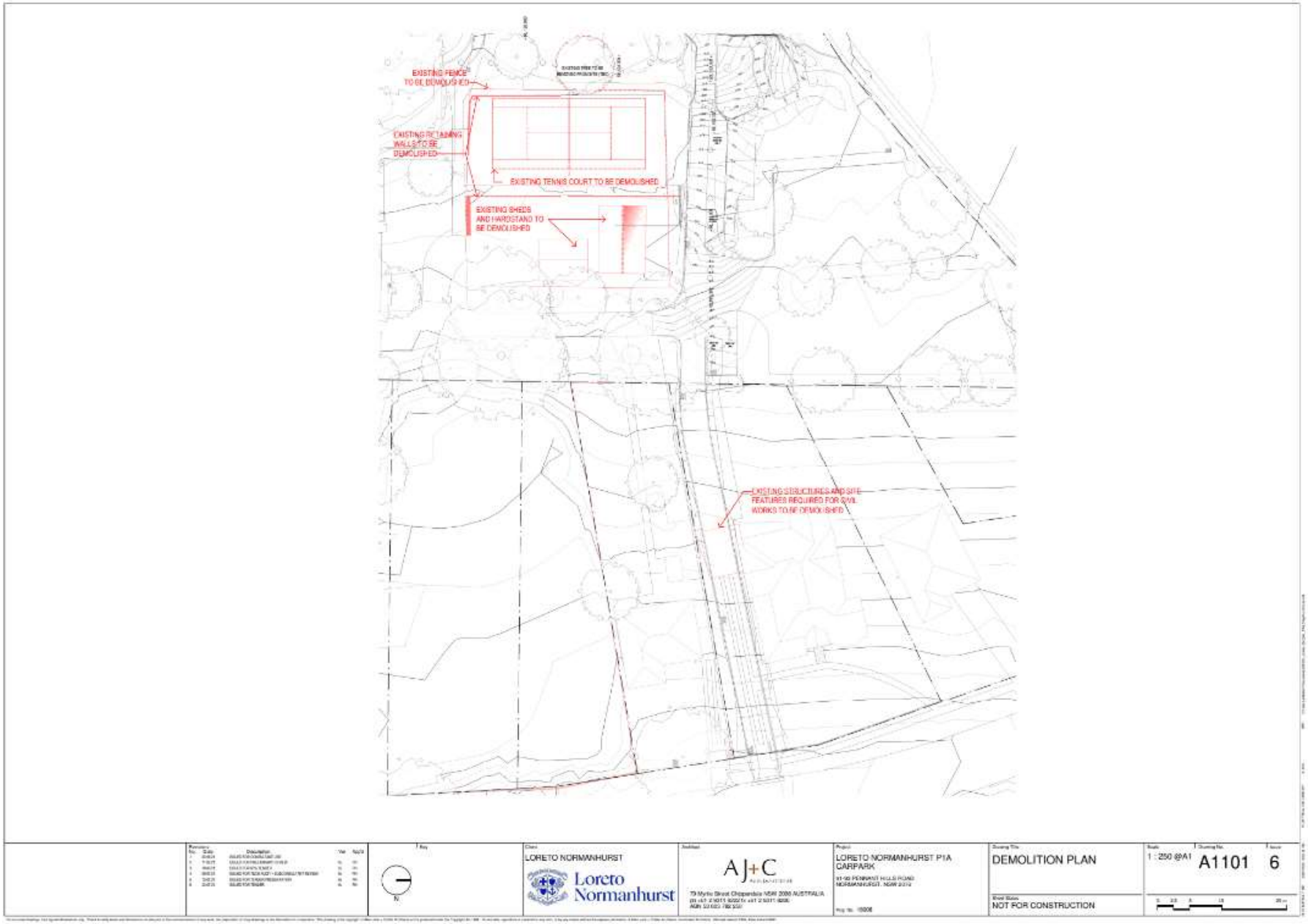


Figure 2.8 – Demolition Plan

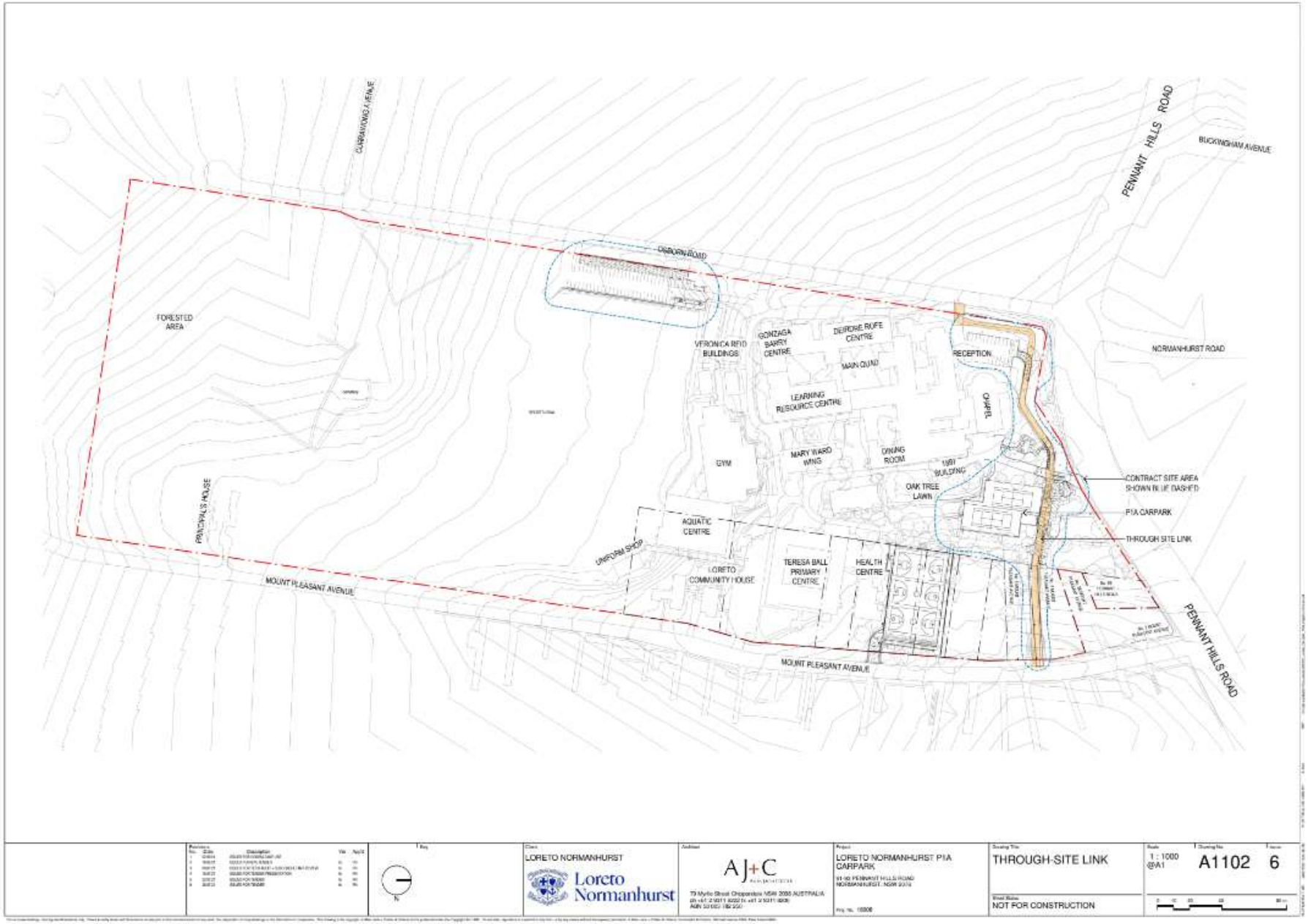


Figure 2.9 – Through Site Link

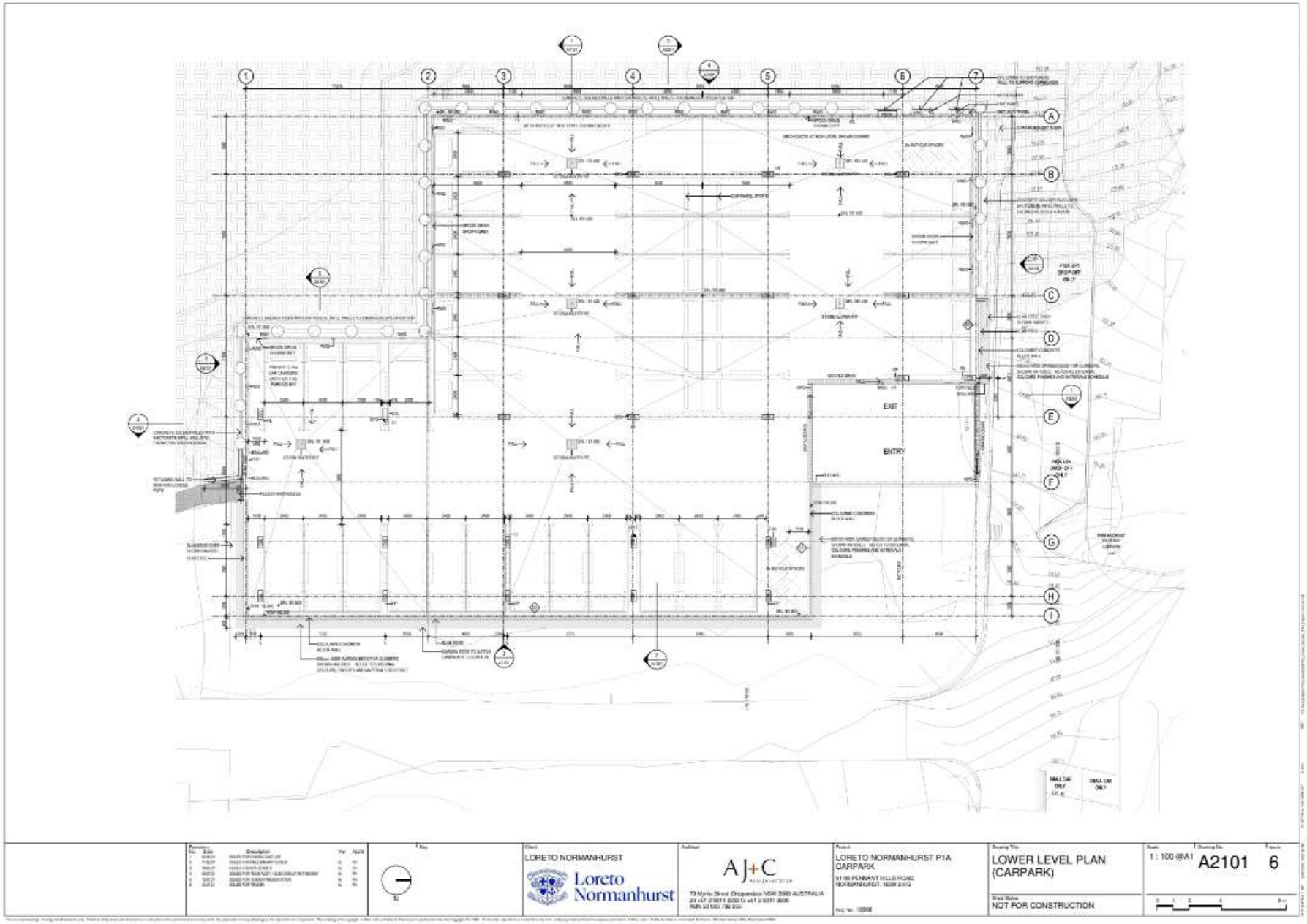


Figure 2.10 – Lower Level Plan (Car Park)

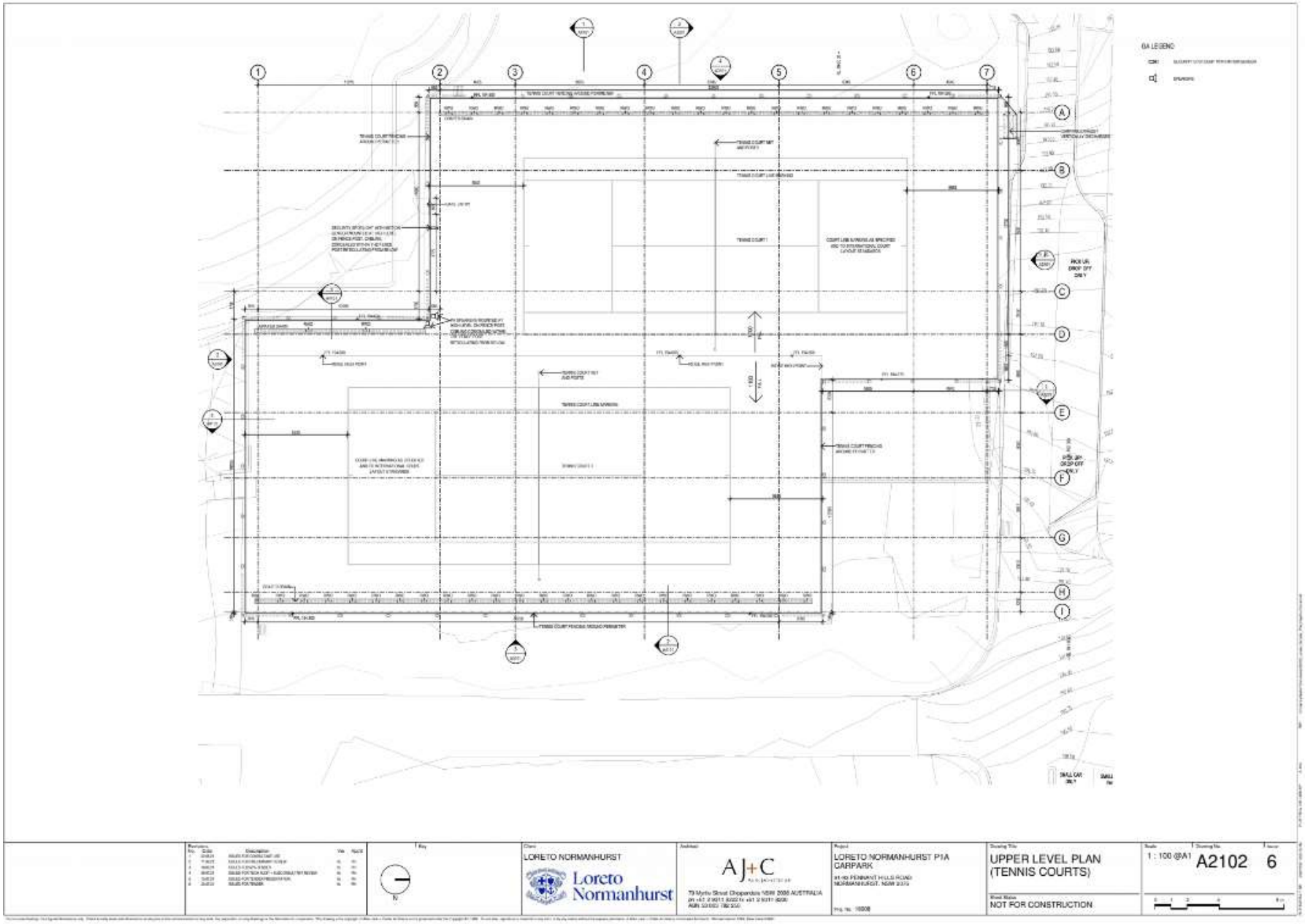


Figure 2.11 – Upper Level Plan (Tennis Courts)

