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Construction Noise & Vibration Management Plan

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1 INTRODUCTION

Acoustic Logic have been engaged to provide a project construction noise and vibration management assessment for the proposed works.

The assessment:

- Identifies sensitive receivers that are likely to be potentially impacted by the proposed works.
- Develops project specific noise and vibration management levels. These will be used to indicate whether additional impact mitigation, beyond normal "good practice", is indicated.
- Identifies the major noise and vibration sources that will be present on the construction site, and additional construction-related traffic generated by the development.
- Predicts the likely noise and vibration levels during the phases of construction and assesses these against the established management levels. Where the predicted impacts exceed the management levels, the Plan identifies and assesses potential measures to minimise these impacts.
- Provides specific and general recommendations for the ongoing monitoring, assessment and management of noise and vibration emissions as the works progress in response to additional information and site conditions, and the updating of the Plan to reflect additional information obtained during the construction period.

The subject site and local context are indicated in Section 3.

Where the term "construction" is used in this assessment, it includes demolition, excavation and any other site activity related to the construction of the development being assessed.

This assessment has been prepared for the sole purpose as stated above and should not be used or relied on for any other purpose.

2 REFERENCED DOCUMENTS

2.1 BACKGROUND INFORMATION USED

The following background information has been utilised throughout this assessment:

- SSDA Acoustic report prepared by RWDI consultancy (Reference: 2300704, dated 30/05/2023).
- Architectural documentation prepared by SBA architects (Job No: 22146, dated 06/04/2023).
- Proposed construction methodology and markup as advised by Vaughan Constructions.
- NSW Government Department of Planning, Housing and Infrastructure conditions of consent (SSD-55266460).

2.2 GUIDELINES

The primary guideline that will be used in this assessment is the NSW EPA – 'Interim Construction Noise Guideline' ("**ICNG**") July 2009.

The ICNG recognises that development occurs close to sensitive receivers and the nature of construction means that it is not possible to prevent noise impacts. The ICNG is focused *"on applying a range of work practices most suited to minimise 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."*

The ICNG requires the identification of activities likely to exceed the noise/vibration management levels, and the implementation of feasible and reasonable mitigation strategies to minimise emissions. Strategies include physical and management controls, liaising with the public and stakeholders, monitoring, etc. The ICNG recognises that each site will have a particular set of circumstances to be addressed, and that it is typically not possible to fully mitigate impacts. The guideline is intended as a pathway to determining a realistic compromise between construction sites and the surrounding receivers.

The following additional planning instruments and guidelines have also been used in the assessment:

- NSW Department of Environment and Conservation Assessing Vibration: A Technical Guideline" (Feb, 2006)
- NSW EPA – 'Noise Policy for Industry' ("**NPfI**") October 2017
- NSW EPA – 'Noise Guide for Local Government' ("**NGLG**") 2023
- NSW EPA – 'Road Noise Policy" ("**RNP**") March 2011
- NSW EPA – 'Approved methods for the measurement and analysis of environmental noise in NSW' 2022.

3 CONDITIONS OF CONSENT – SSD 55266460

3.1 CONDITIONS

The following, construction related noise and vibration conditions (SSD-55266460) have been imposed by the NSW Government Department of Planning, Housing and Infrastructure:

Hours of Work

B14. The Applicant must comply with the hours detailed in Table 1.

Table 1 *Hours of Work*

Activity	Day	Time
Earthworks and construction	Monday – Friday Saturday	7 am to 6 pm 8 am to 1 pm
Operation	Monday – Saturday	7 am to 10 pm

B15. Works outside of the hours identified in condition B14 may be undertaken in the following circumstances:

(a) works that are inaudible at the nearest residential receivers;

(b) works agreed to in writing by the Planning Secretary;

(c) for the delivery of materials required outside these hours by the NSW Police Force or other authorities for safety reasons; or

(d) where it is required in an emergency to avoid the loss of lives, property or to prevent environmental harm.

Construction Noise Limits

B16. The development must be constructed to achieve the construction noise management levels detailed in *the Interim Construction Noise Guideline* (DECC, 2009) (as may be updated or replaced from time to time). All feasible and reasonable noise mitigation measures must be implemented and any activities that could exceed the construction noise management levels must be identified and managed in accordance with the management and mitigation measures in the Appendix 3.

Vibration Criteria

B17. Vibration caused by construction at any residence or structure outside the site must be limited to:

(a) for structural damage, the latest version of *DIN 4150-3 (2016-12) Vibration in Buildings – Part 3: Effects on Structures* (German Institute for Standardisation, 2016); and

(b) for human exposure, the acceptable vibration values set out in the *Environmental Noise Management Assessing Vibration: a technical guideline* (DEC, 2006) (as may be updated or replaced from time to time).

B18. Vibratory compactors must not be used closer than 30 metres from residential buildings unless vibration monitoring confirms compliance with the vibration criteria specified in condition B17.

"Construction Noise and Vibration Management Plan

B22. *The Applicant must prepare a Construction Noise and Vibration Management Plan for the development to the satisfaction of the Planning Secretary. The Plan must form part of a CEMP in accordance with condition C2 and must:*

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

(b) Describe procedure for achieving the noise management levels in EPA's Interim Construction Noise Guidelines (DECC, 2009) (as may be updated or replaced from time to time);

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

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

(e) Include strategies that have been developed with the community for managing high noise generating works such as the provision of respite periods;

(f) Describe the community consultation undertaken to develop the strategies in condition (d) and (e); and

(g) Include a complaints management system that would be implemented for the duration of the development."

3.2 CONDITIONS COMPLIANCE TABLE

Table 1 below presents a summarised conditions compliance table which references the applicable conditions of consent throughout this report.

Table 1 – Conditions Compliance Table (SSD 55266460)

Condition Item	Description	Report Reference
B14	Standard Hours of Work	Section 4.3
B15	Outside of Hours Work	Section 4.3
B16	Construction Noise Limits	Section 5.2.1
B17a	Vibration Criteria – Structural Damage	Section 5.3.2
B17b	Vibration Criteria -Human Amenity	Section 5.3.1
B18	Vibratory Compactors	Section 6.3.5
B22	Construction Noise and Vibration Management Plan	All & Section 6.3

4 SITE DESCRIPTION & THE PROPOSAL

The site is located at 45-47 Moxon Road, Punchbowl and legally occupies Lot B (DP390488), Lot 1 (DP618465), Lot 221 & 222 (DP840328) and Lot 23 (DP552521) within the Canterbury Bankstown local government area. The site forms part of an existing industrial zone sharing a border with a residential zone located across from Moxon Road. Nearby identified receivers consist predominantly residential and industrial and are outlined in more detail below in Figure 1.