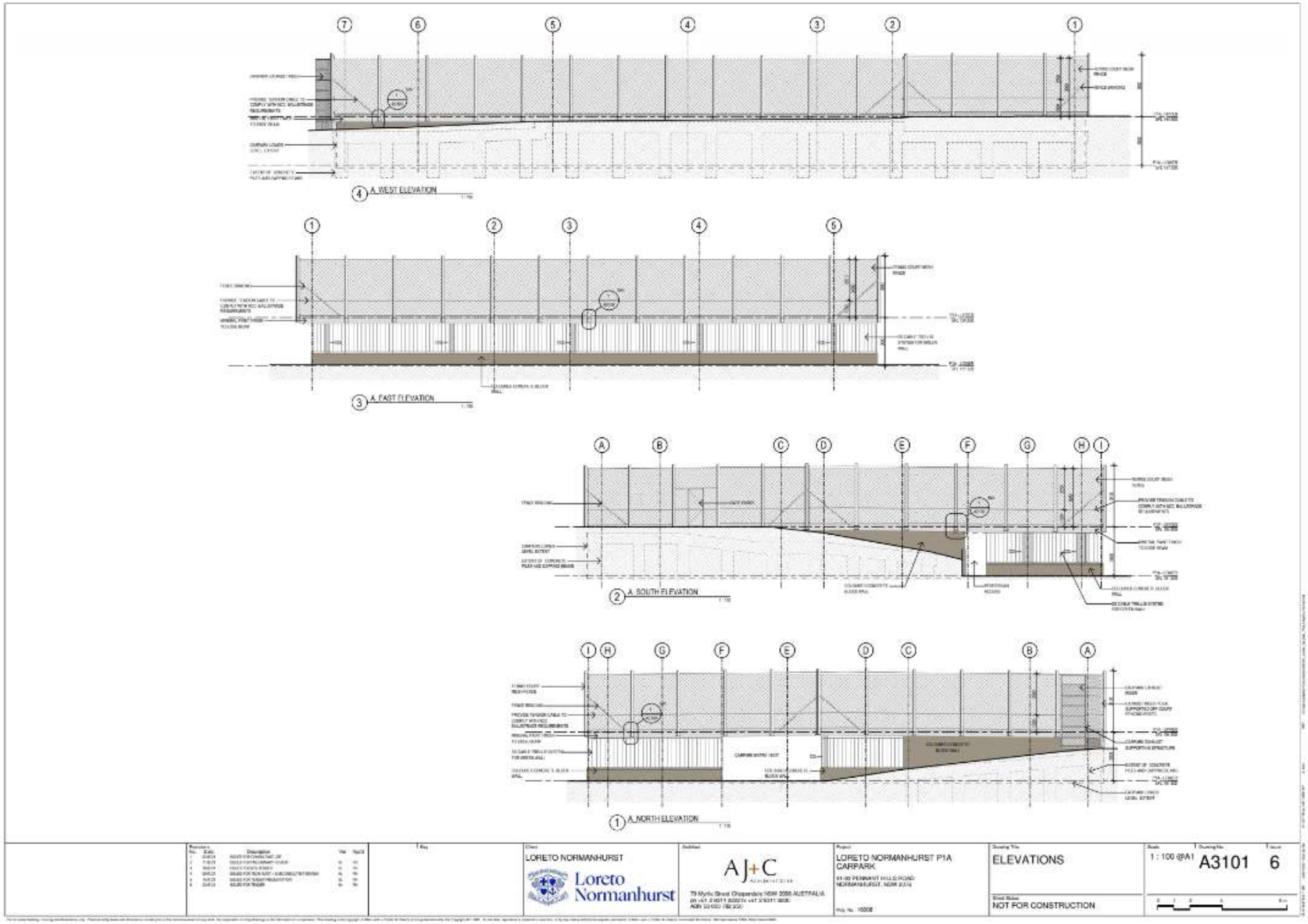


Figure 2.12 – Elevations

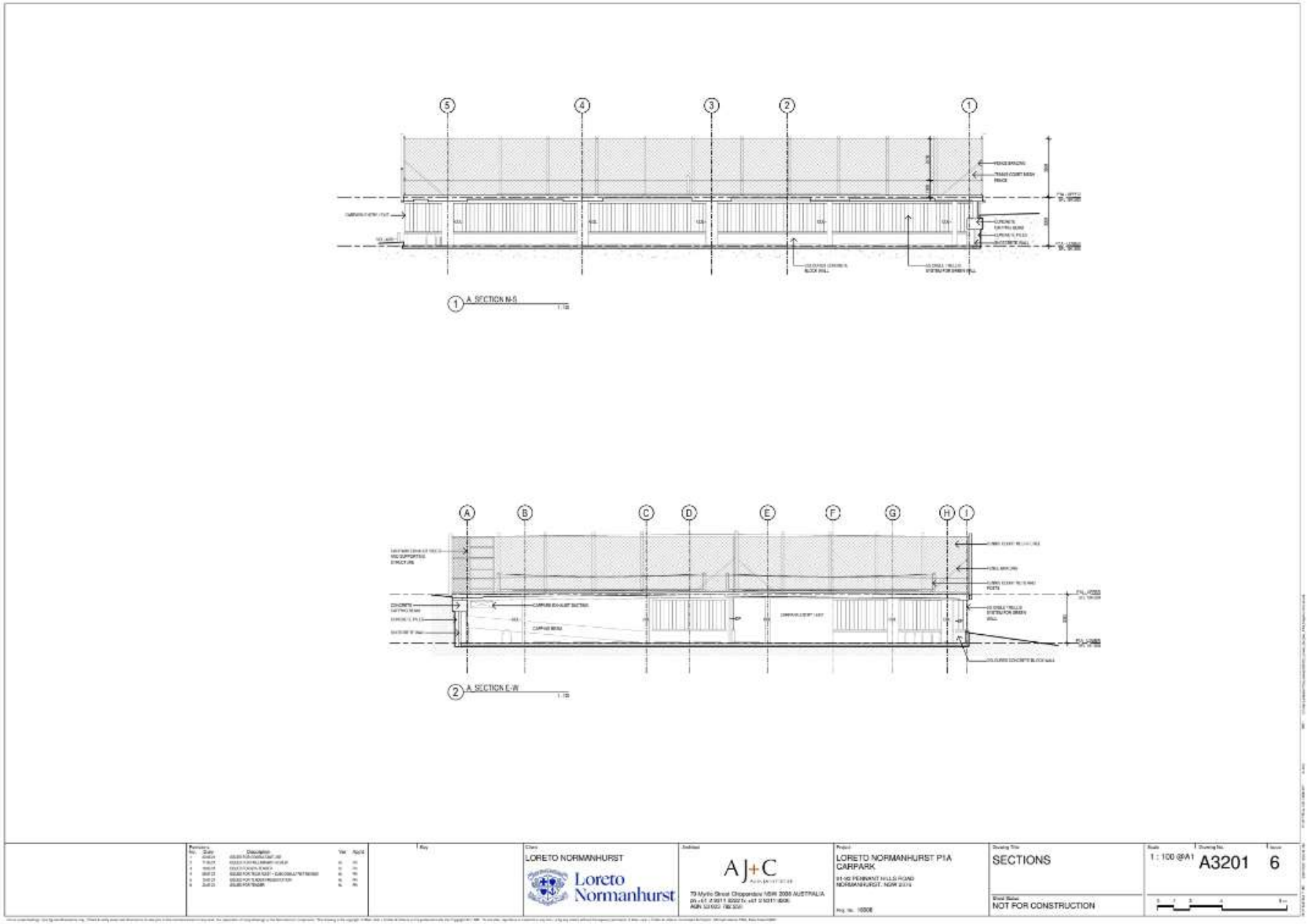


Figure 2.13 – Sections

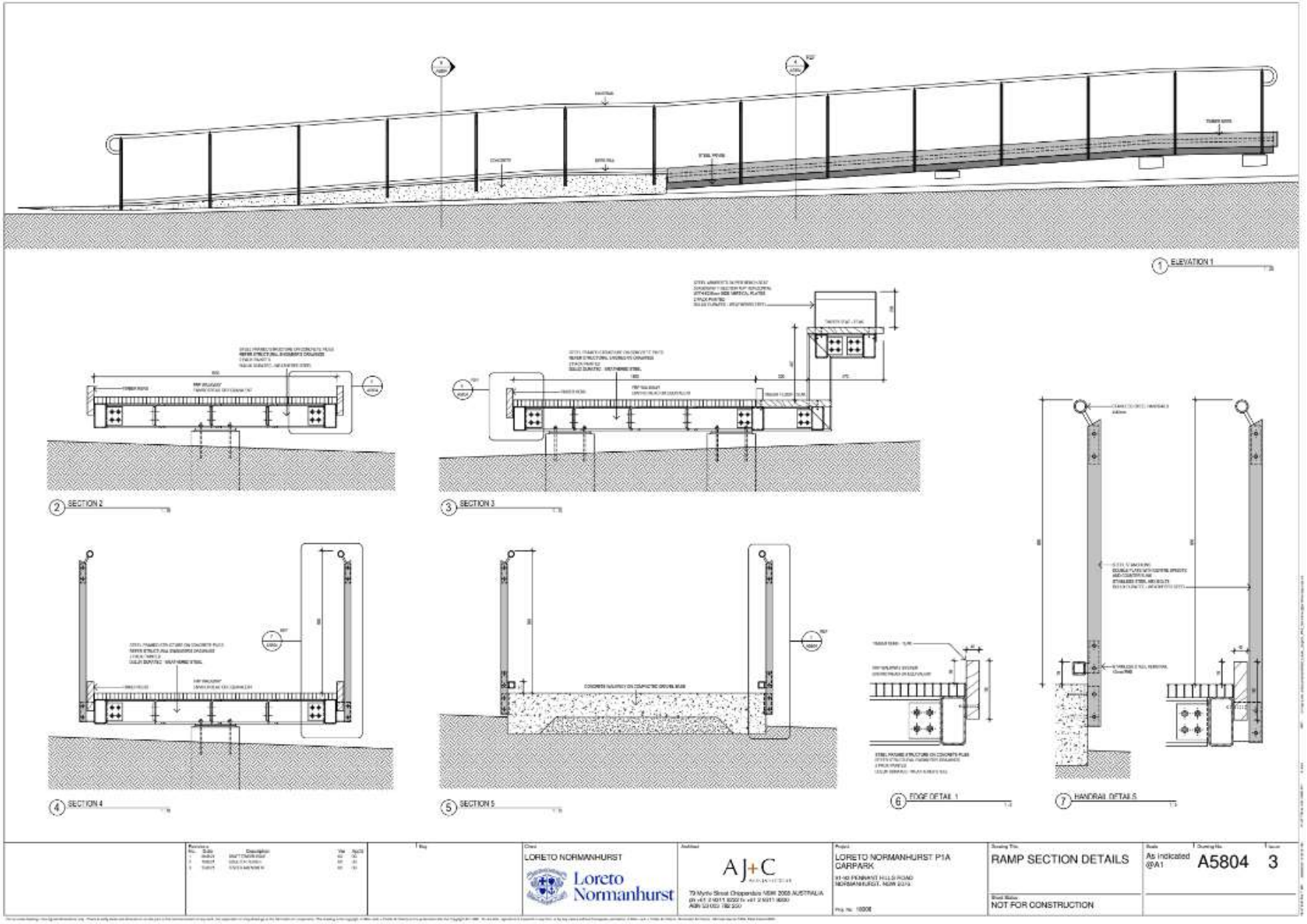


Figure 2.14 – Ramp Section Details

3 GUIDELINES, LEGISLATION & REGULATION

3.1 RELEVANT LEGISLATION

Key environmental legislation relating to noise and vibration management for the project includes:

- Protection of the Environment Operations Act 1997;
- Environment Planning and Assessment Act 1979; and
- Local Government Act 1993.

3.2 GUIDELINES AND STANDARDS

The guidelines and standards relevant to noise management for the project include:

- NSW Government Department of Planning Publication "Development Near Rail Corridors & Busy Roads – Interim Guideline 2008;
- DECC 2009, Interim Construction Noise Guideline, NSW Department of Environment and Climate Change, Sydney NSW.
- NSW Noise Policy for Industry (2017), NSW Office of Environment & Heritage (OEH).
- NSW EPA Road Noise Policy;
- AS 3671 Road Traffic Noise Intrusion;
- AS 1055 Parts 1, 2 and 3 - 1997 Acoustics - Description and Measurement of Environmental Noise;
- AS 2107 - 2018 Acoustics - Recommended design sound levels and reverberation times for building interiors;
- Standards Australia 2010, AS2436-2010, Guide to noise and vibration control on construction, demolition, and maintenance sites. and
- State Environmental Planning Policy (Infrastructure) 2007 (the "ISEPP")

The requirements of these guidelines have been taken fully into account in the Noise & Vibration Management Plan presented in this document.

3.3 CONDITION OF CONSENT

The Consent Conditions for the development require the preparation and implementation of a Construction Noise & Vibration Management Plan, defined in Condition C17 as follows:

C17. The Construction Noise and Vibration Management Sub-Plan (CNVMSP) must address, but not be limited to, the following:

(a) be prepared by a suitably qualified and experienced noise expert;

(b) describe procedures for achieving the noise management levels in EPA's *Interim Construction Noise Guideline* (DECC, 2009);

(c) describe the measures to be implemented to manage high noise generating works such as piling, in close proximity to sensitive receivers;

(d) describe the measures to be implemented to ensure that the noise generated by the construction activities do not have adverse impacts on the ongoing operation of the school;

(e) include details of respite measures to be implemented for high noise generating activities (exceeding 75DBA as measured at the sensitive receiver) including (but not limited to) measures such as:

- works being undertaken in continuous blocks of no more than 3 hours, with at least a 1-hour respite between each block of work generating high noise impact at the identified sensitive receiver;
- respite periods implemented during the day; and
- elimination of high noise generating construction works during identified examination times;

(f) include strategies that have been developed with the community for managing high noise generating works;

(g) describe the community consultation undertaken to develop the strategies in condition C17(d);

(h) include a complaints management system that would be implemented for the duration of the construction; and

(i) include a program to monitor and report on the impacts and environmental performance of the development and the effectiveness of the management measures in accordance with condition C13.

***Note:** the purposes of this condition 'continuous' includes any period during which there is less than one hour respite between ceasing and recommencing any of the work the subject of this condition.*

The requirements of Consent Condition C17 are reflected in the Plan presented in this document.

3.4 ACOUSTIC REPORT

An acoustic assessment of the development is provided in the following report:

> *Loretto Normanhurst Concept Proposal and Stage 1 Construction and Operational Noise Assessment; Wilkinson Murray; December 16th, 2020* – the "Acoustic Report"

This acoustic report includes details of the various advice and recommendations made regarding acoustic issues relevant to the development to ensure the compliance with relevant guidelines, standards and codes.

This report has been used as a reference in the preparation of this Construction Noise & Vibration Management Plan.

3.5 REFERENCE BACKGROUND SOUND LEVELS

Reference Background Sound Levels were measured and presented in the Acoustic Report at four locations as detailed in Table 3.1, below.

Table 3.1 – Background Sound Level Locations

Noise Monitoring Location ID	Noise Monitoring Location Details	Equipment Serial Number
L01	Mt Pleasant (North) receivers	ARL-16-707-015
L02	Mt Pleasant (South) receivers	ARL-16-707-014
L03	Osborn Road (North) receivers	ARL-16-707-015
L04	Osborn Road (South) receivers	ARL-16-707-014

Background sound levels measured at the four reference locations are summarised in table 3.2.

Table 3.2 – Measured Background Sound Levels

Noise Logger	RBL (dBA) [1]				$L_{Aeq,period}$ (dBA) [1]			
	Daytime	Evening	Night-time	Saturday	Daytime	Evening	Night-time	Saturday
L01 [2]	47	44	39	47	56	54	52	55
L02 [2]	49	47	44	48	58	56	55	54
L03 [3]	59	56	38	59	70	69	67	70
L04 [3]	42	39	33	42	55	54	50	40

Note 1: Daytime (6am – 7pm), Evening (7pm – 10pm), and Night-time (10pm – 6am) during weekdays and Saturday (8am – 1pm).
Note 2: Conducted October 2018 between Wednesday 3rd and Thursday 14th
Note 3: Conducted December 2020 between Tuesday 1st and Thursday 10th December

Project Noise Trigger Levels (PNTL's) determined in the Acoustic report are summarised in Table 3.3.

Table 3.3 – Project Noise Trigger Levels

Receiver	Time of Day	ANL [1] $L_{Aeq,period}$	Measured RBL [2]	Measured Noise Level $L_{Aeq,period}$	Criteria for New Sources	
					Intrusive $L_{Aeq,15min}$	Amenity $L_{Aeq,15min}$
Mt Pleasant Ave. (North)	Day	55	47	56	**52**	58
	Evening	45	44	54	49	**48**
	Night	40	39	52	44	**43**
Mt Pleasant Ave. (South)	Day	55	49	58	**54**	58
	Evening	45	47	56	52	**48**
	Night	40	44	55	49	**43**
Osborn Road (North)	Day	55	59	70	64	**58**
	Evening	45	56	69	61	**48**
	Night	40	38	67	43	**43**
Osborn Road (South)	Day	55	42	55	**47**	58
	Evening	45	39	54	**44**	48
	Night	40	33	50	**38**	43

Note 1: ANL = "Amenity Noise Level" for receivers in a Suburban area.
Note 2: RBL = "Rating Background Level".

3.6 CONSTRUCTION NOISE MANAGEMENT LEVELS

Construction noise can represent a significant risk of impact on the amenity of potentially sensitive receivers.

The Interim Construction Noise Guideline (OEH 2009) was developed to focus on applying work practices most suited to minimising construction noise impacts, rather than focusing only on achieving numeric noise levels.

While some noise from construction sites is inevitable, the aim of the guideline is to protect the majority of residences and other sensitive land uses from noise pollution most of the time.

Table 3.2 on the following page sets out management levels for construction noise at residences and how they are to be applied.

The rating background level (RBL), i.e. the overall background noise level measured in each relevant assessment period, is used when determining the management level.

RBL's for this project are detailed in Section 2 of the Noise & Vibration Management Plan presented in the following part of this document.

Table 3.4– Requirements of the Interim Construction Noise Guideline

Recommended Standard hours: **Monday to Friday 7 am to 6 pm** **Saturday 8 am to 1 pm** **No work on Sundays or public holidays**	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise.
		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 meet the noise affected level.
		The proponent should also inform all potentially impacted residents 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, taking into account:
		1. Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or midmorning or mid-afternoon for works near residences; and 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
	Noise affected RBL + 5 dB	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.
* Noise levels apply at the property boundary that is most exposed to construction noise 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 30 m of the residence.		

In addition the following construction noise management levels are recommended for other receivers and areas:

- Active recreation areas (such as parks): external LAeq 15 min 65dBA
- Industrial premises external LAeq 15 min 75dBA
- Offices, retail outlets external LAeq 15 min 70dBA
- Classrooms at schools external LAeq 15 min 45dBA

Based on the above criteria, Table 3.5 summarises the noise management levels applicable for surrounding receivers.

Table 3.5 – Site Specific Construction Noise Management Levels

Location	Construction Noise Management Level (NMLs) - $L_{Aeq,15min}$				Highly Noise Affected Noise Level - $L_{Aeq,15min}$
	Day	Evening	Night	Saturday	
Mt Pleasant Ave (North)	57	49	44	57	75
Mt Pleasant Ave (South)	59	52	49	58	75
Osborn Road (North)	69	66	48	69	75
Osborn Road (South)	52	49	43	52	75

3.7 STATE ENVIRONMENTAL PLANNING POLICY (INFRASTRUCTURE) 2007

State Environment Planning Policy (Infrastructure) 2007 requires that in the case any land developed for residential use that is located in or adjacent to a road corridor for a freeway, a tollway or transitway or any other road with an annual average daily traffic volume of more than 40,000 vehicles, it is required to be demonstrated that the proposed development will not be adversely affected by noise or vibration.

The provisions of the Infrastructure SEPP do not apply in this case.

3.8 NOISE POLICY FOR INDUSTRY (2017)

Noise criteria described in the Noise Policy for Industry (NPI) 2017 (formerly the NSW Industrial Noise Policy 2000) that are relevant to the proposed development have been taken into account in the acoustic assessment undertaken. The noise criterion set out in the NPI depends on whether existing noise levels in a given area are close to recommended amenity levels for different types of residential receiver, for example whether the receivers in question are urban, rural, near existing roads and so on. In this case, the potential receivers in question appear to be both commercial and residential in nature. The Noise Policy for Industry requires that the following actions or circumstances be taken into account in the acoustic assessment of a development of the type proposed:

- Identify the existing level of noise, or noise background
- Determine what weather conditions should be used when predicting noise background
- Assess noise levels that will be involved with the various aspects of the development
- Assess noise from the development at residential receivers
- Assess noise from the development at industrial/commercial receivers

- Apply the urban/industrial interface amenity category, if required
- Identify the appropriate receiver amenity category
- Apply amenity criteria in high traffic noise areas
- Take into account any cumulative noise from multiple developments
- Identify which of the amenity or intrusive criteria apply
- Take into account maximum noise levels during shoulder periods
- Consider the tonality - sliding scale test
- Apply duration correction, if required
- Sleep disturbance
- Present the results of the acoustic assessment in appropriate report form

3.9 INTRUSIVENESS CRITERION

Where existing noise levels are low, noise levels from a proposed new (or changed) operation are limited by the intrusiveness criterion. In such cases, the L_{Aeq} noise level resulting from the impact of any new or substantially changed operation should not exceed the Rating Background Level (RBL) applicable to the residential receivers in question by more than 5dBA.

While the development under consideration is residential in nature, any noise generated by activities associated with the development will be required to not impose an increase of greater than 5dBA over measured RBL at any residential boundary.

3.10 AMENITY CRITERION

The amenity criterion sets an upper limit to control the L_{Aeq} noise level from all industrial sources for daytime, evening and night-time periods, respectively. In accordance with the relevant acoustic criteria and guidelines listed, “maximum” recommended incremental noise levels for these periods are all 5 dBA higher than the “acceptable” levels mentioned in the various NSW acoustic guidelines.

3.11 SLEEP DISTURBANCE

In order to minimise any risk of sleep disturbance to affected residential receivers as a consequence of any activities associated with the proposed development during the nighttime period (10:00pm – 7:00am), the NSW Office of Environment & Heritage (OEH) recommends that:

> *Sleep disturbance is assessed as the emergence of the $L_{A\ (1\ minute)}$ level above the $L_{A90\ (15\ minute)}$ level at the time. Appropriate screening criteria for sleep disturbance are determined to be an $LA1_{\ (I\ minute)}$ level 15dBA above the Rating Background Level (RBL) for the nighttime period.*

While it is considered highly unlikely that potential sleep disturbance impacts will emerge from the proposed residential development, the NSW OEH has confirmed that this is the correct and accepted way to undertake the assessment of sleep disturbance, should such assessment be required.

3.12 INTERPRETATION OF CRITERIA

Where noise levels from industrial sources are close to or above the 5dBA maximum increment over the existing Rating Background Level, as recommended in the NSW Industrial Noise Policy, then the amenity criterion, which incorporates a sliding scale to set limits, becomes relevant.

The sliding scale prevents the overall noise level exceeding the acceptable level as a result of a new noise source. The amenity criterion also needs to consider the possibility of other developments which may affect aggregate noise levels in any given situation.

3.13 VIBRATION

3.13.1 General

Vibration is an important consideration in demolition and construction work and has been considered in the preparation of this Plan.

3.13.2 Types of Vibration

Vibration in buildings can be caused by many different external sources, including industrial, construction and transportation activities.

The vibration may be continuous (with magnitudes varying or remaining constant with time), impulsive (such as in shocks) or intermittent (with the magnitude of each event being either constant or varying with time).

Continuous, impulsive or intermittent vibration are defined as follows:

> **Continuous vibration** continues uninterrupted for a defined period (usually throughout daytime and/or night-time). This type of vibration is assessed on the basis of weighted metres per second acceleration values (m/sec^2).
>
> **Impulsive vibration** is a rapid build up to a peak followed by a damped decay that may or may not involve several cycles of vibration (depending on frequency and damping). It can also consist of a sudden application of several cycles at approximately the same amplitude, providing that the duration is short, typically less than 2 seconds. Impulsive vibration (no more than three occurrences in an assessment period) is also assessed on the basis of acceleration values.
>
> **Intermittent vibration** can be defined as interrupted periods of continuous (e.g. a drill) or repeated periods of impulsive vibration (e.g. a pile driver), or continuous vibration that varies significantly in magnitude. It may originate from impulse sources (e.g. pile drivers and forging presses) or repetitive sources (e.g. pavement breakers), or sources which operate intermittently, but which would produce continuous vibration if operated continuously (for example, intermittent machinery, railway trains and traffic passing by). This type of vibration is assessed on the basis of vibration dose values.

In this case, the obvious apparent source of potential vibrational impacts is the regular and continuous operation of road and rail traffic, and the potential vibration source is considered to be primarily continuous in nature.

The assessment of vibration requires the use of an overall frequency-weighted value for each axis (x, y, and z directions). This overall value is assessed against the preferred value for the relevant axis.

it is important to note that vibration may enter the body along different orthogonal axes, i.e. x-axis (back to chest), y-axis (right side to left side) or z-axis (foot to head) (see Figure 3.1). The three axes are referenced to the human body. Thus, vibration measured in the horizontal plane should be compared

with x- and y-axis criteria if the concern is for people in an upright position, or with the y- and z-axis criteria if the concern is for people in a lateral position (e.g. asleep at night).

When measured vibration values exceed the preferred values, then mitigation measures to meet the preferred values should be considered. Where measured values are lower than the preferred values, vibration is generally found not to be an issue of concern, and no further remedial actions are required.

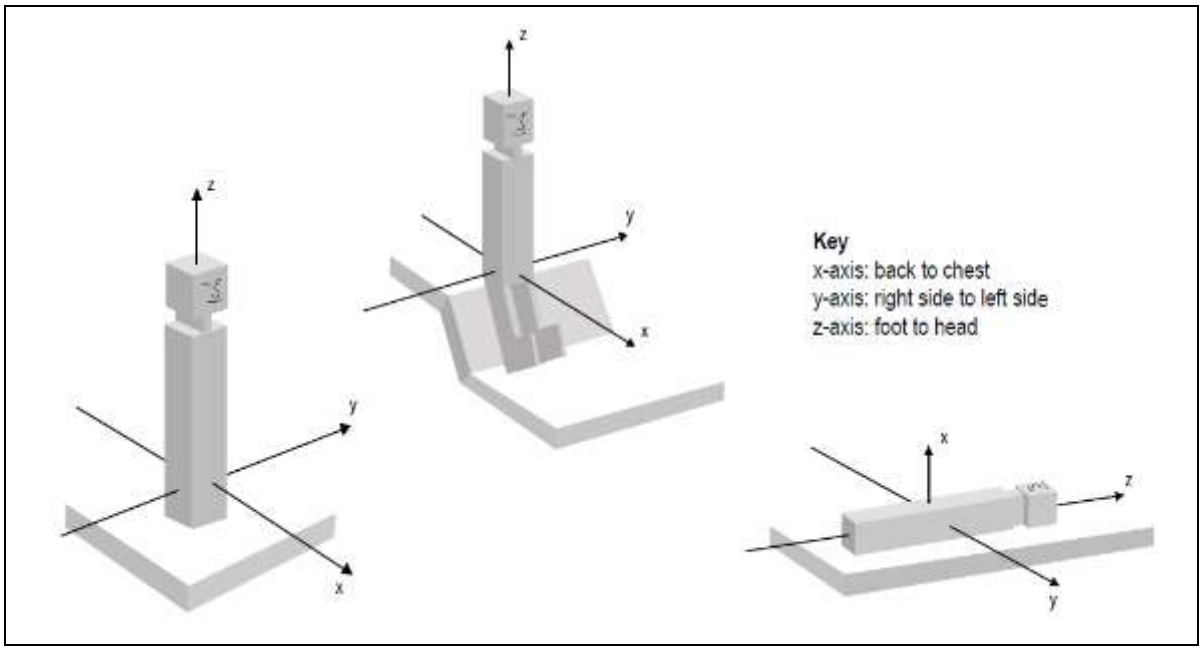


Figure 3.1 - Axes for Assessment of Human Exposure to Vibration (BS 6472–1992)

3.13.3 Relevant Standards

Over the past two decades, ISO, British and Australian Standards for vibration evaluation and assessment have converged. BS 6472–1992, *Evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz)*, ISO 2631.1–1997, *Mechanical vibration and shock – Evaluation of human exposure to whole-body vibration – Part 1: General requirements*, and ISO 2631.2–1989, *Evaluation of human exposure to whole-body vibration – Part 2: Continuous and shock induced vibration in buildings (1–80 Hz)*, contain the most recent advances in vibration evaluation.

The proposed assessment will take these standards fully into account.

3.13.4 Summary of Vibration Guidelines

The vibration guidelines applicable and adopted in relation to this assessment are as follows:

Table 3.6 – Vibration Guidelines

Type of Receiver/Time Period	Preferred	Maximum
	Vibration Dose: m/sec$^{1.75}$	
Residential - Daytime (7:00am – 10:00pm)	0.20	0.40
Residential - Night-time (10:00pm - 7:00am)	0.13	0.26

(Source: NSW Industrial Noise Policy, Noise Policy for Industry (2017), and other)

4 ASSESSMENT CONSIDERATIONS

4.1 PURPOSE & GENERAL SCOPE

The Consent Conditions for the development require the preparation and implementation of a Construction Noise & Vibration Management Plan, as follows:

C17. The Construction Noise and Vibration Management Sub-Plan (CNVMSP) must address, but not be limited to, the following:

(a) be prepared by a suitably qualified and experienced noise expert;

(b) describe procedures for achieving the noise management levels in EPA's *Interim Construction Noise Guideline* (DECC, 2009);

(c) describe the measures to be implemented to manage high noise generating works such as piling, in close proximity to sensitive receivers;

(d) describe the measures to be implemented to ensure that the noise generated by the construction activities do not have adverse impacts on the ongoing operation of the school;

(e) include details of respite measures to be implemented for high noise generating activities (exceeding 75DBA as measured at the sensitive receiver) including (but not limited to) measures such as:

- works being undertaken in continuous blocks of no more than 3 hours, with at least a 1-hour respite between each block of work generating high noise impact at the identified sensitive receiver;
- respite periods implemented during the day; and
- elimination of high noise generating construction works during identified examination times;

(f) include strategies that have been developed with the community for managing high noise generating works;

(g) describe the community consultation undertaken to develop the strategies in condition C17(d);

(h) include a complaints management system that would be implemented for the duration of the construction; and

(i) include a program to monitor and report on the impacts and environmental performance of the development and the effectiveness of the management measures in accordance with condition C13.

Note: the purposes of this condition 'continuous' includes any period during which there is less than one hour respite between ceasing and recommencing any of the work the subject of this condition.

The purpose and scope of the services described in this proposal relate to the preparation and delivery of such a Plan.

The specific acoustic services proposed are summarised in Section 5 of this proposal.

NOISE & VIBRATION MANAGEMENT PLAN

1 NOISE RECEIVERS

1.1 REQUIREMENTS & OBJECTIVE

This document has been prepared with the intention of providing a Noise & Vibration Management Plan that will protect potentially sensitive receivers, including neighbours and other members of the community, from undue, intrusive or otherwise inappropriate noise impacts during site and constructions works associated with the Community School development at 1 Rosemead Road Hornsby NSW.

The objective of the Plan is to ensure that noise and vibration impacts are minimised and maintained within appropriate levels, and that any issues or complaints that might emerge regarding noise impacts, and any contributing issues, are quickly and effectively resolved.

1.2 NOISE SENSITIVE RECEIVERS

This Plan, and Consent Condition C17, require the identification of potentially affected receivers.

Receivers in this case are exclusively residential in nature.

The residential receivers potentially exposed to acoustic impacts during the site preparation and construction phases of the development are identified in Section 3.3 of this Plan.

It is noted that a Plan that provides satisfactory acoustic protection for these most potentially exposed residents, will also provide effective protection and control for any other residences in the vicinity of the development.

These adjoining properties are shown in Figure 3.1 “Locations of Nearest Potentially Affected Noise Receivers”, in Section 3 of this Plan

2 BACKGROUND NOISE MEASUREMENTS

2.1 REQUIREMENTS & OBJECTIVE

This Plan requires details of the prevailing background sound levels at the site, and therefore the additional levels of noise that are considered to be acceptable at adjoining property boundaries in terms of the various applicable acoustic guidelines and regulations.

2.2 RATED BACKGROUND SOUND LEVELS

Based on the background data summarised in Table 2.1, the rated background sound levels adopted for the development project under consideration, in accordance with relevant acoustic assessment guidelines, are as shown in Table 2.1, below.

Table 2.1 – Measured Noise Levels

Noise Logger	RBL (dBA) [1]				$L_{Aeq,period}$ (dBA) [1]			
	Daytime	Evening	Night-time	Saturday	Daytime	Evening	Night-time	Saturday
L01[2]	47	44	39	47	56	54	52	55
L02[2]	49	47	44	48	58	56	55	54
L03[3]	59	56	38	59	70	69	67	70
L04[3]	42	39	33	42	55	54	50	40

Note 1: Daytime (6am – 7pm), Evening (7pm – 10pm), and Night-time (10pm – 6am) during weekdays and Saturday (8am – 1pm).
Note 2: Conducted October 2018 between Wednesday 3rd and Thursday 14th
Note 3: Conducted December 2020 between Tuesday 1st and Thursday 10th December

2.3 PROJECT NOISE TRIGGER LEVELS

Project Noise Trigger Levels (PNTL's) determined in the Acoustic report are summarised in Table 2.2.

Table 2.2 – Project Noise Trigger Levels

Receiver	Time of Day	ANL[1] $L_{Aeq,period}$	Measured RBL[2]	Measured Noise Level $L_{Aeq,period}$	Criteria for New Sources	
					Intrusive $L_{Aeq,15min}$	Amenity $L_{Aeq,15min}$
Mt Pleasant Ave. (North)	Day	55	47	56	**52**	58
	Evening	45	44	54	49	**48**
	Night	40	39	52	44	**43**
Mt Pleasant Ave. (South)	Day	55	49	58	**54**	58
	Evening	45	47	56	52	**48**
	Night	40	44	55	49	**43**
Osborn Road (North)	Day	55	59	70	64	**58**
	Evening	45	56	69	61	**48**
	Night	40	38	67	43	**43**
Osborn Road (South)	Day	55	42	55	**47**	58
	Evening	45	39	54	**44**	48
	Night	40	33	50	**38**	43

Note 1: ANL = "Amenity Noise Level" for receivers in a Suburban area.
Note 2: RBL = "Rating Background Level".