4.1 GENERAL PROJECT DESCRIPTION

The project site is located at 45-47 Moxon Road, Punchbowl and consists of the following:

- Demolition of several existing buildings structures and the construction of 12 x new warehouses.
- 12x new separate tenancies spread out across 2 levels consisting of 6 warehouses on each level.
- Each tenancy consists of a main warehouse, mezzanine office space, lobby and associated external carparking area and dedicated loading areas for heavy vehicles.

4.2 PROPOSED WORKS

Construction of the proposed development includes:

- Phase 1 (Demolition Phase) – This includes the demolition and removal of existing structures.
- Phase 2 (Excavation Phase) – This includes the excavation and site preparation to allow for construction of the basements and footings of the proposed structures. This phase will also include the installation of ground services.
- Phase 3 (Construction Phase) -This includes the erection of structure, façade, internal fit-out, landscape and other ancillary works.

4.3 CONSTRUCTION HOURS OF WORK

The construction hours during which works will take place are expected to be in accordance with the noise conditions hours of work as outlined within the conditions of consent SSD-55266460.

Table 2 – SSD 55266460 Hours of Work Condition B15

Activity	Day	Hours of Work
Earthworks and construction	Monday to Friday	7am – 6pm
	Saturday	8am – 1pm
Operation	Monday – Saturday	7am – 10pm

The condition of consent also provides reasonable and feasible circumstances where works outside of these hours may also occur as noted within condition B16:

- Works that are inaudible at the nearest sensitive receivers;
- For the delivery of materials required outside these hours by the NSW Police Force or other authorities for safety reasons; or
- Where it is required in an emergency to avoid the loss of lives, property or to prevent environmental harm.

4.4 SENSITIVE RECEIVERS

The nearest sensitive receivers surrounding the site has been identified and allocated into noise groups/catchments. The identified receivers and site map has been adopted from the approved acoustic report prepared by RWDI (document reference: 2300704, dated 30/05/2023). An aerial photo of the site encapsulating the adopted local site context have been presented below in Figure 1.

Figure 1 – Site Map Context and nearby surrounding receivers (Source: SixMaps)

Table 3 – Nearest Sensitive Receivers

Receiver	Receiver Type	Receiver Address
R1	Residential	46 Moxon Road, Punchbowl
R2		48 Moxon Road, Punchbowl
R3		50 Moxon Road, Punchbowl
R4		52-54 Moxon Road, Punchbowl
R5		56 Moxon Road, Punchbowl
R6		58 Moxon Road, Punchbowl
R7		60 Moxon Road, Punchbowl
R8		1 Craig Street, Punchbowl
P1	Passive Recreation	McLaughlin Oval, Punchbowl
A1	Active Recreation	Moxon Sports Club, Punchbowl
I1	Industrial	57 Moxon Road, Punchbowl
I2		41 Moxon Road, Punchbowl
I3		1 Gow Street, Padstow
I4		2 Gow Street, Padstow

4.5 NOISE AND VIBRATION SOURCES

The main noise and vibration sources relevant to each phase of the works have been identified and presented in the following section.

4.5.1 Construction Works Staging

Proposed construction works are expected to be undertaken in the following stages as advised by Vaughan Constructions. The construction methodology as advised by Vaughan Constructions has been attached in the appendix.

Stage 1

- Demolition of the western zone of the site, starting from the western boundary and moving east towards the breezeway.
- Site clearing and excavation works using a 30t excavator + hammer attachment in the western zone.
- No works are expected to be undertaken on the eastern half of the site.

Stage 2

- Demolition of the southern zone of the site, starting from the southern boundary and moving towards the breezeway.
- Site clearing and excavation works using a 30t excavator + hammer attachment in the southern zone.
- Bored piling rig is to start in the western zone and move east.

Stage 3

- Demolition of the northern zone site, starting from the breezeway (between north and south zone) and moving towards the north most boundary of the site.
- Site clearing and excavation works using a 30t excavator + hammer attachment in the northern zone.
- A separate bored piling rig is to start in the south zone and move north towards the north boundary.

Stage 4

- Concrete works – truck, pumps, etc, throughout all zones.
- Construction of all buildings simultaneously using associated equipment.

4.5.2 Stage 1

The main noise/vibration producing plant items likely to be used in this phase are summarised in the following table.

Table 4 – Primary Demolition Noise Sources

Phase/Activity	Plant
Services strip out	Electric Hand Tools
	Bobcat
	Truck
Structure Demolition	Excavator mounted concrete pulveriser
	10t Excavator mounted hydraulic hammer
	30t Excavator - Tracked
	Bulldozer
	Excavator with bucket loading truck
	Truck@ 20 km/hr
	Truck Idling
	Pneumatic Jack Hammer
	Air Compressor

4.5.3 Stage 2 & 3

The main noise/vibration producing plant items likely to be used in this phase are summarised in the following table.

Table 5 – Excavation Noise Sources

Phase/Activity	Plant
Piling	Piling Rig
	Excavator loading truck
	Truck@ 20 km/hr
	Truck Idling
Excavation	Excavator
	Bulldozer
	Excavator mounted hydraulic hammer
	Rock Saw
	Truck@ 20 km/hr
	Truck Idling
	Hand tools

4.5.4 Stage 4

The main noise/vibration producing plant items likely to be used in this phase are summarised in the following table.

Table 6 – Construction Noise Sources

Phase/Activity	Plant
Construction	Hand Tools
	Bobcat
	Truck
	Elevated work platforms
	Forklifts/Materials handling
	Concrete Pump
	Concrete Truck
	Concrete Float
	Concrete Vibrator
	Crane
	Hoist

5 CONSTRUCTION NOISE & VIBRATION ASSESSMENT

5.1 GENERAL

A quantitative evaluation of the proposed works has been undertaken to identify those activities that have the potential to adversely impact nearby properties.

The assessment uses site specific noise and vibration management levels developed using the EPA ICNG and consent conditions stipulated. The predicted, receiver noise and vibration levels will be compared to the management levels to identify those activities that are likely to require additional management, above what is considered to be normal good practice.

5.2 CONSTRUCTION NOISE MANAGEMENT LEVELS

Construction noise management levels have been previously established within Section 8 of RWDI's SSDA report (Reference: 2300704, dated 30 May 2023). The overall construction noise management levels for each receiver have been summarised in the following section.

5.2.1 Summarised Construction Noise Management Levels

The site-specific construction noise management levels (NML) are presented below.

Table 7 – Project Construction Noise Management Levels

Location/Receiver	RBL dB(A) L_{90}	NML dB(A) L_{eq}	HANML dB(A) L_{eq}
R1 – R6 Residential	50	60	75
R7 – R8 Residential	47	57	75
Industrial I1 – I4	-	75	-

Note: Construction works are proposed to be conducted during the daytime standard hours (7am-6pm)

5.3 CONSTRUCTION VIBRATION MANAGEMENT LEVELS

5.3.1 Amenity Management

Vibration goals for the amenity of nearby land users are those recommended by the EPA document *Assessing Vibration: A technical guideline.* These levels (extracted from Tables 2.2 and 2.4 of the guideline) are presented in the following table for various types of vibration:

Table 8 - (Table 2.2 Assessing Vibration: A Technical Guideline) – Preferred and Maximum Weighted RMS Values for Continuous and Impulsive Vibration Acceleration (m/s^2) 1-80Hz.

Location	Assessment Period [1]	Preferred values		Maximum Values	
		z-axis	x- and y-axes	z-axis	x- and y-axes
Continuous Vibration					
Residences	Daytime	0.010	0.0071	0.02	0.014
Offices	Day or night-time	0.020	0.014	0.040	0.028
Impulsive Vibration					
Residences	Daytime	0.30	0.21	0.60	0.42
Offices	Day or night-time	0.64	0.46	1.28	0.92

1 Daytime is 7:00am to 10:00pm.

Table 9 -(Table 2.4 Assessing Vibration: A technical guideline) – Acceptable Vibration Dose Values for Intermittent Vibration ($m/s^{1.75}$)

Location	Daytime[1]		Night-time[1]	
	Preferred value	Maximum Value	Preferred value	Maximum Value
Residences	0.20	0.40	0.13	0.26
Offices	0.40	0.80	0.40	0.80

1 Daytime is 7:00am to 10:00pm

5.3.2 Structural Damage Risk Criteria

German Standard DIN 4150-3 (2016) provides a guideline for acceptable levels of vibration velocity in building foundations, to assess the effects of vibration on structures. The table give guidance on the maximum accepted values of velocity at the foundation and in the plane of the highest floor of various types of buildings, to prevent any structural damage.

The table following lists the peak particle velocity, which is the maximum absolute value of the velocity signals for the three orthogonal components. This is measured as a maximum value of any of the three orthogonal component particle velocities when measured at the foundation, and the maximum levels measured in the x- and y-horizontal directions in the plane of the floor of the uppermost storey.

It is noted that if measured vibration levels do not exceed the guidelines listed in the following table, damage that will reduce the serviceability of the building will not occur, and if damage to the building does occur, it is assumed that the damage is related to other causes. Furthermore, the DIN4150-3 guideline states the following regarding the limits presented in Table 1 of the standard:

"Exceeding the guideline values does not necessarily lead to damage. Should they be exceeded, however, further investigations may be necessary, such as determining and evaluating the stresses as detailed in 4.3 and 4.4.".

Table 10 -(Table 1 – DIN 4150-3 (2016)) – Guideline Values for Vibration Velocity, $v_{i,max}$, for Evaluating the Effects of Short-Term Vibration on Structures

	TYPE OF STRUCTURE	Guideline values for $v_{i,max}$ in mm/s				
		Foundation, all directions, i = x, y, z, at a frequency of			Topmost floor, horizontal direction, i = x, y	Floor slabs, vertical direction, i = z
		1Hz to 10Hz	10Hz to 50Hz	50Hz to 100Hz [a]	All Frequencies	All Frequencies
L/C	1	2	3	4	5	6
1	Buildings used for commercial purposes, industrial buildings, and buildings of similar design	20	20 to 40	40 to 50	40	20
2	Residential buildings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15	20
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 **and** are of great intrinsic value (e.g. listed buildings) buildings that are under a preservation order)	3	3 to 8	8 to 10	8	20[b]

NOTE Even if guideline values as in line 1, columns 2 to 5, are complied with, minor damage cannot be excluded.

a At frequencies above 100 Hz, the guideline values for 100 Hz can be applied as minimum values.

b It may be necessary to lower the guideline value markedly to prevent minor damage

5.4 CONSTRUCTION NOISE ASSESSMENT

5.4.1 Predicted Construction Noise Emission Levels

Construction noise emissions to nearby development depend on the activities being undertaken at the time, and where on the site the activities occur:

Construction noise levels at the surrounding receivers have been predicted based on the following inputs:

- The plant sound power levels indicated in the Appendix. These have been corrected for estimated typical operation duty indicated in the table using 10 x log(%duty/100)
- Barrier or directivity attenuation where present.
- Source heights – 1.5m above the ground/building level of the noise source location, unless noted otherwise.