3 GENERAL CONSTRUCTION NOISE CONSIDERATIONS

3.1 REQUIREMENTS & OBJECTIVE

This Noise Management Plan takes into account a number of key noise issues associated with site works, demolition and construction. These considerations are necessary in order to ensure that the Plan:

- Takes into account an appropriate prediction as to the level of noise impact likely to affect the nearest noise sensitive receivers during the development process; and
- Identifies whether or not development noise levels will comply with the relevant noise criteria; whether or not resultant site noise levels are likely to exceed this noise criteria, and where relevant considers the duration and frequency of respite periods that may be required to be afforded to the occupiers of neighboring properties during the development process.

Some important considerations are summarised below.

3.2 NOISE

The following review of demolition, site preparation and construction noise impacts are based on the numbers and types of construction equipment likely to be used during the project, together with consideration of the construction site layout, and the associated proximity of anticipated site activities to nearby noise sensitive receivers. The review has been structured to assist with decisions to be made by worksite personnel, with the aim of reducing noise impacts during construction.

3.3 CONSTRUCTION NOISE MANAGEMENT LEVELS (CNML's)

The locations of the nearest potentially vulnerable noise receivers are shown in Figure 3.1, on the following page.

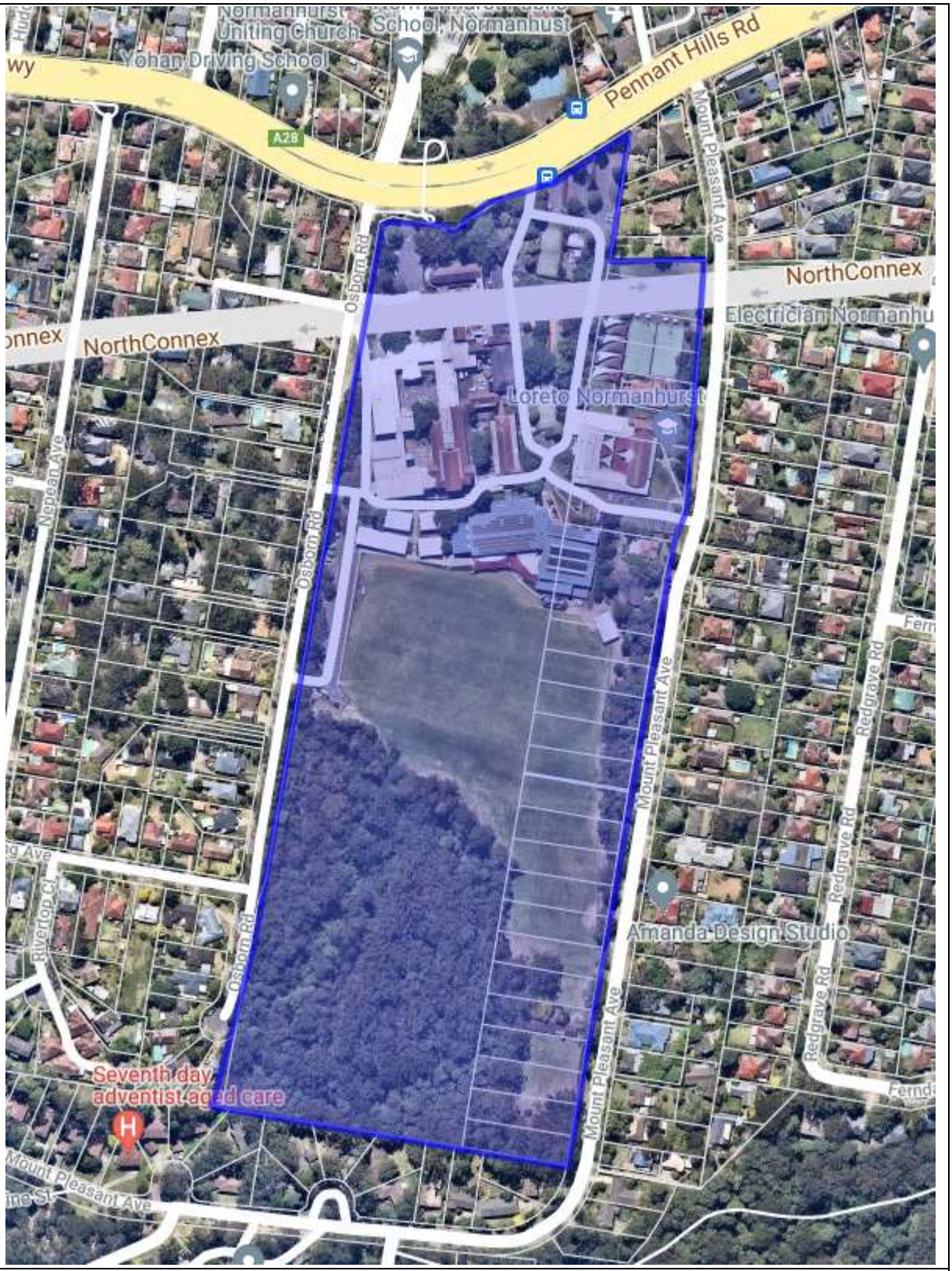
The receivers shown in Figure 3.1 were grouped in the Acoustic Report as:

Table 3.1 – Background Sound Level Locations

Noise Monitoring Location ID	Noise Monitoring Location Details	Equipment Serial Number
L01	Mt Pleasant (North) receivers	ARL-16-707-015
L02	Mt Pleasant (South) receivers	ARL-16-707-014
L03	Osborn Road (North) receivers	ARL-16-707-015
L04	Osborn Road (South) receivers	ARL-16-707-014

The same groupings have been retained in this Noise & Vibration Management Plan.

The receiver locations are illustrated in Figure 3.1, on the following page.



A.

Figure 3.1 – Locations of Potentially Affected Receivers

Based on the background noise levels identified in Section 3, and the requirements of the NSW DECC (OEH) Interim Construction Noise Guideline and other relevant acoustic protocols and standards the Noise Management Levels (NML's) for the potentially noise sensitive residential receivers are summarised in Table 3.5, below.

Operating hours for the site preparation and constriction works covered by this Plan will be to be between 7:00am and 6:00pm Mondays to Fridays, and between 8:00 am and 1:00 pm Saturdays, which correspond with "daytime" hours as defined in the noise management guidelines and protocols relevant to this Plan.

No construction activities will be undertaken on Sundays or public holidays.

Accordingly, Noise Management Levels for daytime hours and Saturdays are relevant to this Plan.

Table 3.2 – Site Specific Construction Noise Management Levels

Location	Construction Noise Management Level (NMLs) - $L_{Aeq,15min}$				Highly Noise Affected Noise Level - $L_{Aeq,15min}$
	Day	Evening	Night	Saturday	
Mt Pleasant Ave (North)	57	49	44	57	75
Mt Pleasant Ave (South)	59	52	49	58	75
Osborn Road (North)	69	66	48	69	75
Osborn Road (South)	52	49	43	52	75

3.4 PREDICTED NOISE LEVELS

The various activities and equipment expected to be undertaken and used at the site during the project. The items identified in the Acoustic report are summarised in Table 3.3, below.

Table 3.3 – Site Construction Activities, Equipment and Estimated Noise Emission Levels

Plant	Sound Power Level	Sound Pressure Level at 7m
Concrete Truck	109	84
Angle Grinder	109	84
Concrete Pump – 120mm diameter / 50 bar	112	87
Concrete Saw	116	91
Mobile Crane	98	73
Dump Truck	108	83
Compressor	100	75
Bobcat	103	78
Hand Tools	90	65
Excavator	108	83
Crawler Cranes	98	73
Tower Crane	104	79
Front End Loader	112	87
Excavator	107	82
Hammer Hydraulic	122	97
Bored Pile Rig	112	87
Asphalt Milling Machine	110	85
Bitumen Spray Truck	100	75
Road Profiler	107	82
Vibratory Roller (10-12 tonne)	109	86

For prediction purposes, a total sound pressure level for each activity or item of major equipment has been included based on published and reviewed data.

In the case of equipment, sound levels have been based on detailed data published by the UK Department of Environment (refer Appendix B).

3.5 PROPOSED WORKS

Proposed works to be undertaken during the overall project are summarised below:

Boarding Facility (Envelope 1)

- Demolition
- Excavation
- Building Construction
- Façade / Fit Out Finishing Works

Garden Plaza (Project A)

- Site Preparation & Clearing Works
- Landscaping & Finishing Works

Demolished Dock & Maintenance Wing (Project B)

- Demolition
- Excavation
- Building Construction
- Landscaping & Finishing Works

Multi-Sport Courts with Underground Car Park (Envelope 13)

- Site Preparation & Clearing Works
- Excavation
- Building Construction

Tennis Courts with Underground Car Park

- Site Preparation & Clearing Works
- Excavation
- Building Construction

Link Road from Osborn Road – Mt Pleasant Avenue (Project H)

- Site Preparation & Clearing Works
- Construction of Roadway
- Landscaping & Finishing Works (including Paving)

Osborn Road Car Park Expansion Project J)

- Site Preparation & Clearing Works
- Expansion of Parking Area

During standard construction hours the Acoustic report predicts exceedances of up to 13 dBA of the established Noise Management Levels (NML's) at residential receivers in close proximity to the development.

These exceedances are typically predicted during site clearing, demolition and excavation stages of the work.

No exceedances are predicted during standard construction hours for the other construction activities.

The Acoustic report found that there are no noise sensitive receivers that are considered to be Highly Noise Affected, that is with predicted noise levels exceeding 7 dB Leq.

The Interim Construction Noise Guideline (ICNG) (refer Appendix A) describes strategies for construction noise mitigation and control that are applicable to this development.

Where construction noise is predicted to exceed the established Noise Management Levels (NML's) it is recommended that construction noise mitigation measures should be considered where reasonable and feasible.

Appropriate mitigation measures have been included in this Plan.

4 NOISE MITIGATION

4.1 REQUIREMENTS & OBJECTIVE

One of the primary requirements of this Noise Management Plan is to provide specific requirements in relation to noise mitigation, including in particular:

- Details of noise mitigation measures that will be deployed on site to reduce noise impacts on the occupiers of neighbouring properties to a minimum; and
- Details of sound mitigation measures to be undertaken in relation to plant and equipment to be used at the site, taking into account the likely noise impacts on the occupiers of neighbouring properties, and any other less intrusive technologies available.

4.2 REFERENCES & GUIDELINES

Refer “Background & Reference Information” Section 3.

4.3 CONTROLS

Noise control measures include the timing during which work is undertaken, and the way in which work is undertake.

Noise mitigation controls are summarised in Table 4.1, on the following page.

4.4 NOISE MITIGATION ACTIONS

Noise mitigation actions are summarised in Table 4.1, on the following page.

Noise and vibration levels from construction are likely to be similar to the levels for receivers immediately surrounding the site.

The school; itself will be one of the potentially most impacted receivers, and measures will be required.to manage impacts on the school, its teachers, and its students.

Specific measures that can be adopted to manage noise and vibration impacts at the school will include:

- Closing of classroom windows;
- Relocating classes during busy construction periods; and
- Where practicable, scheduling high noise works during school holiday periods

Table 4.1 – General Noise Impact Mitigation Control & Action Measures

	Mitigation Control & Action Measures	Phase			Timing	Reference	Responsibility
		Site Preparation	Demolition	Construction			
Administrative Controls							
	Construction activities that are audible at any residential receptor, shall only be undertaken during the following hours: a) 7:00 am to 6:00 pm, Mondays to Fridays, inclusive; b) 8:00 am to 1:00 pm on Saturdays; and c) at no time on Sundays or public holidays.	✓	✓	✓	Throughout Project	Noise & Vibration Management Plan	CBG
	The OEH construction noise management levels will be achieved as far as practicable. If works are predicted to exceed the NMLs (refer Section 3), residents should be informed of the time, type, duration, and noise level of noisy activities prior to the anticipated exceedance.	✓	✓	✓	Throughout Project	Noise & Vibration Management Plan	CBG
	Provide an appropriate induction to site personnel (which includes Environmental Due Diligence Training) addressing the requirements of this Plan and their responsibilities with regard to noise and management.	✓	✓	✓	Throughout Project	Noise & Vibration Management Plan	CBG / Acoustic Consultant
	Ensure truck drivers are informed of any designated vehicle routes, parking locations, delivery hours, and minimisation of engine braking and idling.	✓	✓	✓	Throughout Project	Noise & Vibration Management Plan	CBG
	Provide education of supervisors, operators, and sub-contractors on the need to minimise noise through workplace meetings and on-site coaching.	✓	✓	✓	Throughout Project	Noise & Vibration Management Plan	CBG
	Observe the strategy outlined in Section 6 for handling noise complaints that includes recording, reporting, and acting and notification procedures to adjoining property owners when noisy works are to be conducted.	✓	✓	✓	Throughout Project	Noise & Vibration Management Plan	CBG
	Consider scheduling activities where cumulative impacts indicate increased noise impacts so that these works are not undertaken together.	✓	✓	✓	Throughout Project	Noise & Vibration Management Plan	CBG

Construction Controls – General							
	Select appropriately sized equipment for the task, such as excavation equipment.	✓	✓	✓	Throughout Project	Noise & Vibration Management Plan	CBG
	Avoid, where possible, noisy plant working simultaneously close together	✓	✓	✓	Throughout Project	Noise & Vibration Management Plan	CBG
	Ensure all equipment is equipped with appropriate noise control (e.g. mufflers, silenced exhausts, acoustic enclosures, and flashing lights as an alternative to revising beepers) and is turned off when not in use.	✓	✓	✓	Throughout Project	Noise & Vibration Management Plan	CBG
	Ensure equipment is operated in the correct manner and adequately maintained - including replacement of engine covers, repair of defective silencing equipment, tightening of rattling components, repair of leakages in air lines and shutting down equipment not in use.	✓	✓	✓	Throughout Project	Noise & Vibration Management Plan	CBG
	Where practicable, maintenance work on all construction plant will be carried out in site areas as remote as practicable from nearby receivers.	✓	✓	✓	Throughout Project	Noise & Vibration Management Plan	CBG
	Ensure traffic movement is kept to a minimum, e.g. ensure trucks are fully loaded so that the volume of each delivery is maximised.	✓	✓	✓	Throughout Project	Noise & Vibration Management Plan	CBG
	Consider the use of temporary screens for mitigation of specific stationary noise sources, where identified, as causing excessive noise impact. If required, deploy screens in a way to ensure noise goals are met	✓	✓	✓	Throughout Project	Noise & Vibration Management Plan	CBG
Monitoring							
	Monitor noise levels in accordance with Section 5 to verify compliance with the provisions of this Plan.	✓	✓	✓	Per Section 5	Noise & Vibration Management Plan	CBG / Acoustic Consultant

Note: CBG = Cowyn Building Group

5 NOISE MONITORING

5.1 REQUIREMENTS & OBJECTIVE

One of the objectives of this Plan is to provide a practical and effective methodology to ensure that noise monitoring is undertaken at appropriate times during the project.

This section of the Plan provides guidelines for project noise monitoring.

5.2 REFERENCES & GUIDELINES

Refer “Guidelines, Legislation & Regulation”, Section 3.

5.3 CONTROLS

Refer “Guidelines, Legislation & Regulation”, Section 3.

Monitoring controls and actions presented as part of this Plan are limited to noise.

Previous assessments, and the nature of the proposed development, both indicate that vibration is unlikely to require specific monitoring (refer Section 6).

However, if issues arise in relation to vibration issues, advice will need to be obtained from the contractor’s nominated Acoustic Consultant (or elsewhere as necessary), and appropriate action taken.

Responses to any complaints received regarding vibration issues should be dealt with in accordance with the provisions of Section 7 of this Plan.

5.4 ACTIONS

The analysis presented in Section 3 of this Plan indicate that exceedances of adopted site reference noise levels may occur during site clearing, demolition, and excavation stages of the work. work.

This Plan requires that if necessary appropriate noise monitoring can be undertaken during these potentially higher noise work activities in order to:

- Verify compliance with the noise objectives presented in Section 3;
- In response to complaints where this is considered appropriate;
- In the event of any requirement for out-of-hours works, or works involving noise generation substantially different to, and in excess of, that identified in Section 3; and
- By default, and in the absence of the above circumstances, for appropriate periods during site clearing, demolition, and excavation activities.

Details of noise monitoring are provided below.

5.4.1 Noise Monitoring Locations

Two locations have been selected for noise monitoring, consistent with the potentially sensitive boundary locations identified in Section 3.

These locations are identified in Figure 5.1 on the following page.

Figure 5.1 – Noise Monitoring Locations

The locations shown in Figure 5.1 are:

A. The western site boundary of the development site adjacent to Osborn Road; and

B. The eastern site boundary adjacent to Mount Pleasant Avenue.

Noise management levels for each monitoring location are repeated in Table 5.1, on the following page

Table 5.1 - Noise Monitoring Locations and NMLs

Location	Construction Noise Management Level (NMLs) - $L_{Aeq,15min}$				Highly Noise Affected Noise Level - $L_{Aeq,15min}$
	Day	Evening	Night	Saturday	
Mt Pleasant Ave (North)	57	49	44	57	75
Mt Pleasant Ave (South)	59	52	49	58	75
Osborn Road (North)	69	66	48	69	75
Osborn Road (South)	52	49	43	52	75

5.4.2 Noise Monitoring

Noise levels will be monitored at each of the two locations in the circumstances described in 5.4, above.

- Noise levels should be measured using a Type 1 or Type 2 Sound Level Meter.
- Measurements should be recorded over 15-minute periods.
- The L_{Aeq}, L_{A90}, L_{MAX} and L_{MIN} parameters should be measured, and results recorded in a suitable field log or record.

A suitable Noise Monitoring Record Form for the recording of noise levels is provided at Appendix D.

Attended noise monitoring is recommended in the first instance. Continuous unattended monitoring will only be required if unresolved issues arise with any receivers regarding noise impacts.

Any identified noise level exceedances will be investigated to determine the cause, and to identify any necessary mitigation measures.

5.4.3 Noise Monitoring Methodology

Instrumentation

The following procedures should be observed during noise measurement operations:

- Ensure that the Sound Level Meter (SLM) used for monitoring has current laboratory calibration certification;
- Operate the SLM strictly in accordance with relevant guidelines;
- Ensure the windscreen is attached and that the SLM is set to A-weighted and fast response;
- Prior to and completing each sound level measurement, the SLM should be field calibrated using the calibrator supplied with the instrument; and
- Ensure that the pre- and post- measurement calibrations do not differ by more than 0.5dB(A).

Conditions

Noise monitoring should be undertaken on days of light winds (<5 m/s) and no rain. Rain and too much wind will elevate the noise level. If there is no choice but to monitor in inclement weather, note the conditions in the field sheet.

Conduct of Monitoring

The required monitoring van be undertaken by site personnel, if experienced with the use of sound level meters, or by the project acoustic consultant (refer Section 12).

Noise Monitoring Procedure

Monitoring should be undertaken for a minimum of 15 minutes in each location and the following information should be recorded in accordance with AS 1055.2—1997 Acoustics—*Description and measurement of environmental noise.*

The field sheet for noise monitoring should capture the following details.

- Date and time of measurement;
- Details of the measurement positions, instrumentation used, and types of analyses made;
- Weather conditions during the measurements (wind direction, wind velocity, relative humidity, temperature, recent precipitation);
- Description of the noise being investigated as well as operating conditions of the sound source(s) under investigation;
- Noise due to other sources including normal and possibly unusual noises;
- Noise levels should be measured using a Type 1 Sound Level Meter.
- Results and interpretation including LAeq, LA90, LA10 values as a minimum; and
- Associated observations (vibrations, amplitude, or frequency modulation or similar).

Noise monitoring results will be recorded on a Noise Monitoring Record Form.

An example Noise Monitoring Record form is provided as Appendix D.

In the absence of site personnel experienced in the use of acoustic monitoring instruments, it is recommended that, if required, noise monitoring is undertaken by an appropriately qualified and experienced environmental/acoustic consultant.

Noise monitoring records should be retained on site for inspection by authorised stakeholders, as required.

6 VIBRATION

6.1 REQUIREMENTS & OBJECTIVE

The primary requirement of this Noise & Vibration Management Plan is to provide specific procedures and controls in relation to noise emissions.

6.2 REFERENCES & GUIDELINES

Refer “Background & Reference Information” Section 3.13.

6.3 BACKGROUND

Impacts associated with construction vibration are most likley to occur during excavation for the Boarding Facility and development of the Link Road from Osborn Road to Mount Pleasant Avenue.

Table 6.1 below sets out sets out typical ground vibration levels at various distances for safe working distances.

Table 6.1 - Recommended Safe Working Distances for Vibration Intensive Plant

Item	Description	Safe Working Distance	
		Cosmetic Damage	Human Response
Small Hydraulic Hammer	(300kg – 5 to 12t Excavator)	2m	7m
Medium Hydraulic Hammer	(900kg – 12 to 18t Excavator)	7m	23m
Large Hydraulic Hammer	(1600kg – 18 to 34t Excavator)	22m	73m
Vibratory Pile Driver	Sheet piles	2m to 20m	20m
Pile Boring	≤ 800mm	2m (nominal)	N/A
Jackhammer	Hand held	1m (nominal)	Avoid contact with structure

6.4 CONTROLS

Vibration controls for the Boarding Facility (Envelope 1) and the Link Road from Osborn Road to Mount Pleasant Avenue (Project H) are provided below:

Boarding Facility

The proposed Boarding Facility is located on a fairly steep gradient with significant cut and fill required during the excavation stage. Excavation is anticipated to be required within 9 metres of the Aquatic centre building.

Based on the indicative construction equipment identified in Table 6.1 (previous page) the minimum working distance to avoid cosmetic damage are as follows:

- 13-tonne excavator with medium sized (900 kg) hydraulic hammer — 7 metres
- Pile boring ≤ 800 mm — 2 metres (nominal)

The Aquatic Centre building is located 9 metres from the proposed work activities and falls outside the distance for potential cosmetic damage.

A review of the site plant and surrounding residential receivers indicates that the minimum distance between the vibration generating activities and surrounding residential buildings will be approximately 40 metres. At this distance structural damage to residential buildings from all proposed work activities is considered unlikely.

Link Road

Vibration intensive items of plant proposed for use during construction works will include vibratory rollers associated with the construction of the Link Road from Osborn Street to Mount Pleasant Avenue (Project H).

There are no vibration sensitive receivers in close proximity to the proposed road construction activities.

6.5 VIBRATION MITIGATION ACTIONS

Other than the controls described in 6.4 above, no specific vibration mitigation actions are anticipated.

Should the need for vibration mitigation arise, it is recommended that specialist advice is sought the Cowyn Building Group's nominated acoustic consultant on a circumstance specific basis.

7 COMMUNICATION & COMPLAINTS MANAGEMENT

7.1 REQUIREMENTS & OBJECTIVE

Part of the purpose of this Plan is to provide practical and effective protocols in relation to communication, community consultation and complaints management. Two important aspects of this process are:

- To provide the basis for an effective level of community engagement to be undertaken with the building managers/occupiers of the main adjoining noise sensitive commercial and residential properties likely to be most affected by site works and the operation of plant/machinery particularly during the site preparation and construction stages of the project; and.

- To establish the course of action will be taken following receipt of a complaint concerning site noise or vibration.

7.2 REFERENCES & GUIDELINES

Refer Sections 3 & 4.

7.3 CONTROLS

Refer Sections 3 & 4.

7.4 COMPLAINTS MANAGEMENT ACTIONS

7.4.1 Community Relations

An effective community relations program should be put in place to keep the community that has been identified as being potentially affected appraised of progress of the works and to forewarn potentially affected groups (for example by letterbox drop and meetings) of any anticipated changes in noise and vibration emissions prior to critical stages of the works, and to explain complaint procedures and response mechanisms. This program involves a Community and Stakeholder Engagement Strategy specifically for the Loretto Normanhurst project.

Close liaison should be maintained between the communities overlooking work sites and the parties associated with the construction works to provide effective feedback regarding perceived noise and vibration emissions. In this way, equipment selection and work activities can be coordinated where necessary to minimise disturbance to neighbouring communities and to ensure prompt and effective response to any complaints that may arise.

7.4.2 Communication & Consultation

A suitable letter to be forwarded to all residential and other neighbours within a 100 metre radius of the development site, prior to the commencement of site works, advising that site preparation and construction works will be proceeding at the site over a certain estimated tine frame; that all care will be taken to ensure that no undue impacts are imposed on neighbouring properties, and providing a site contact for any questions or complaints.

A potentially suitable letter has been provided for reference at Appendix E.

7.4.3 Complaints Management

The following procedure will be followed in the case of any complaints received, either verbally or in writing:

1. All complaints received in relation to noise or other issues, including vibration and dust issues, will be recorded in an appropriate log.
2. In respect of noise, each complaint will be investigated and where the noise in question is in excess of allowable limits, appropriate noise amelioration measures will be put in place to mitigate future occurrences.
3. In respect of vibration or other issues, each complaint will be investigated, and if needed advice and assistance sought from the developer's environmental consultant or otherwise.
4. A written response will be provided to all complainants, advising the outcome of the investigation of the complaint, and any relevant actions taken.

8 PLANT & EQUIPMENT

8.1 REQUIREMENTS & OBJECTIVE

An important aspect of this Plan is to provide an indications of what general types of plant and equipment is to be used on the site; the level of sound mitigation measures to be undertaken in each case and the criteria adopted in the selection of equipment, taking into account anticipated noise impacts on the occupiers of neighbouring properties, and taking into consideration any other less intrusive technologies available.

The objective of this aspect of the Plan is to help ensure that the level of sound associated with and generated by plant and equipment used during the site preparation and construction phases of the development does not cause any undue or intrusive acoustic impact on neighbouring properties and residents.

These matters have been dealt with in Section 3 and 4 of this Plan, but the requirement is restated here for completeness.

8.2 REFERENCES & GUIDELINES

Refer Sections 3 & 4.

8.3 CONTROLS

Refer Sections 3 & 4.

8.4 PLANT & EQUIPMENT ACTIONS

Refer Section 4, Table 4.1.

9 HIGH NOISE GENERATING WORKS

As detailed previously in this Plan, excessively high noise generating works are not anticipated during the redevelopment works proposed for Loretto Normanhurst.

However, if for any reason high noise generating works are experienced, the following procedures will be followed in order to ensure compliance with relevant and applicable acoustic guidelines and requirements:

- Cease any such works until appropriate consultation has taken place with any potentially affected receiver;

- Subject to the completion of appropriate consultation, comply with the procedures and guidelines provided in Table 4.1, as follows:

  - The established construction noise management levels will be achieved as far as practicable. If works are predicted to exceed the NMLs (refer Section 3), residents should be informed of the time, type, duration and noise level of noisy activities prior to the anticipated exceedance;

  - Observe the strategy outlined in Section 6 for handling noise complaints that includes recording, reporting and acting and notification procedures to adjoining property owners when noisy works are to be conducted;

  - Consider scheduling activities where cumulative impacts indicate increased noise impacts so that these works are not undertaken together;

  - Avoid, where possible, noisy plant working simultaneously close together; and

  - Consider the use of temporary screens for mitigation of specific stationary noise sources, where identified, as causing excessive noise impact. If required, deploy screens in a way to ensure noise goals are met.

10 TRAINING

10.1 REQUIREMENTS & OBJECTIVE

This Plan provides for the appropriate and effective training of staff and contractors involved in the proposed development.

Appropriate training protocols and procedures are required to ensure that this Plan can be effectively implemented, and its objectives achieved.

10.2 REFERENCES & GUIDELINES

Refer Sections 3 & 4.

10.3 CONTROLS

Refer Sections 3 & 4.

10.4 ACTIONS

1. The Cowyn Building Group shall implement appropriate training and induction in the requirements of this Plan.

2. All employees, contractors and utility staff working on site will undergo site induction training which will include Environmental Due Diligence Training. The induction will address:

    - This Noise & Vibration Management Plan;
    - The existence of noise legislation and what this means for the project, including Noise Management Levels;
    - Delivery hours and locations;
    - Reporting and recording of environmental incidents related to noise and vibration;
    - Noise and vibration minimisation measures; and
    - The importance of regular plant and vehicle maintenance.

3. Records will be kept of all personnel undertaking the site induction and training, including the contents of the training, date, and name of trainer/s.

4. Key staff will undertake more comprehensive training relevant to their position and/or responsibility. The need for and nature of this training will be determined by the Cowyn Building Group, in consultation with its nominated acoustic consultant or other advisor(s) to the project as required.

11 COMPLIANCE, REVIEW, AND IMPROVEMENT

11.1 COMPLIANCE

Evidence should be recorded, and available for inspection as required by authorised stakeholders demonstrating the implementation of the various requirements of this Noise & Vibration Management Plan, including in particular compliance with recommendations regarding noise monitoring and management, and public consultation, provision of information, and complaints handling by the Site Supervisor(s).

Appropriate evidence should be included in the review process described in 11.3, below.

11.2 REQUIREMENTS & OBJECTIVE

Provision of a practical and achievable method for compliance, review and continuous improvement is an important part of this Noise & Vibration Management Plan.

Normally accepted management guidelines and protocols require consideration of ongoing compliance with relevant guidelines, regulations and protocols, and provision for review as required, and continuous improvement.

11.3 REVIEW & IMPROVEMENT ACTIONS

11.3.1 Environmental Management Review

The effectiveness and proper implementation of the Plan will be reviewed by the Cowyn Building Group in consultation with the appointed site supervisor(s) and the Cowyn Building Group's acoustic consultant or other advisors as required at a minimum of every six months or sooner as necessary during the course of the project.

The review will comprise:

- Reviewing the results of any noise monitoring required by this Plan;
- Reviewing any complaints received, and the outcomes of associated investigations, corrective actions, and responses as required by this Plan; and
- Reviewing any other relevant issues.

11.3.2 Continuous Improvement

Continual improvement of this Plan, as required, will be achieved by the regular evaluation of noise and vibration management performance against objectives and targets for the purpose of identifying opportunities for improvement.

The continual improvement process will, on a minimum six-monthly basis:

- Review the adequacy of this Plan; and
- Consider any recent developments in practices and technology to ensure best management practices are followed to minimise noise impacts.

On a minimum quarterly basis:

- Review noise monitoring results and identify areas of opportunity for improvement of noise management which can contribute in a practical and cost-effective way to improved performance.

And, if any incidents/non-conformances occur:

- Determine the root cause or causes of any non-conformances and deficiencies;
- Develop and implement a plan of corrective and preventative action to address non-conformances and deficiencies, if required; and
- Verify the effectiveness of any corrective and preventative actions undertaken.

Outcomes of these reviews shall be documented and retained for the duration of the project.

12 CONTACT DETAILS

PRINCIPAL CONTRACTOR:

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13 NOISE & VIBRATION ACTION PLAN

An Action Plan summarising the key actions identified in this overall Noise & Vibration Management Plan, has been included for convenience in Table 13.1, below.

Table 13.1 – Noise Management Action Plan

Action	Timing	Responsibility
1. Finalise Noise Management Plan.	December 2021	CBG / Acoustic Consultant
2. Submit the finalised and approved Plan to the PCA as required to confirm compliance with Condition of Consent C17.	December 2021	CBG
3. Obtain CC approval for the development and the associated Noise & Vibration Management Plan.	December 2021	CBG.
4. Revise Plan as required to achieve approval.	December 2021	CBG / Acoustic Consultant
5. Finalise and deliver advisory letter to noise sensitive receivers by letter box drop	December 2021	CBG
6. Develop training strategies and materials as required by the Plan.	tba	CBG / Acoustic Consultant
7. Conduct safety initial noise training induction	tba	CBG
8. Establish complaints management procedures per Section 6	tba	CBG
9. Undertake compliance noise monitoring per Section 5	If required	CBG / Acoustic Consultant
10. Conduct ongoing noise training inductions	As required	CBG
11. Respond to any complaints received	As required	CBG
12. Apply noise mitigation strategies per Section 4 and otherwise as applicable	Throughout project	CBG
13. Review Noise Management Plan per Section 11	Six monthly & quarterly	CBG / Acoustic Consultant

Note: CBG = Cowyn Building Group

Further actions can be added as required during the course of the project, and in particular following the review steps described in Section 10.