The predicted construction noise emissions levels at the identified surrounding receivers have been presented below:

Table 11 – Predicted Noise Impacts – Stage 1

Location/Receiver	Highest Predicted Level Range dB(A) L_{eq}	NML dB(A) L_{eq}	HNAML dB(A) L_{eq}
R1 –R6 Residential	60-62	60	75
R7-R8 Residential	55-57	57	75
I1 – Industrial	62-79	75	-
I2 – Industrial	62-79	75	-
I3 – Industrial	57-60	75	-
I4 - Industrial	57-60	75	-

Table 12 – Predicted Noise Impacts – Stage 2

Location/Receiver	Highest Predicted Level Range dB(A) L_{eq}	NML dB(A) L_{eq}	HNAML dB(A) L_{eq}
R1 –R6 Residential	64-65	60	75
R7-R8 Residential	60-62	57	75
I1 – Industrial	67-83	75	-
I2 – Industrial	67-83	75	-
I3 – Industrial	62-65	75	-
I4 - Industrial	62-65	75	-

Table 13 – Predicted Noise Impacts – Stage 3

Location/Receiver	Highest Predicted Level Range dB(A) L_{eq}	NML dB(A) L_{eq}	HNAML dB(A) L_{eq}
R1 –R6 Residential	68-80	60	75
R7-R8 Residential	68-80	57	75
I1 – Industrial	72-88	75	-
I2 – Industrial	72-88	75	-
I3 – Industrial	67-68	75	-
I4 - Industrial	67-68	75	-

Table 14 – Predicted Noise Impacts – Stage 4

Location/Receiver	Highest Predicted Level Range dB(A) L_{eq}	NML dB(A) L_{eq}	HNAML dB(A) L_{eq}
R1 –R6 Residential	60-72	60	75
R7-R8 Residential	60-72	57	75
I1 – Industrial	60-82	75	-
I2 – Industrial	60-82	75	-
I3 – Industrial	60-64	75	-
I4 - Industrial	60-64	75	-

5.4.2 Discussion of Predicted Construction Noise Emissions

The results of the predicted noise impacts reveal the following impacts:

- Residential receivers R1-R8 are likely to experience exceedances to the NML, whilst exceedances to the HNAML are only expected to occur when working close to the boundary. Noise impacts are expected to be greatest at the residential receivers during stage 3 and 4 where works are being carried out closer to the eastern boundary of the site.

- Industrial receivers I1-I2 are both expected to experience exceedances to the NML during all stages, however, the greatest exposure is expected to occur during Stages 2 and 3 where piling may be undertaken close to the boundaries closest to each receiver. Receivers I3 and I4 are likely to experience the smallest noise impact from construction works. During all stages, the predicted noise level is to remain below the noise management level.

- It should, however, be noted that the predicted noise levels presented above have assumed a "worst-case" scenario, as opposed to a typical/likely noise level. The modelled noise levels include all plant operating simultaneously and very close to the boundary of receivers. In reality, this would be very unlikely and, in most cases, not possible due to spatial limitations and construction methodology. For example, it is unlikely that the piling rig, the excavator (with hammer attachment) and the rock saw will all operate close to the same receiver simultaneously.

- Furthermore, during the earlier stages (1 and 2) there is likely to be a significant shielding/barrier effect between the western zone works and the residential receivers to the east (R1-R8). The North and South zone prior to beginning demolition will act as a barrier and reduce noise impacts being transmitted during the earlier staged works.

- We note that although there are significant exceedances expected to be experienced at adjacent receivers, the above presented noise levels portray the worst-case scenario. The typical scenario is likely to be lower when considering the affects from the proposed hoarding, staged works and spatial distribution of the operating plant and equipment throughout the entire site. Given the relatively large site, it is unlikely that more than one or two activities will take place in the same area at any given time. Once proposed construction works begin, and the facades have been installed, it is likely that the ongoing noise and vibration impacts will increasingly mitigated.

5.5 CONSTRUCTION VIBRATION

5.5.1 Vibration Sources

The following sources have been identified as potentially producing significant ground vibration:

- Dynamic compaction (drop weight)
- Vibratory rollers
- High Energy Impact Compactor (triangular roller)
- "Pogo" or "Jumping jack" rammer
- Vibratory Plate compactor (wacker packer)
- Vibratory piling (sheet piles)
- Impact Piling
- Vibrating screen
- Bore Piling (in rock)
- Impacts from falling rocks/rubble
- Ripping (excavator with claw)
- Pneumatic jack hammer
- Hydraulic hammer (rock)

The remaining activities are not expected to produce significant ground vibration and/or are sufficiently separated from sensitive receivers. Vibration from these activities is expected to be significantly below amenity or damage risk management levels at all receivers.

5.5.2 Assessment of Vibration

A precise assessment of vibration emissions from the proposed works is not possible due to the large number of unknowns including the actual equipment employed, how it is operated, site conditions, etc.

In the absence of any specific equipment the generic minimum safe working distances presented in Table 15 – Recommended Base Minimum Working Distances for Vibration Intensive Plant From Sensitive Receivers should be used with caution for guidance. It is noted that the vibrating roller distances are based on asphalting road works and are not applicable to earthworks as the vibration frequencies are considerably lower leading to a greater safe-work distance requirement. Empirical formulae by Hiller and Crabb will be used in lieu.

Should the types and models of the plant and equipment be available then vibration levels may be predicted at the nearest and most affected receivers by using the published generic formulae, source levels or historical data as found in:

- BS 5228-2:2009+A1:2014
- ISO 4866:2010
- FTA Transit Noise and Vibration Impact Assessment Manual (2018)
- Caltrans Transportation and Construction Vibration Guidance Manual (2020)
- Construction Vibrations 2nd Edition (Dowding, 2000)

Regardless of the method used site vibration levels from machinery and processes should be verified on site as soil conditions may be different from the basis sources.

The assessment of building and soil settlement or the liquefaction of soils under induced vibration is outside the scope of typical vibration standards such as DIN 4150-3 and expert advice is to be sought from a Geotechnical Engineer.

5.6 TRAFFIC GENERATION ON EXISTING ROADS

During all stages:

- Trucks movements are proposed to access the site via Moxon Road.
- The exact number of vehicle movements generated due to construction are unknown, however, 3-5 are typical for a site of this size.
- During concrete pours, a few additional truck movements may occur temporarily.

Based on existing traffic volumes along Moxon Road, this is a relatively small change in volume of traffic would not cause a noticeable change in traffic noise experienced at adjacent properties/receivers.

5.7 CONSTRUCTION OUTSIDE OF NORMAL HOURS

The predictions indicate that the main noise producing activities (CFA piling and concrete pours) will generate noise levels exceeding the after-hours NML's for Saturday afternoon (and other after-hours periods). The ICNG guidelines would not normally permit these activities to occur after normal hours without justification.

6 NOISE AND VIBRATION MANAGEMENT PLAN & CONTROLS

6.1 MANAGEMENT PLAN

The assessment indicates that the proposed activities will produce noise or vibration that will exceed the adopted management levels. These impacts should be minimised by developing and adopting a project specific management plan to regulate site activities.

The plan should be revised as the works proceed in response to changing or latent conditions and to incorporate the results of additional analysis, monitoring or modified work practices implemented to minimise impacts.

The management plan should be prepared in accordance with IGNG guideline and include:

- Identification of sensitive receivers and applicable noise and vibration management levels
- A description of the main noise or vibration producing activities, processes and equipment that will be employed and an indicative construction programme.
- Proposed construction hours.
- A prediction of likely noise/vibration levels at the most impacted receivers.
- The assessment and recommendation of mitigation methods to be applied where the predicted levels exceed the management levels, as indicated below.
- A monitoring plan including the type and extent of monitoring, reporting procedures.
- Recommended management procedures including complaints handling, response to monitoring exceedances, reporting, site training, etc.
- Community liaison.

6.2 NOISE AND VIBRATION CONTROL

The flow chart that follows illustrate the process followed to assess construction activities prior to the start of work on site, and for the ongoing investigation of noise and vibration impacts during the construction period.

The ICNG recommends “feasible and reasonable” mitigation measures to be implemented where works generate noise levels above the out of normal hours NML but does not specify what mitigation measures or to what extent these measures should be applied.

The CNVG and CNVS provide a clear hierarchy of mitigation measures to be applied when noise reduction by substitution, reasonable and feasible engineering and administrative means have been exhausted.

6.2.1 General Noise Controls Methods

The determination of appropriate additional noise control measures will be dependent on the particular activities and the construction equipment and plant identified as requiring future acoustic treatments to those already identified in this report. This section provides an outline of available methods which have previously been used on similar construction sites and may be possible on this site.

6.2.1.1 Selection of Alternate Appliance or Process

Where a particular activity or plant and equipment is found to generate noise levels that exceed the management levels, it may be possible to select an alternative approach or plant and equipment. For

example, the use of excavator mounted hydraulic hammers of the site may potentially generate high levels of noise. By carrying this activity by using concrete saws or smaller plant here practical, construction noise levels and/or length of exposure to construction noise levels may be reduced.

6.2.1.2 Acoustic Barriers

The placement of barriers at the source is generally only effective for static plant. Placing barriers at the source cannot effectively attenuate equipment which is on the move or working in rough or undulating terrain.

The degree of noise reduction provided by barriers is dependent on the amount by which the line of sight can be blocked by the barrier. If the receiver is totally shielded from the noise source, reductions of up to 15 dB(A) can be affected. Where only partial obstruction of line of sight occurs, noise reductions of 5 to 8 dB(A) may be achieved. Where the barrier does not obstruct line of sight, generally no noise reduction will occur.

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

6.2.1.3 Silencing Devices

Where construction methodologies or plant and equipment permit, investigate the use of silencing devices. These may take the form of engine shrouding, or special industrial silencers fitted to exhausts, for example.

6.2.1.4 Treatment of Specific Equipment

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

6.2.1.5 Establishment of Site Practices

This involves the formulation of work practices to reduce noise generation. This includes, for example, investigating the possibility of locating fixed plant items as far as possible from residents, rotating plant and activities to provide respite to receivers, scheduling activities after the construction of buildings that will screen receivers, avoiding noise sensitive periods for receivers, identify "safe" working distances, etc.

6.2.1.6 Vibration Management

The following principles should be considered to manage adverse vibration impacts identified:

- Obtaining separate structural or specialist advice for critical or fragile structures as to the level of damage risk.
- Selection of processes that minimise structure and ground vibration – generally avoiding percussive methods.
- Use smallest plant that is able to efficiently undertake the work activity.
- Lay vibration absorbing mats to cushion impacts from falling debris.
- Application of vibration dampening pads to metal surfaces subject to impacts.
- When demolishing, cut control joints in structures to form vibration "breaks", or work away from sensitive receiver locations to form natural vibration breaks in propagation path.
- Monitoring of structures using attended and/or unattended monitors with alarms.

- Time scheduling works to minimise amenity impacts.
- Communicating with affected receivers.
- Identify "safe" working distances to sensitive receivers/structures for various activities by conducting site simulation tests, and limiting activities within those distances to those that are not likely to exceed vibration goals. Vary locations/equipment/techniques used as determined by the simulation testing. The following table provides an initial guide to working distances that should be confirmed by site measurement.

6.2.1.7 Notification

Notification of affected receivers of the progress of works, particularly when short-term activities likely to create higher noise levels occur, can in many cases minimise community reaction.

6.3 SUMMARY OF MITIGATION

The project specific mitigation and management to be adopted is summarised in the following sections.

6.3.1 Management Controls

Reporting Requirements

The following is an example of reporting which may be kept on site:

1. A register for complaints received/communication with the local community shall be maintained and kept on site with information as detailed below.
2. Where noise/vibration complaints require noise/vibration monitoring, results from the monitoring shall be retained on site at all times.
3. Any recorded exceedances including the actions taken and results of follow up monitoring.
4. A report detailing any complaints received and actions taken shall be presented.
5. All monitoring and reporting shall be conducted in conjunction with the conditions of consent.

Response Procedures

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

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

- The name and address of the complainant (if provided).
- The time and date the complaint was received.
- The nature of the complaint and the time and date the noise was heard.
- The name of the employee who received the complaint.
- Actions taken to investigate the complaint, and a summary of the results of the investigation.
- Indicate what operations were occurring on site at the time of the complaint.
- Required remedial action, if required
- Validation of the remedial action.
- Summary of feedback to the complainant.

Notification

Notification of affected receivers of the progress of works, particularly when short-term activities likely to create higher noise levels occur, can in many cases minimise community reaction.

Community Consultation with Adjoining Receivers & Mitigation Strategies

In order for any construction noise management programme to work effectively, continuous communication is required between, all parties which may be potentially impacted upon, the builder and the regulatory authority. This establishes a dynamic response process which allows for the adjustments of control methods and management levels for the benefit of all parties.