14 PLAN SUMMARY

Noise Management Plan	
Objective	❑ To meet appropriate noise standards so as to minimise any impacts of construction noise works on noise sensitive land uses.
Requirements	❑ Hornsby Council noise guidelines ❑ Australian Standard AS 2436-1981 Guide to Noise Control on Construction, Maintenance and Demolition on Sites. ❑ NSW Interim Construction Noise Guideline (2009) ❑ Protection of the Environment Operations Act 1997 ❑ Acoustic Assessment (Refer Section 3)
Performance Criteria	❑ Undertake works in accordance with relevant standards and guidelines. ❑ The L10 level measured over a period of 15 minutes when the construction site is in operation should not exceed the background level by more than 10 dB(A) at any affected boundary (residential or school).
Mitigation Measures	❑ An awareness program for construction personnel on noise minimisation will be incorporated into site induction training. The awareness program will include discussion of mitigation measures as outlined in this Noise & Vibration Management Plan. 1. Where applicable and practical, residential class mufflers and engine shrouds (acoustic lining) will be used on all construction equipment. 2. All equipment will be maintained in good order including mufflers, enclosures and bearings to ensure unnecessary noise emissions are eliminated. 3. Plant and equipment will be used appropriately. This includes reasonable work practices with no extended periods of 'revving', idling or 'warming up' within the proximity of existing residential receivers. Plant will be turned off when not being used. Any excessively loud activities will be scheduled during periods of the day when higher ambient noise levels are apparent. Where possible, noisy plant will be located away from potentially noise affected neighbours. 4. Where reasonable, respite periods will be utilised for any particularly noisy activities. 5. Workers will avoid dropping materials from height. 6. Noisy activities will be planned, where possible, for parts of the day when they would have the least impact 7. Vibration will be minimised by restricting hammering where possible. 8. Undertake construction activities that will generate an audible noise at any residential premises during the following hours: (a) 7.00 am to 6.00 pm, Mondays to Fridays; (b) 8.00 am to 1:00 pm on Saturdays; and (c) At no time on Sundays or public holidays Note: This does not apply in the event of a direction from police or other relevant authority for safety reasons.
Monitoring	❑ Noise compliance monitoring will be conducted by the Cowyn Building Group (CBG), and/or the appointed acoustic consultant at affected residential boundaries during noisy activities. ❑ Results will be recorded as L10 and Leq (as relevant) and compared against relevant performance criteria. ❑ It is anticipated that the mitigation measures described should be sufficient for construction work to proceed without causing undue noise impact. ❑ If complaints are received, monitoring shall be undertaken by the CBG according to the provisions of this Plan
Responsible Person	❑ Appointed Site Manager(s) or Site Supervisor(s)
Reporting	❑ Site Manager(s) and/or Site Supervisor(s) will be responsible for day to day management, and for reporting non-conforming noise and vibration activities to the CBG Project Manager, or other as advised. ❑ The Site Manager(s) or Site Supervisor(s) shall be responsible for reporting any incident which causes or threatens to cause material harm or breaches of acoustic guidelines to the CBG Project Manager as soon as possible.
Corrective Actions	❑ In the event of a complaint or failure to comply with the relevant acoustic guidelines, the following corrective / preventative actions shall be taken by CBG: ❑ An investigation shall be undertaken to determine the cause of the problem or non-conformance; ❑ Measure sound power and pressure levels emitted from equipment identified as the likely source of the problem and review possible mitigation techniques; ❑ Modify work practices as necessary to reduce the duration or level of noise.

15 AUTHORISATION & LIMITATIONS

NG Child & Associates has based this Plan on the data, methods and sources described herein.

Subject to the limitations described herein, it is the view of NG Child & Associates that this document presents an appropriate Construction Noise & Vibration Management Plan to effectively manage and minimise noise (and where relevant vibration) in relation to the redevelopment works approved for Loretto Normanhurst and detailed in this document.

The information presented in this document has been prepared by NG Child & Associates exclusively for the use of the Cowyn Building Group, and for submission to the Principal Certifying Authority (PCA) at interest, or other stakeholders as required, as part of the ongoing development process.

This document should not be used for any purposes other than those of the Cowyn Building Group in relation to the development described in this report.

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26 November 2021

16 GLOSSARY OF CONSTRUCTION NOISE TERMS

Ambient Noise

The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.

Audible Range

The limits of frequency which are audible or heard as sound. The normal ear in young adults detects sound having frequencies in the region 20 Hz to 20 kHz, although it is possible for some people to detect frequencies outside these limits.

Background Noise

Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the **L90** noise level (see below).

Decibels (dB)

The level of noise is measured objectively using a Sound Level Meter. This instrument has been specifically developed to mimic the operation of the human ear. The human ear responds to minute pressure variations in the air. These pressure variations can be likened to the ripples on the surface of water but of course cannot be seen. The pressure variations in the air cause the eardrum to vibrate and this is heard as sound in the brain. The stronger the pressure variations, the louder the sound is heard. The range of pressure variations associated with everyday living may span over a range of a million to one. On the top range may be the sound of a jet engine and on the bottom of the range may be the sound of a pin dropping. Instead of expressing pressure in units ranging from a million to one, it is found convenient to condense this range to a scale 0 to 120 and give it the units of decibels. The following are examples of the decibel level of every day steady sounds.

0dB	the faintest sound we can hear
20dB	quiet bedroom at night or recording studio
30dB	quiet library or quiet location in the country
40dB	living room
50dB	typical office space or ambience in the city at night
60dB	normal conversational speech
70dB	a car passing by
80dB	kerbside of a busy road
90dB	truck passing by
100dB	nightclub
110dB	rock band or 2m from a jackhammer
120dB	70m from a jet aircraft
130dB	threshold of pain
140dB	25m from a jet aircraft

dB(A); A-weighted decibels

The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the “A” filter. A sound level measured with this filter switched in is denoted as dB(A). Practically all noise is measured using the A filter.

Diffraction

The distortion around solid obstacles of waves travelling past.

Frequency

Of a periodic quantity: the time rate of repetition. The reciprocal of the period. Frequency is measured in Hertz (Hz).

Loudness

A 3dB increase represents a doubling of the sound pressure, however an increase of about 10dB is required before the sound will subjectively appear to be twice as loud. That is, a sound of 85dB is twice as loud as a sound of 75dB, which is twice as loud as a sound of 65dB and so on. That is, the sound of 85dB is four times as loud as a sound of 65dB. The smallest change which can be readily heard is approximately 2dB. An increase beyond 5dB is considered to represent the level at which a change in loudness begins to be clearly perceived.

L10

The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.

L90

The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).

Leq	Equivalent sound pressure level – the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
Microphone	An electro-acoustic transducer which receives an acoustic signal and delivers a corresponding electric signal.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	An alteration in pressure, stress, particle displacement, or particle velocity which is propagated in an elastic material or the superposition of such propagated alterations.
Sound Level Meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance, and designed to measure sound pressure levels.
Sound Pressure Level	The level of sound pressure, expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound Power Level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Structure-borne noise	Vibration propagating through solid structures in the form of compression or bending waves, heard as sound

APPENDIX A

NSW EPA Interim Construction Noise Guideline

Interim Construction Noise Guideline

What is the Interim Construction Noise Guideline?

The Interim Construction Noise Guideline (the Guideline) sets out ways to deal with the impacts of construction noise on residences and other sensitive land uses. It does this by presenting assessment approaches that are tailored to the scale of construction projects and indicate how work practices can be modified to minimise noise.

The Guideline provides detailed advice on the range of work practices and regulatory approaches to manage construction noise.

The Guideline takes into account comments made during community consultation on the draft guideline in late 2008. The key changes made in response to issues raised are listed at the end of this information sheet.

The Guideline is primarily aimed at managing noise impacts from construction works regulated by the Department of Environment and Climate Change NSW (DECC). It will be used to assist DECC in setting statutory conditions in licences or other regulatory instruments for construction noise. The Guideline may also be of assistance to local councils in guiding their decision-making on construction projects they regulate.

'Construction' is defined in the Guideline to include the erection, installation, alteration, repair, maintenance, cleaning, painting, renewal, removal, excavation, dismantling or demolition of, or addition to, any building or structure, or any work in connection with any of these activities, that is done at or adjacent to the place where the building or structure is located. The Guideline takes into account that construction noise has only a temporary impact.

Who is the Guideline for?

The Guideline is for all those involved with construction, including project planners, managers, contractors, acoustic practitioners, consent authorities and regulators, who require an understanding of noise impacts and management of work practices.

The Standards Australia committee responsible for revising AS2436-1981: Guide to noise control on construction, maintenance and demolition sites was consulted to address any potential inconsistencies between the Guideline and relevant standards.

Is the Guideline mandatory?

No. The Guideline aims to inform the selection and application of work practices to minimise noise impacts based on the level and extent of impact expected taking into account site-specific considerations, and therefore is not mandatory.

However, the Guideline will assist DECC in setting statutory conditions in licences or other regulatory instruments for construction noise. Other determining authorities (such as the Roads and Traffic Authority or Sydney Water) and consent authorities (such as the Department of Planning and local councils) may also find the Guideline useful when dealing with noise from construction and maintenance works that require planning approval.

What types of construction does DECC regulate?

The types of construction regulated by DECC under the *Protection of the Environment Operations Act 1997* are:

- construction, maintenance, or renewal carried out by a public authority (section 6 of the Act). An example is maintenance and repair of public roads.
- non-scheduled activities for the purpose of regulating water pollution (section 43(d) of the Act) – in this case the licence may include conditions for managing noise impacts. An example is a small construction project that discharges to environmentally sensitive waters.
- development work that will enable scheduled activities to be carried out (section 47 of the Act). An example is the construction stage of a new coal loader terminal or a new major marina.
- construction, maintenance, or renewal related activities described in Schedule 1 of the Act – DECC regulates these through an environment protection licence. An example is construction, maintenance, or repair of railway lines.

The Guideline does not cover occupational noise, noise from powered equipment used on residential premises, vibration from construction works, noise from quarrying or mining, or noise from construction traffic on public roads, as these are covered by other regulations or policies.

Why has the Guideline been developed?

The previous guideline was out of step with current approaches and a new guideline was needed to deal with the following issues:

- choosing the appropriate assessment method assessing construction noise at sensitive land uses other than residences (such as schools, hospitals, and places of worship)
- assessing noise from tunnelling works
- selecting less annoying audible warning alarms on powered mobile plant
- assessing noise from out-of-hours construction works.

When will the Guideline be reviewed?

The Guideline will be reviewed after three years to ensure it meets the needs of regulators, the construction industry, and the community.

Guidance on work practices to minimise noise impacts

The Guideline contains extensive information on options for work practices to minimise noise. This information can be used by regulatory and consent authorities to guide construction proponents to consider a broad range of work practices that may be feasible and reasonable.

The categories of work practices covered in the Guideline include:

- training site workers to minimise noise
- consultation and notification processes
- using quieter methods and operating plant in an efficient manner work scheduling, including respite periods and delivery times
- temporary noise barriers and treatments to residences.

One of the greatest improvements in managing noise impacts from construction works is expected to arise from communication between project staff and the community, particularly where this leads to changes in work practices to minimise annoyance to the surrounding community.

What are the differences between the previous and interim guidelines?

The table below highlights the main advances of the Guideline over the previous guideline in (1) choice of assessment method, (2) realistic noise management levels, and (3) guidance on work practices with case study examples.

Comparison of previous and interim guidelines

Previous guideline	Interim guideline
Recommended standard hours	
Monday to Friday 7am to 6pm Saturdays 8am to 1pm No work on Sundays or public holidays	No change from previous
Choice of assessment method	
No choice – only numeric noise criteria given	Choice of either qualitative assessment for projects under three weeks, or quantitative assessment for major projects
Noise levels	
Noise goal	**Noise management level**
0 to 4 weeks Background + 20 dB(A)	**Short-term infrastructure maintenance** Qualitative assessment – apply work practices in checklist at all times of the day **Major construction projects** Recommended standard hours: Background + 10 dB(A) and L_{Aeq} 75 dB(A) Outside recommended standard hours: Background + 5 dB(A)
5 to 26 weeks Background + 10 dB(A)	
Greater than 26 weeks Background + 5 dB(A)	
Guidance on work practices	
No guidance	Extensive list of options for work practices, based on world-wide review of best approaches
Examples on applying guideline	
No examples	Six case studies based on real-life projects. Also worked examples throughout the Guideline.
Ground-borne noise levels	
No guidance	Evening internal level L_{Aeq} 40 dB(A) Night internal level L_{Aeq} 35 dB(A)

Choice of assessment method

The qualitative assessment method is a new approach presented in the Guideline to provide a simplified means of assessing and managing noise from works of less than three weeks' duration.

This assessment method requires the proponent to consider the Guideline's checklist of work practices to minimise noise and implement appropriate strategies. It reduces the complexity and cost of noise assessment for short-term projects by avoiding the need to measure background noise levels and predict noise levels.

For most major construction projects, such as those that DECC licenses, the assessment method remains the same. This is the quantitative assessment method which involves predicting noise levels and comparing them with the recommended noise management levels and taking feasible and reasonable action to minimise noise.

Realistic noise management levels

The Guideline presents noise management levels for use when undertaking a quantitative assessment, such as for major construction projects. The changes to noise management levels in the Guideline have been based on a review of achievable construction noise levels on recent major projects in NSW, as well as a review of international best practice in regulating the noise impact of construction works.

The noise management level for works during the recommended standard hours is background + 10 dB(A). Above this noise level the proponent needs to implement all feasible and reasonable work practices, as defined in the Guideline, to minimise noise impacts. For works outside the recommended standard hours, the noise management level is background + 5 dB(A).

The highly noise-affected level of LAeq 75 dB(A) represents the point above which there may be strong community reaction to noise and indicates a need to consider other feasible and reasonable ways to reduce noise, such as restricting the times of very noisy works to provide respite to affected residences. This noise management level was derived from the following considerations:

- A review of predicted noise levels for some recent major construction projects indicated that a level of 75 dB(A) would not likely be triggered on many projects.
- Some other countries (New Zealand, Ireland, and parts of the United States) apply a management level of 75 dB(A) when assessing construction noise.
- The Occupational Health and Safety noise limit in current legislation is 85 dB(A) for an eight-hour workday.

Will the Guideline be more costly to apply?

Noise management costs associated with the Guideline are likely to be either lower than, or equivalent to, those under the previous guideline, because of the introduction of a simplified assessment approach for short-term construction works.

Benefits to industry include more flexible ways to identify and assess noise impacts, improved understanding of options to minimise noise, and reduced time dealing with complaints about noise. All these benefits are expected to lower costs.

Benefits to the community include improved awareness of the expected amount and duration of noise from construction works, and improved communication between the community and construction professionals, as well as lowered noise impacts.

Summary of the main changes incorporated into the Guideline

Selecting the assessment method

The draft guideline suggested a quantitative noise assessment for projects of more than one week's duration. Several of the government agencies responsible for maintenance of public infrastructure questioned the cost and practicality of undertaking a quantitative assessment for routine infrastructure maintenance projects. The Guideline clarifies that a qualitative assessment can be used on short term maintenance of public infrastructure, where an individual or sensitive land use (such as a school) is affected by noise for no more than a total of three weeks.

Recommended standard hours

Submissions on the draft guideline from a local council and a construction company supported work on Saturday afternoons in industrial and commercial areas. A union wanted standard hours to observe union work-hour agreements. An individual wanted no construction work before 9 am and consideration of the needs of shift workers when determining standard hours. The remaining 53 submissions either supported or made no comment on the recommended standard hours.

The recommended standard hours in the Guideline remain the same as those in the previous guideline, as they are in line with community expectations. The Guideline clarifies what construction typically needs to be undertaken outside the recommended standard hours.

Alternatives to reversing alarms

Several submissions were received about the 'beeper' alarms on construction equipment; some were unclear as to whether alternatives to reversing beeper alarms are permitted under current legislation, and whether it is illegal to replace a fitted alarm with a less annoying alternative. Others considered that beeper alarms are a necessary feature of the industry where many workers have hearing loss. WorkCover NSW clarified that it is not mandatory under current occupational health and safety legislation to use reversing beeper alarms; any safe system can be used. WorkCover confirmed that the 2004 code of practice does not require the use of reversing beeper alarms and discusses a range of options that may be considered a safe system of work. DECC is currently reviewing alternatives to reversing beeper alarms.

What the Guideline applies to

There was a range of opinions about what the Guideline should apply to. Some wanted the Guideline to apply to all construction across NSW, others preferred that the Guideline not apply to works dealt with by local councils or the Department of Planning. The Guideline clarifies that the guidance is primarily aimed at construction regulated by DECC, and that the Guideline may be of assistance to local councils and other regulatory bodies in their decision-making.

Feasible and reasonable

The Guideline has new definitions of the terms 'feasible' and 'reasonable' to give more guidance on selecting appropriate noise mitigation practices. A range of hypothetical examples of feasible and reasonable work practices has been added to the Guideline. It also explains how the regulatory authority would review the information on feasible and reasonable practices provided by a proponent.

Equipment noise levels

Several submissions asked for more details to be included in the table of indicative noise levels in Appendix B of the draft guideline. After consideration of the comments raised, the table was replaced by a list of published databases that present extensive details on equipment noise levels.

Predicting noise levels

Further guidance has been added on factors to consider when deciding what level of detail to apply to calculations. A worked example has been added to illustrate a rough calculation of noise levels.

Industry published procedures

Guidance was added recommending that organisations consult with the public and take into account any comments raised when finalising their procedures. The Guideline also clarifies that any published procedures should be consistent with the Guideline and, regardless of whether a published procedure is in place, the organisation's principal obligation is to meet any statutory conditions imposed.

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APPENDIX B

Construction Scenarios for Stage 1 Works

CONSTRUCTION SCENARIOS FOR STAGE 1 WORKS

Stage 1	Phase	Equipment	Operating minutes in 15-min period	Number of items in same location	Sound Power Level (dB)		
					Maximum Item (SWL)	L_{Aeq} Activity	L_{Amax} Activity
Boarding Facility *(Envelope 1)*	Demolition	Excavator (25 tonne) – rock breaker	7.5	1	121	**119**	124
		Front End Loader	15	1	112		
		Dump Truck	15	2	100		
	Excavation	Piling Rig (Bored)	7.5	2	108	**112**	118
		Excavator (12 tonne)	15	2	97		
		Low Loader	15	1	106		
	Building Construction	Concrete Truck / Agitator	7.5	2	106	**111**	114
		Forklift	15	2	104		
		Compressor	15	1	95		
		Crane	15	2	100		
		Bump Truck	15	1	98		
		Concrete Pump	7.5	1	103		
		Truck (12-15 tonne)	15	2	106		
	Façade / Fitout	Hammer Drill	15	1	100	**105**	108
		Tower Crane	15	1	100		
		Forklift	15	1	101		
Garden Plaza *(Project A)*	Site preparation	Circular Saw (Battery Operated)	15	1	108	**115**	128
		Forklift	15	1	101		
	Landscape	Chainsaw	5	1	108	**114**	128
		Chipper	5	1	120		
Demolish Dock + Maintenance Wing *(Project B)*	Demolition	Concrete Saw (Soff-Cut)	7.5	1	103		111
		Excavator (20 tonne)	15	1	99		
		Dump Truck (approx. 15 tonne)	15	1	100		
		Front End Loader (L120)	15	1	104		

CONSTRUCTION SCENARIOS FOR STAGE 1 WORKS
(Continued)

Stage 1	Phase	Equipment	Operating minutes in 15-min period	Number of items in same location	Sound Power Level (dB)		
					Maximum Item (SWL)	L_{Aeq} Activity	L_{Amax} Activity
Multi-Sport Courts with underground carpark *(Envelope 13)* + Tennis Courts with underground carpark[1] *(Envelope 14)*	Landscape and finish	Forklift	15	2	104		
		Compressor	15	1	95		
		Crane (small)	15	1	98		
		Bump Truck	15	1	98		
		Concrete Pump	7.5	1	103		
		Truck (12-15 tonne)	15	2	106		
		Hammer Drill	15	1	100	**105**	108
		Tower Crane	15	1	100		
		Forklift	15	1	101		
	Site Preparation and Clearing Works	Dozer	15	1	110	**111**	118
		Chainsaw	5	1	108		
		Dump Truck (15 tonne)	5	1	98		
	Excavation	Excavator (20 tonne)	15	1	99	**113**	119
		Front End Loader (FEL) 962	15	1	112		
		Dump Truck (approx. 15 tonne)	15	2	100		
	Building Construction	Concrete Pump	7.5	2	106		
		Concrete Truck / Agitator	15	2	106	**107**	112
		Crane (small)	15	1	98		
Link Road from Osborn Road - Mt Pleasant Avenue *(Project H)*	Site Preparation	Dozer	15	1	110	**111**	118
		Chainsaw	5	1	108		
		Dump Truck (15 tonne)	5	1	98		
	Road Construction	Asphalt Milling Machine1	15	1	111	**114**	119
		Bitumen Spray Truck	15	1	100		
		Vibratory Roller (10 - 12 tonne)1	15	1	109		
		Compactor	15	1	108		
	Landscape and paving	Concrete Pump	15	1	95	**111**	114
		Concrete Truck / Agitator	15	1	98		
		Paving Machine	15	1	98		
		Compactor	7.5	1	103		

CONSTRUCTION SCENARIOS FOR STAGE 1 WORKS
(Continued)

Stage 1	Phase	Equipment	Operating minutes in 15-min period	Number of items in same location	Sound Power Level (dB)		
					Maximum Item (SWL)	L_{Aeq} Activity	L_{Amax} Activity
Osborn Road Carpark Expansion *(Project J)*	Site preparation	Dozer	15	1	110	**114**	123
		Chainsaw	5	1	108		
		Dump Truck (15 tonne)	5	1	98		
	Extension of carpark	Concrete Pump	7.5	1	106	**111**	114
		Concrete Truck / Agitator	7.5	1	106		
		Paving Machine	15	1	104		
		Compactor	15	1	108		

NOTE 1: Similar construction methodologies and equipment assumed for both scenarios

APPENDIX C

Predicted Construction Noise Impacts – Stage 1

PREDICTED CONSTRUCTION NOISE IMPACTS – STAGE 1

Works	Stage	Sensitive Receiver Area	Noise Level – $L_{Aeq,15min}$ dBA		
			NML Day Standard Hours[1]	Worst-case Predicted	Exceedance
Boarding Facility *(Envelope 1)*	Demolition	Mt Pleasant (North)	57 / 57	54	-
		Mt Pleasant (South)	59 / 58	52	-
		Osbourne Road (North)	69 / 69	43	-
		Osbourne Road (South)	52 / 52	45	-
	Excavation	Mt Pleasant (North)	57 / 57	52	-
		Mt Pleasant (South)	59 / 58	69	10 / 11
		Osbourne Road (North)	69 / 69	52	-
		Osbourne Road (South)	52 / 52	54	-
	Building Construction	Mt Pleasant (North)	57 / 57	46	-
		Mt Pleasant (South)	59 / 58	63	4 / 5
		Osbourne Road (North)	69 / 69	54	-
		Osbourne Road (South)	52 / 52	54	-
	Façade and Fitout	Mt Pleasant (North)	57 / 57	37	-
		Mt Pleasant (South)	59 / 58	59	- / 1
		Osbourne Road (North)	69 / 69	50	-
		Osbourne Road (South)	52 / 52	52	-
Garden Plaza *(Project A)*	Site Preparation	Mt Pleasant (North)	57 / 57	42	-
		Mt Pleasant (South)	59 / 58	41	-
		Osbourne Road (North)	69 / 69	<30	-
		Osbourne Road (South)	52 / 52	<30	-
	Landscaping	Mt Pleasant (North)	57 / 57	45	-
		Mt Pleasant (South)	59 / 58	44	-
		Osbourne Road (North)	69 / 69	<30	-
		Osbourne Road (South)	52 / 52	<30	-
Demolished Dock + Maintenance Wing *(Project B)*	Demolition	Mt Pleasant (North)	57 / 57	54	-
		Mt Pleasant (South)	59 / 58	50	-
		Osbourne Road (North)	69 / 69	36	-

PREDICTED CONSTRUCTION NOISE IMPACTS – STAGE 1
(Continued)

Works	Stage	Sensitive Receiver Area	Noise Level – $L_{Aeq,15min}$ dBA		
			NML Day Standard Hours[1]	Worst-case Predicted	Exceedance
		Osbourne Road (South)	52 / 52	40	-
	Building Construction / Landscape	Mt Pleasant (North)	57 / 57	44	-
		Mt Pleasant (South)	59 / 58	44	-
		Osbourne Road (North)	69 / 69	29	-
		Osbourne Road (South)	52 / 52	41	-
Multi-Sport Courts with underground carpark ***(Envelope 13)***	Site Preparation	Mt Pleasant (North)	57 / 57	60	3 / 3
		Mt Pleasant (South)	59 / 58	44	-
		Osbourne Road (North)	69 / 69	31	-
		Osbourne Road (South)	52 / 52	22	-
	Excavation	Mt Pleasant (North)	57 / 57	64	7 / 7
		Mt Pleasant (South)	59 / 58	47	-
		Osbourne Road (North)	69 / 69	32	-
		Osbourne Road (South)	52 / 52	23	-
	Building Construction	Mt Pleasant (North)	57 / 57	57	-
		Mt Pleasant (South)	59 / 58	40	-
		Osbourne Road (North)	69 / 69	27	-
		Osbourne Road (South)	52 / 52	18	-
Tennis Courts with underground carpark ***(Envelope 14)***	Site Preparation	Mt Pleasant (North)	57 / 57	65	8 / 8
		Mt Pleasant (South)	59 / 58	39	-
		Osbourne Road (North)	69 / 69	56	-
		Osbourne Road (South)	52 / 52	22	-
	Excavation	Mt Pleasant (North)	57 / 57	59	2 / 2
		Mt Pleasant (South)	59 / 58	33	-
		Osbourne Road (North)	69 / 69	51	-
		Osbourne Road (South)	52 / 52	19	-
	Building Construction	Mt Pleasant (North)	57 / 57	57	-
		Mt Pleasant (South)	59 / 58	31	-
		Osbourne Road (North)	69 / 69	49	-

PREDICTED CONSTRUCTION NOISE IMPACTS – STAGE 1
(Continued)

Works	Stage	Sensitive Receiver Area	Noise Level – $L_{Aeq,15min}$ dBA		
			NML Day Standard Hours[1]	Worst-case Predicted	Exceedance
		Osbourne Road (South)	52 / 52	18	-
Link Road from Osbourn Road - *Mt Pleasant Avenue (Project H)*	Site Preparation	Mt Pleasant (North)	57 / 57	70	13 / 13
		Mt Pleasant (South)	59 / 58	42	-
		Osbourne Road (North)	69 / 69	63	-
		Osbourne Road (South)	52 / 52	37	-
	Construction of Link Rd	Mt Pleasant (North)	57 / 57	69	12 / 12
		Mt Pleasant (South)	59 / 58	45	-
		Osbourne Road (North)	69 / 69	64	-
		Osbourne Road (South)	52 / 52	39	-
	Landscaping and finishing works (including paving)	Mt Pleasant (North)	57 / 57	66	9 / 9
		Mt Pleasant (South)	59 / 58	41	-
		Osbourne Road (North)	69 / 69	47	-
		Osbourne Road (South)	52 / 52	17	-
Osborn Road *(Project J)*	Site Preparation	Mt Pleasant (North)	57 / 57	44	-
		Mt Pleasant (South)	59 / 58	43	-
		Osbourne Road (North)	69 / 69	56	-
		Osbourne Road (South)	52 / 52	65	13 / 13
	Landscaping	Mt Pleasant (North)	57 / 57	44	-
		Mt Pleasant (South)	59 / 58	43	-
		Osbourne Road (North)	69 / 69	56	-
		Osbourne Road (South)	52 / 52	65	13 / 13

APPENDIX D

Management of Demolition & Construction Noise

MANAGEMENT OF DEMOLITION & CONSTRUCTION NOISE

Site preparation and construction works during development projects need to be controlled so they do not become a nuisance, and all reasonable and practicable steps must be taken by developers and contractors to prevent offensive noise.

Some important general noise management guidelines are summarised below.

Noise criteria ▪ No more that 5dB above background noise level during the first working hour; ▪ No more than 10dB above background noise level at all other times	

- Suitable steps that should be employed include substituting noisy equipment with alternative, quieter machinery; retro fitting existing equipment with noise damping materials and mufflers, using well maintained machinery and the erection of acoustic barriers around noisy operations.

- There are occasions where sound levels from certain construction activities and the use of some equipment may not be able to meet the noise criteria. This may be for example where construction sites are in close proximity to neighbouring noise sensitive receivers and the use of highly intrusive demolition and excavation equipment, or other noisy machinery is necessary.

- Local government authorities can quite reasonably restrict the use of highly intrusive equipment and require that developers provide suitable breaks and respite periods or restrict the times that any intrusive equipment may or may not be used in order to minimise the impact on neighbouring occupiers. Respite periods can be required at both the development approval stage and during the demolition and construction operation should complaints of excessive noise be justified.

- The contractor is expected to initiate a complaint monitoring and resolution procedure so that any neighbourhood concerns can be investigated and resolved when raised. The contact details of a suitable and readily contactable representative of the contractor should be publicly displayed at the site and be made available to the occupiers of neighbouring noise sensitive properties.

- Complaint logs should be kept detailing any complaints as they are received and the action taken in response to each complaint, and these should be made available to officers of Hornsby and others as appropriate when reasonably required.

Why machines get noisier with use:

Worn or chipped gear teeth, bearings

Loose or worn parts – drive belts

Poor lubrication – squeals from dry bearings

Imbalance in rotating parts eg motor shafts

Blunt blades or cutting faces – drill bits etc

Damaged silencers / mufflers

Removal of mufflers, acoustic guards etc.

Noise Management Plans

Where there is likelihood that demolition and construction works will have a potentially significant impact on the local community, developers are typically required to formulate and submit a Noise Management Plan, prior to the commencement of any site works.

Noise Management Plans should be completed by a suitably qualified and competent person, who possesses the qualifications to render them eligible for membership of the Australian Acoustic Society, Institution of Engineers Australia or the Australian Association of Acoustic Consultants and are expected to contain appropriate details of the work methods that the developer will employ on site. The requirement for developers to have a demolition and construction Noise Management Plan will be included within conditions of Development Consent.

Problems with offensive noise during demolition and construction works can result in the requirement for additional controls under the Protection of the Environment Operations Act 1997, which include the requirement for developers to amend and review Noise Management Plans and work methods when necessary.

DEMOLITION & CONSTRUCTION NOISE QUESTIONS & ANSWERS

Q: What can contractors do to reduce construction noise?

A: They should be taking suitable steps, including substituting noisy equipment with alternative, quieter machinery; retro fitting existing equipment with noise damping materials and mufflers, using well maintained machinery and the erection of acoustic barriers around noisy operations.

Q: Can the public complain about excessive noise from demolition and construction sites?

A: Yes. It is the developer and contractor's responsibility to initiate a complaint monitoring and resolution procedure so that any neighbourhood concerns can be investigated and resolved when raised. The contractor should display details of a suitable and readily contactable representative, which should be publicly displayed at the site and be made available to the occupiers of neighbouring noise sensitive properties.

Q. What else should the developers and contractors be doing to resolve complaints?

A: They should be keeping documented logs detailing any complaints as they are received, and the action taken in response to each complaint.

APPENDIX E

Sample Field Noise Measurement Log

1 Rosemead Road Hornsby Noise Monitoring Report Report No: _____

Measurement Location: _____

Date: _____ **Time:** _____

Measurement Conducted By: _____

Construction Activity: _____

_____

Test Conditions (General) _____

Wind Speed: _____ **Temperature (ºC):** _____

Wind Direction: _____ **Cloudcover (%):** _____

Intervening Ground (eg hard/soft; fenced/flat): _____

SLM Make/Model: _____ **Last Calibration:** _____

Calibrator Make/Model: _____ **Last Calibration:** _____

Test Procedure: AS 1055.2 – 1997 Acoustics – Description and measurement of environmental noise

Noise Measurement Results:

Measurement No:	1	2	3	
Measurement Time:				Predicted LA10 noise level from this activity (refer to monitoring plan) _____ dB(A)
Measurement Duration:				
L_{Aeq}				
L_{A90}				Estimated construction contribution _____ dB(A)
L_{A10}				
L_{MIN}				
L_{MAX}				

Comments/Observations: (include description of dominant noise sources)

_____

_____

_____

_____

Site Diagram: (show location, buildings, construction activitiy, other noise sources, north, distances)

APPENDIX F

Letter to Potentially Noise Affected Receivers

(*Insert Address Detail*)

Redevelopment Works – Loretto Normanhurst

Dear _____

As you may already be aware, major redevelopment works have been approved and are about to commence at Loretto Normanhurst.

The project will involve site preparation works, demolition and excavation activities, and the construction of new internal roads and buildings.

Some aspects of the redevelopment process will involve potentially noisy operations and equipment.

To help ensure that noise and vibration generated during the redevelopment process does not have any unreasonable impacts on our many neighbours, and to ensure that any such impacts are minimised, we have prepared a detailed Noise & Vibration Management Plan.

The Plan, which has been reviewed and approved by an independent acoustic consultant, contains a wide range of management, control, mitigation and monitoring procedures which will apply to all operations at the site, and which have been specifically designed to minimise and control the generation of noise and vibration.

My purpose in writing is to advise you of the development and provide contact details in the unlikely event that you do experience any undue levels of noise or vibration from the project.

If you do have any concerns, or if you would simply like to know a little more about this very exciting development, please contact:

(*Insert details*).