The objectives in undertaking a consultation process is to:

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

To ensure that this process is effective, regular scheduled meetings may be required for a finite period, until all issues have been addressed and the evidence of successful implementation is embraced by all parties. An additional step in this process is to produce a newsletter informing nearby residents of upcoming activities that are likely to generated higher noise/vibration levels.

It should be noted that Vaughan Constructions have made efforts to consider and communicate potential constructions noise and vibration impacts with the community. Efforts to consult, notify and communicate with the adjoining neighbours include:

- Detailed notification letters and opportunities for community engagement and feedback. All letters have details regarding:
    - Description of works
    - Name of contact.
    - Contact number
    - Contact email
    - Proposed construction activities and period of works.
- Vaughan Construction invite the notified members to provide feedback (including complaints) and stay informed regarding via email or WhatsApp in a newsletter style format.

To date, Vaughan Construction have made significant efforts to initiate and be proactive with community consultation. Examples of notices that have already been issued to adjoining neighbours include:

- Notification of commencement of works to all dwellings within 20m of the boundary.
- Notification of commencement of works to other surrounding residents.
- Notification of Asbestos works.
- Dilapidation Report and pre-construction work updates.

Acoustic Logic have been advised that the outcome of the community consultation and notification process conducted thus far is that there have not been any direct responses from the community. Throughout the entire construction period, VC should continue to actively engage with the community and seek feedback, provide notification and work together to reduce noise and vibration impacts.

Dealing with Complaints

Should ongoing complaints of excessive noise or vibration recommendations occur immediate measures shall be undertaken to investigate the complaint, the cause of the exceedances and identify the required changes to work practices.

If a noise complaint is received the complaint should be recorded. Any complaint form should list:

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

A permanent register of complaints should be held.

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

The investigation of a complaint shall involve where applicable:

- Noise measurement at the affected receiver.
- An investigation of the activities occurring at the time of the incident.
- Inspection of the activity to determine whether any undue noise is being emitted by equipment; and
- Whether work practices were being carried out either within established guidelines or outside these guidelines.

Where an item of plant is found to be emitting excessive noise, the cause is to be rectified as soon as possible. Where work practices within established guidelines are found to result in excessive noise generated then the guidelines should be modified so as to reduce noise emissions to acceptable levels. Where guidelines are not being followed, the additional training and counselling of employees should be carried out.

Measurement or other methods shall validate the results of any corrective actions arising from a complaint where applicable.

6.3.2 Contingency Plans

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

1. Determine the offending plant/equipment/process.
2. Locate the plant/equipment/process further away from the affected receiver(s) if possible.
3. Implement additional acoustic treatment in the form of localised barriers, silencers etc where practical.
4. Selecting alternative equipment/processes where practical.
5. If necessary, setup noise and vibration monitoring devices at locations representing the nearest noise/vibration affected receivers and provide data or each complaint time period. Analysis is required to determine suitable mitigation measures.

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

6.3.3 Physical Controls

- Construction hoarding should be erected around the boundary at all times during proposed construction works.
- Where feasible and reasonable, equipment silencers should be implemented to reduce the emitted noise levels for louder machinery.
- During operation, care should be taken to orientate machinery away from nearby receivers so as to reduce the directivity of emissions.

6.3.4 Recommended Monitoring

Specific monitoring requirements of location and quantity of monitors are to be discussed in consultation with the client. In certain circumstances, additional monitoring may be required in response to complaints, site conditions, etc.

6.3.5 Safe Working Distances

In the event that additional equipment/activities are proposed, generic minimum safe working distance presented in the table below for vibration intensive plant should be used with caution for guidance. It is noted that vibrating roller distances are based on asphalting road works and are not applicable to earthworks as the vibration frequencies are considerably lower, leading to a greater safe work distance requirement. Empirical formulae by Hiller and Crabb will be used in lieu.

Table 15 – Recommended Base Minimum Working Distances for Vibration Intensive Plant From Sensitive Receivers

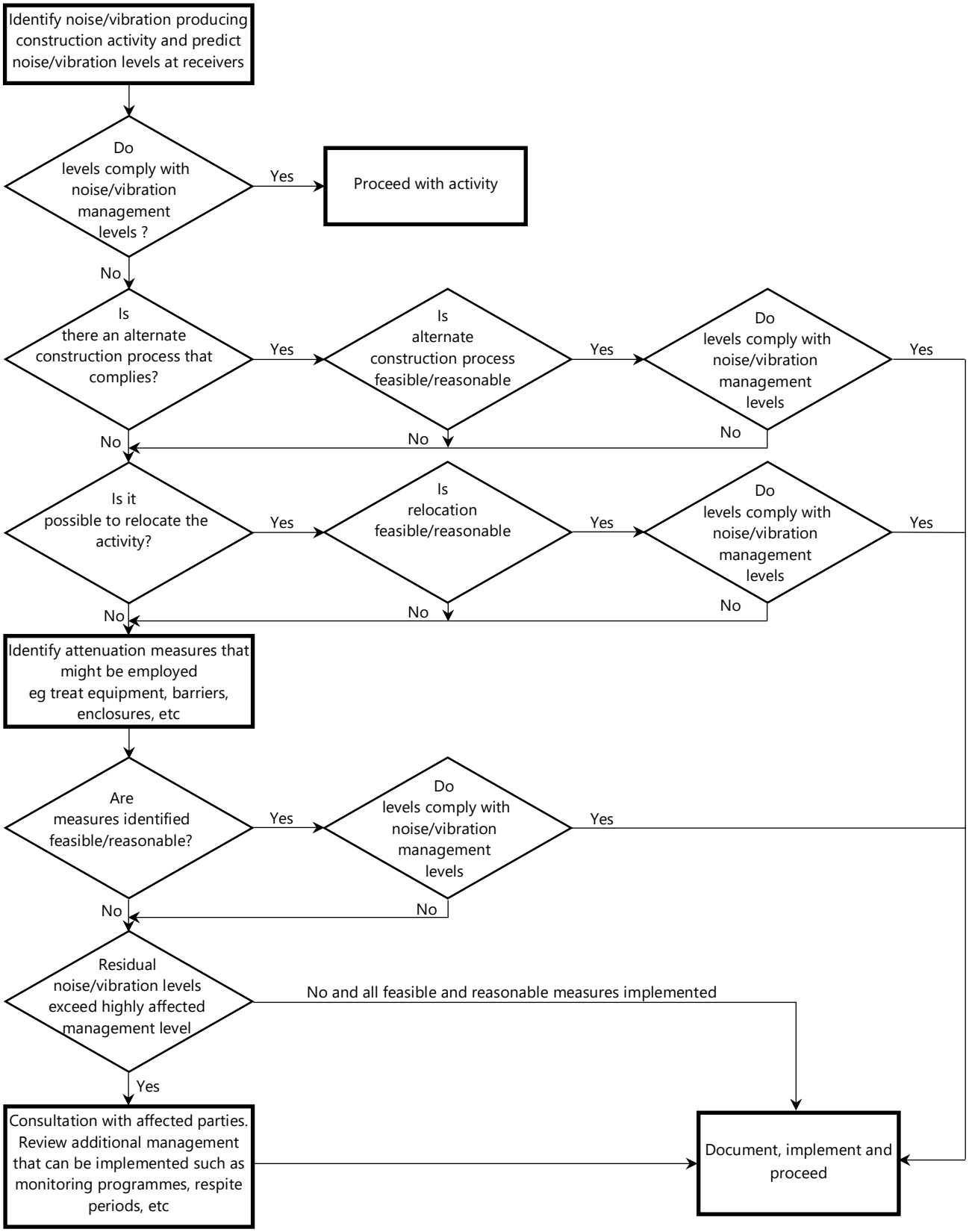
Plant item	Rating / Description	Minimum Working Distance			
		Cosmetic Damage			Human Response
		Light-Framed Structure (BS 7385)	Residential Structures (DIN 4150)	Heritage and Other Sensitive Structures (DIN 4150)	NSW EPA's Vibration Guideline
Vibratory Roller	< 50 kN (Typically 1-2 tonnes)	5 m	18.5	14 m	15m
	< 100 kN (Typically 2-4 tonnes)	6 m	17.8	16 m	20 m
	< 200 kN (Typically 4-6 tonnes)	12 m	43	33 m	40 m
	< 300 kN (Typically 7-13 tonnes)	15 m	51.5	41 m	100 m
Medium Hydraulic Hammer	(900 kg – 12 to 18t excavator)	7 m	-	19 m	23 m
Large Hydraulic Hammer	(1600 kg – 18 to 34t excavator)	22 m	-	60 m	73 m
Pile Boring	≤ 800 mm	2 m (nominal)	-	5 m	7 m
Jackhammer	Hand held	1 m (nominal)	-	2 m	3 m
Profiler	Wirtgen W210	4 m	-	-	-
Steel Drum Roller	Hamm HD70 (Oscillating Mode)	2 m	-	-	-
Steel Drum Roller	Hamm HD70 (Static Mode)	1 m	-	-	-

Note: Conditions B30 and B31 outline the following regarding construction vibration impacts:
"B30 vibratory compactors must not be used closer than 30m from residential buildings unless vibration monitoring confirms compliance with the vibration criteria specified in condition B30."
"B31 The limits in conditions B30 and B31 apply unless otherwise outlined in a Construction Noise and Vibration Management Plan, approved as part of the CEMP required by condition C2 of this consent."

Acoustic Logic have been advised by the civil contractors that within 30m of neighbouring residential buildings, no vibration compactors will be utilised. Further to this, the construction zone contains only a very limited area within 30m of neighbouring residential buildings. The eastern boundary closest to the residential buildings (located across Moxon Road) is approximately 25-30m away from the buildings. Therefore, very minimal works are expected to be conducted within 30m of the neighbouring residential buildings.

6.4 ASSESSMENT OF METHODOLOGY AND MITIGATION METHODS

The flow chart presented below illustrates the process that will be followed in assessing construction activities.



7 CONCLUSION

This report assesses potential noise and vibration impacts from the construction of the proposed development at 45-47 Moxon Road, Punchbowl (Hale Punchbowl). The assessment uses the methodology contained in the EPA ICNG to:

- Determine appropriate noise and vibration management levels.
- Identify those activities are likely to impact nearby receivers.
- Indicate the measures that are likely to be required to minimise the impacts to the extent that is recommended in the ICNG.

The assessment indicates that:

- There will be receivers around the site (as identified in the assessment) that will be exposed to noise levels exceeding the ICNG management levels. Mitigation of these impacts has been recommended in the Plan.
- Although it is not possible to confirm, there may be receivers around the site that will be exposed to vibration levels exceeding the relevant vibration management levels for amenity, but not exceeding the damage risk vibration limits. Accordingly, as required by the ICNG, mitigation of these impacts has been recommended.

It is concluded that with the implementation of the mitigation and ongoing assessment recommended in Section 6, construction noise and vibration emissions from the proposed development will be minimised in accordance with the ICNG.

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

Yours faithfully,

Acoustic Logic Pty Ltd
James Ting

APPENDIX A CONSTRUCTION PLANT NOISE AND VIBRATION EMISSION LEVELS

This section provides the plant noise and vibration emission levels adopted in the assessment.

A.1 NOISE

The following table presents typical sound power levels for construction plant used in this assessment.

The following have been considered to establish typical plant A-weighted sound power levels:

- Transport for NSW Construction Noise and Vibration Strategy (April 2018).
- Previous measurements undertaken by Acoustic Logic.
- AS 2436-2010 "Guide to noise and vibration control on construction, demolition and maintenance sites (Appendix A).

The equipment sound power spectra are based on information in the DEFRA database, and when not available from that source, from manufacturer's data or from measured spectra taken by this office of similar machinery.

Items identified as having annoying characteristics have been penalised by adding 5dB to the levels in the Transport for NSW's noise data base.

The emission levels in the table assume that machinery operates continuously (i.e. 100% duty), which is not always be the case. For example, excavators may load trucks intermittently for 5 minutes in every 15-minute assessment period so their duty would be 33%. The duty correction used in the assessment is indicated in the table.