Please be assured that the project team will be working very hard to ensure that you are not inconvenienced by any aspect of the development, including noise and vibration.

Yours Sincerely

Marc Cohen
General Manager
Cowyn Building Group

Phone: +61 2 9790 7511

APPENDIX G

Noel Child
Summary of Qualifications, Capability & Experience

1 PERSONAL DETAILS

Full Name: Noel George CHILD
Profession: Consultant in Environmental Assessment and Management
Date of Birth: 6th December 1946
Nationality: Australian
Experience: > 30 Years
Address: 22 Britannia Road, Castle Hill, NSW, 2154
Contact: **Phone**: 61 2 9899 1968 **Fax**: 61 2 9899 1797 **Mobile:** 0409 393024

2 CAPABILITY AND EXPERIENCE - SHORT SUMMARY

Noel Child is a successful and experienced commercial and technical professional with over 30 years' experience in a variety of senior level appointments and assignments, within both the corporate and private sectors, with a particular focus on strategic, infrastructure and environmental applications.

Noel's experience includes senior management at both the State and National levels in the Australian petroleum industry, and a number of senior consultancies for both government and corporate clients. His record reflects the ability to develop and achieve positive commercial outcomes through effective planning and communication; critical and objective analysis; and quality task completion and delivery at both the personal and team level.

His management responsibilities have included transport, environmental, safety, and general operational activities at a national level, while his formal professional training includes strategic management, environmental, engineering and business disciplines. He has undertaken a number of senior corporate appointments with distinction and been successfully involved in the ownership and operation of a major petroleum distribution and marketing company in regional Australia. More recently, working through his own businesses Environment Australia and NG Child & Associates, he has applied his knowledge and experience in the areas of strategic management, infrastructure development, energy and the environment on a consultancy and contractual basis to a number of private and public-sector clients, both nationally and internationally.

Noel has had post-graduate training in several technical and commercial disciplines, and provides specialised teaching input, by invitation, to post graduate engineering and business management courses conducted by the Faculties of Business and Engineering at Sydney's University of Technology. He has strong affiliations with a number of international corporations and agencies and has worked closely with both the regulators and the regulated in a number of aspects of environmental management, assessment and performance. He has also been recognised as an independent expert on engineering, and environmental issues by the Land and Environment Court of NSW.

Noel has a detailed understanding of environmental engineering and associated processes and has specific experience and expertise in the fields of acoustics, air quality, electromagnetic field assessment, electrolysis and stray current assessment, contaminated site assessment, and liquid and solid waste management. He also provides post graduate teaching input on environmental engineering issues to post graduate courses at the University of Technology, Sydney, and La Trobe and Monash Universities in Melbourne.

3 EDUCATION, QUALIFICATIONS AND AFFILIATIONS

BE, PhD (Chemical Engineering), UNSW, Sydney
Master of Business Studies, University of New South Wales, Sydney
B.Sc. (Hons) Applied Chemistry (Environmental), University of Technology, Sydney
Graduate Diploma (Environmental Engineering and Management), UNSW, Sydney
Qualified Environmental Auditor, Standards Australia
Member, Royal Australian Chemical Institute, 1972/2021
Member, Institution of Engineers, Australia, 1972/2021
Member, Clean Air Society of Australia and New Zealand, 1992/2021
Member, Australian Natural Gas Vehicle Council, 1996/2004
Executive Director, Australasian Natural Gas Vehicles Council, 2003/2004
Visiting Fellow, Institute for Sustainable Futures, UTS, 1995/2002
Research Fellow, Faculty of Civil & Environmental Engineering, UTS, 1996/2021
Research Associate, New York Academy of Sciences, 2000/2021

4 RECENT ASSIGNMENTS & EXPERIENCE

Mostyn Copper (2016 – Current) – Assessment of air quality, acoustic, electromagnetic field and site contamination issues associated with a number of childcare centre projects undertaken by the Mostyn Copper Group and clients throughout the Sydney metropolitan area.

Mostyn Copper & the ATC (2017 – Current) – Environmental assessment of various aspects of the Coopers Paddock site near the ATC racecourse at Warwick Farm.

Boskovitz Lawyers & Ceerose Construction (2019 - Current) – Independent assessment of acoustic, air quality and electromagnetic field issues associated with a proposed childcare centre development at Willoughby Road Willoughby for submission to the NSW Land and Environment Court,

Lodestone HQ (1998 - Current) – Environmental assessment of proposed childcare centre development at the Princes Highway Kirrawee NSW, and several previous childcare centre developments over a twenty year period, including acoustic, electromagnetic field, air quality and site contamination considerations.

Government of the PRC & Thyssen Transrapid Australia (2004 - Current) – Adviser on technical and operational issues associated with the development and construction of a high-speed magnetic levitation train systems within the People's Republic of China, and elsewhere, including electrolysis, electromagnetic and stray field effects.

The Bathla Group (2014 - Current) – Environmental assessment of a number of residential development projects for submission to local government consent authorities, or the NSW Land and Environment Court, including acoustic, air quality, site contamination and environmental management issues.

Trumen Corporation (2006 - Current) – Environmental assessment, including electromagnetic field, acoustic and contamination assessment and certification, of mixed use, childcare centre and industrial unit and self-storage development projects throughout the Sydney metropolitan area.

Montessori Academy (2012 - Current) – Independent audit and assessment of acoustic, air quality and electromagnetic field issues associated with a range of childcare centre and early learning developments throughout the Sydney area, and in the ACT.

Archizen Architects (2003 - Current) – Environmental assessment of a range of proposed childcare centre developments throughout NSW, including general environmental, acoustic assessment, air quality and electromagnetic field assessment.

Dr James Smith SC (2018 – Current) – Provision of specialist advice and delivery of expert evidence regarding a number of cases, including acoustic, electromagnetic and site contamination issues.

Australian Consulting Architects (2010 – 2019) – Acoustic, electromagnetic, stray current and electrolysis assessments of development projects a Field Place Telopea; Windsor Road Vineyard; Camden Valley way Horningsea Park and others.

Futurespace/Renascent (2008 - 2018) – Environmental assessment of proposed childcare centre developments at Waterloo Road Macquarie Park and Cleveland Street Strawberry Hills, including general environmental, acoustic assessment, air quality and electromagnetic field assessment.

Commonwealth Bank (2016 – Current) – Environmental assessment, including general, acoustic, air quality, electromagnetic field and wind impact assessment, of a childcare centre development to be located on Level 2 of Darling Park Power 2, Sussex Street, Sydney.

LEDA Holdings – Environmental Assessment of a proposed childcare centre at 32 Cawarra Road Caringbah NSW, including general environmental, acoustic, air quality and electromagnetic field assessments.

Universal Property Group (Current) – Environmental assessment of a proposed multi building, multi-level residential development at Garfield Street, Wentworthville NSW, including general environmental, acoustic, site and soil contamination and preliminary geotechnical assessments.

Gundagai Meat Processors (Current) – Review and enhancement of solid and liquid waste processing and management systems at GMP's Gundagai abattoir, including the on-site treatment of waste streams from meat processing and other operations.

Campbelltown City Council (Current) – Peer review of acoustic assessments submitted to Campbelltown City Council regarding assessment of the acoustic impacts of developments including a major truck maintenance facility and the expansion of Macarthur Square shopping centre, including the conduct of noise measurements.

Brenchley Architects (2009 - Current) – Acoustic assessments of proposed residential and commercial developments at Elizabeth Street Sydney; Spit Road Mosman, Botany Road Waterloo, Cranbrook Street, Botany and Bellevue Hill Road, Bellevue Hill NSW.

Bovis Lend Lease (20010 -2017) – Environmental assessment of a major development site at Darling Walk, Darling Harbour NSW, including a detailed review of air quality, electromagnetic field and acoustic issues for review by the NSW Department of Planning.

Penrith City Council (2012 - 2016) – Preparation of the ongoing Penrith City Council response to the NSW Government Long Term Transport Plan, including consideration of transport and associated environmental issues affecting the Penrith Local Government Area.

Western Sydney Mayoral Forum (1998- 2015) – Environmental assessment and review of the development of a second Sydney airport at Badgerys Creek, including assessment of acoustic and electromagnetic field impacts.

Michael Bell Architects & Clients (2004 to Current) – Assessment of the environmental impacts, including acoustic impacts, associated with various childcare centre applications in suburban Sydney, and the Sydney CBD, including the development of plans for the management and control of such impacts.

NSW Roads & Traffic Authority (2004 to 2018) – Review of international technologies, systems & applications in relation to the treatment of motor vehicle exhaust emissions and associated air pollution within and discharged from road tunnels, in accordance with the conditions of approval for the M5 East Motorway

Federal Airports Corporation (1995 - 2017) – Environmental studies for the Sydney West Airport, including consideration of air quality, acoustic and electromagnetic and radio-frequency issues.

Isuzu-GM (2003 to 2018) – Representations to Environment Australia and the Department of Transport and regional Services regarding the emission performance standards of Japanese sourced medium and heavy natural gas trucks, with the aim of having the current Japanese emission standard accepted within the Australian design Rule 80 series of vehicle emission standards.

City of Sydney (2005 - 2007) – Assessment of air quality and odour issues associated with a proposed redevelopment of craft studios and associated facilities at Fox Studios, Moore Park, Sydney, and review of air quality monitoring stations in the Sydney CBD area, in part as a basis for monitoring the air quality and potential health cost impacts of transport congestion and modes.

Warren Centre for Advanced Engineering, University of Sydney (2000 to 2003) – Contribution to the report "Sustainable Transport for Sustainable Cities", a major government and private enterprise funded study into the future sustainability of transport in Sydney and adjoining regions, including in particular a review of associated environmental issues. Study received the 2003 Bradfield Award for Engineering Excellence from the Australian Institute of Engineers.

United Kingdom Department of the Environment (1994) – Contribution to the development of revised environmental guidelines for air, soil and groundwater water quality.

United States Environmental Protection Agency (1994) - Contribution to an international team developing strategies for the control and management of air pollution in seven major US cities.

5 CORPORATE EXPERIENCE

NG Child & Associates

- **1992--Present**, Managing Principal - Responsible for all aspects of the conduct of a specialist private engineering and environmental consultancy, including administration, marketing, team coordination and technical and professional delivery.

Western Fuel Distributions Pty Limited, Australia

- **1984-92** Managing Principal. - Responsible for all aspects of the management and development of one of the largest private petroleum distributorships then operating in Australia, with a peak annual sales volume of 70 million litres, turnover of $30 million per annum, a direct staff of thirty, and a network of some 40 retail and wholesale agency outlets. This position included direct personal accountability for all aspects of storage, distribution and environmental performance.

Caltex Oil Australia Limited

- **1982-84** General Manager, Marketing and Operations. Responsible for the management and operation of Caltex Australia's marketing, storage, warehousing, distribution, environmental and safety functions, including seaboard terminal and marine operations.
- **1980-82** National Consumer Marketing Manager. Responsible for Caltex Australia's national consumer, industrial and distributor marketing activities.

Golden Fleece Petroleum Limited

- **1977 - 1980** Manager Operations, NSW. Responsible for the overall management of the distribution, warehousing, seaboard terminal and lubricant production activities of Golden Fleece Petroleum in New South Wales, including environmental, occupational health and safety matters.

Esso Australia Limited

- **1976-77** SA Manager, Marketing and Operations. Responsible for all aspects of the management of Esso's petroleum, lubricant and LPG storage, distribution and marketing throughout South Australia.
- **1975-76** Refinery Manager. Responsible for all engineering, operational and environmental aspects of the joint Esso/Mobil refinery at Port Stanvac in South Australia.
- **1975** Manager, Process Operations, Port Dixon Refinery, Malaysia. Six-month special assignment at the Esso Petroleum Refinery, Port Dixon, Malaysia.
- **1971-75** Senior Analyst, Logistics and Corporate Strategy Departments, Esso Sydney Head office.

6 SOME REPORTS & PUBLICATIONS

- **High Speed Rail – Benefits for the Nation,** Keynote address at the UNSW Institute of Environmental and Urban Studies International High-Speed Rail Seminar, August 2018.
- **Electromagnetic Impact of Magnetic Levitation Trains,** Report to the Shanghai Municipal Transport Commission detailing constraints associated with electromagnetic field impacts, September 2017)
- **The M5 East Road Tunnel: Implications for Ventilation, Air Quality and Emission Treatment Systems**, International Road Transport and Tunneling Forum, Graz Austria, May 2016.
- **Sydney's High Residential Growth Areas: Averting the Risk of a Transportation Underclass**, World Transport & Environmental Forum, Reims France, June 2014.
- **Review of Options for the Treatment or "Filtration" of Tunnel Gases and Stack Emissions**, City of Sydney. January 2014
- **M5 East Freeway: A Review of Emission Treatment Technologies, Systems and Applications**, NSW RTA and NSW Department of Planning, April 2004; June 2008; September 2010)
- **High Speed Trains in Australia: Connecting Cities and Energising Regions**; with the Hon Peter Nixon AO, October 2010.
- **Transport Fuels in Australia: The Folly of Australia's Increasing Reliance on Imported Crude Oil**, Submission to the Australian Senate Rural and Regional Affairs and Transport Committee Inquiry into Australia's Future Oil Supply and Alternative Transport Fuels, February 2006.
- **The Japan 2003 CNG Emission Standard & the Emission Performance of the Isuzu 4HF-1-CNG: The Case for Acceptance under ADR80**. Submission on behalf of Isuzu GM Australia to the Commonwealth Department of Transport and Regional Services, June 2004.
- **Sustainable Transport for Sustainable Cities**, Warren Centre for Advanced Engineering, Sydney University, January 2003
- **Future Directions: Challenges & Opportunities in the Australian CNG Vehicle Industry**, ANGVC, December 2002
- **Engineering and Environmental Aspects of Enclosing the Cahill Expressway Cutting**, City of Sydney, May 2001.
- **High Speed Rail in Australia: Beyond 2000** (with the Hon Peter Nixon), November 2000
- **M5 East Motorway: Proposed Single Emission Stack at Turrella – Review of Air Quality Impacts and Consideration of Alternative Strategies**, Canterbury City Council, February 1999

7 PERSONAL & PROFESSIONAL REFERENCES

- The Hon Peter Nixon AO, Former Federal Transport Minister
- John Black, Professor Emeritus of Civil & Transport Engineering, University of NSW
- The Hon Frank Sartor, former Lord Mayor of Sydney; Former NSW Government Minister.
- Dr Jack Mundey, Past Chairman Historic Houses Trust, Environmentalist
- Mr Stephen Lye, Development Manager, Trumen Corporation, Sydney.
- Mr Peter Han, Project Director, Commonwealth Bank, Sydney
- Mr Michael Bell, Principal, Michael Bell Architects, Sydney.
- Mr Graeme Allen, Director, the Bathla Group
- Mr Luke Johnson, General Manager, Wollondilly Shire Council
- Mr Bernie Clark, Chief Executive, Thyssen Australia
- Mr Bruce Glanville, former Managing Partner, Deloitte Canberra
- Alex Mitchell, Journalist

Noel G Child
26 November 2021

ATTACHMENT A
Client Reference List

Acre Woods Childcare Pty Ltd
Australian Commonwealth Environmental Protection Agency
Australian Consulting Architects
Australian Federal Airports Corporation
Australian Federal Department of Transport and Regional Development
Bovis Lend Lease
Brenchley Architects
Campbelltown City Council
Canterbury City Council, Sydney, NSW
Commonwealth Banking Corporation
Environment Protection Authority of NSW
Exxon Chemical
Fairfield City Council, Sydney, NSW
First Impressions Property
FreightCorp, Sydney, NSW
Futurespace
GM - Isuzu
Guangxi Environment Protection Bureau
Gundagai Meat Processors
Hong Kong Department of the Environment
Hornsby and Ku-ring-gai Councils, Sydney, NSW
John McCormack
Kaunitz Yeung Architecture
LEDA Holdings
Michael Bell Architects
Minter Ellison
Mobil Oil Australia Associated
NSW Roads & Traffic Authority
Ove Arup & Partners
Qantas Airways
Queensland Ports Corporation
Renascent
Salibeau Pty Ltd
Shell Australia
Sinclair Knight Merz
Skouras and Mabrokardatos
Southern Sydney Regional Organisation of Councils (SSROC)
State Rail Authority of NSW
Stephen Davidson Property Investments
Sydney Skips & Galaxy Waste
The City of Sydney
The Western Sydney Alliance of Mayors
Thyssen Krup Transrapid Australia
Tom Howard QC
Trumen Corporation
UK Department of the Environment
United States Environment Protection Agency
University of Technology, Sydney
Warren Centre for Advanced Engineering, University of Sydney
Waverley Council, Sydney, NSW
Western Sydney Parklands Trust
Wollondilly Shire Council