Construction, Demolition and Civil works Machinery Effective Sound Power Levels based on Continuous operation (100% duty)

Equipment	Approx. Size/ Weight/Model	Sound Power Level (dBA) 100% Duty (inc Penalties)	Duty	Unweighted Octave Band Sound Power Levels, dB (includes Applicable Penalties)							
				63	125	250	500	1000	2000	4000	8000
Crane - Fixed	-	113	50%	120	115	116	112	106	99	93	87
Crane - Truck mounted	20 to 60 tonne	108	25%	112	109	107	105	103	100	95	87
Crusher – Rock*	-	118	100%	135	128	121	123	117	113	108	101
Dozer	CAT D9	116	75%	112	116	114	114	111	108	102	94
Excavator - tracked	30 tonne	110	75%	113	113	107	107	105	102	97	91
As above + hydraulic hammer*	-	122	75%	125	123	119	123	121	121	118	114
Excavator - tracked	40 tonne	115	75%	111	114	113	110	110	109	104	97
Grinder*	-	105	50%	86	80	81	89	99	106	102	102
Piling Rig - Bored	-	112	100%	112	120	109	108	106	104	96	89
Pump - Concrete	-	109	100%	115	107	101	102	104	104	97	89
Saw – Concrete*	-	118	75%	120	122	114	114	113	114	118	116
Truck - Concrete	-	109	100%	112	103	95	98	99	107	89	84
Truck - Dump	15 tonne	110	10%	114	111	111	107	104	103	97	90
Truck - Medium rigid	20 tonne	103	10%	109	107	101	99	96	94	97	89
Truck - road truck/ truck and dog	30 tonne	108	10%	123	109	101	100	104	99	98	91
Vibrator – Concrete*	-	113	100%	122	120	120	113	109	112	110	105

APPENDIX B CONSTRUCTION METHODOLOGY

LEGEND:

LEVELS DATUM IS AHD.

T-SC	- TIED SOFT SAW CUT
SC-DJ	- DOWELLED SAW CUT
EJ	- EXPANSION JOINT
DJ	- DOWEL JOINT
ET	- EDGE THICKENING
IK	- INTEGRAL KERB
KO	- KERB ONLY
KG	- KERB & GUTTER
GD	- GRATED DRAIN
DJ-GD	- DOWEL JOINT & GRATED DRAIN
G-ADJ	- GALVANIZED ARMOURED DOWEL JOINT
PD	- PEDESTRIAN DOOR
WBK	- W-BEAM BARRIER & KERB
	- 2N16 TRIMMERS, 1500 MIN. LONG TIED TO UNDERSIDE OF MESH

50mm

1ST STAGE EARTHWORKS FROM WESTERN BOUNDARY

DEMO: MID JULY COMMENCEMENT (60 DAYS DURATION including stage 2)
- assume 1x70t & 1x35t excavator for demo works

PILING: MID OCTOBER COMMENCEMENT (25 DAYS DURATION including stage 2)
- assume 2 rigs used up to breezeway, then 1 piling rig moves to stage 2 zone to commence

PROPOSED CROSSOVER IN ACCORDANCE WITH COUNCIL STANDARD DRAWINGS. ALL EXISTING SERVICES ALIGNMENT, FITTINGS AND DEPTHS TO BE CONFIRMED VIA POTHOLING PRIOR TO COMMENCEMENT OF WORKS. TYPICAL

SITE ACCESS

2ND

SITE ACCESS

1ST

1ST

1ST

1ST

STAGE 2
EARTHWORKS FROM SOUTHERN BOUNDARY

PROVIDE TIED SAW CUTS (T-SC) AT TYPICAL 4500 CTS.

PROVIDE ALTERNATING DOWEL JOINTS (DJ) AND EXPANSION JOINTS (EJ) AT TYPICAL 25m.

NOTES:

ATTENTION IS DRAWN TO THE FACT THAT DUE TO THE NATURE OF CONCRETE, CRACKING OF A NON-STRUCTURAL NATURE MAY OCCUR. REINFORCEMENT HAS BEEN ADDED TO THE SLABS TO MITIGATE THE EXTENT OF CRACKING, HOWEVER IT IS NOT POSSIBLE TO GUARANTEE COMPLETE ELIMINATION OF SLAB CRACKING.

NOTES:

ENSURE JOINTS ARE MIN 300mm FROM EDGE OF PIT GRATE. REFER TO PIT IN SLAB DETAIL ON DRAWING C450. TYPICAL

NOTES:

NO WATER IS TO BE ADDED TO CONCRETE ON SITE

T MAINTENANCE NOTES:

DURING THE LIFE OF THE PAVEMENT, DAMAGE IN VARIOUS FORMS IS LIKELY TO OCCUR. GOOD MAINTENANCE WILL KEEP PROBLEMS TO A MINIMUM AND EXTEND THE LIFE OF PAVEMENTS. THE FOLLOWING LIKELY AREAS OF DAMAGE MAY OR MAY NOT OCCUR DURING THE LIFE OF THE PAVEMENTS:

SLAB PAVEMENTS :

1. DAMAGE TO JOINTS SUCH AS FRETTING OR BREAKING AWAY OF PIECES SHOULD BE REPAIRED USING CONCRETE REPAIR PRODUCTS AND THE JOINTING MATERIAL MADE GOOD.
2. CRACKING OF SLABS WHICH MAY OCCUR OVER THE LIFE OF THE SLAB SHOULD BE REPAIRED BY EPOXY GROUTING AS SOON AS POSSIBLE TO PREVENT LOCAL FRETTING AND BREAKING AWAY. THE DEFINITION OF A CRACK WHICH MAY BECOME DETRIMENTAL IS ONE WHICH IS GREATER THAN 0.3mm.
3. LOCAL DAMAGE DUE TO MECHANICAL PROCESSES OR PALLETS (WITH PROTRUDING NAILS) SHOULD BE REPAIRED AS SOON AS POSSIBLE WITH AN EPOXY CONCRETE REPAIR PRODUCT.
4. LOCAL MOVEMENT OF SLABS CAUSED BY EXTERNAL SOURCES SUCH AS INGRESS OF WATER SHOULD BE REFERRED TO THE ENGINEER TO DETERMINE THE BEST METHOD OF REPAIR.
5. JOINT SEALANTS WILL GENERALLY BREAKDOWN AND NEED REPLACEMENT AFTER 12 MONTHS WHEN MOST OF THE SLAB SHRINKAGE HAS TAKEN PLACE. RESEALING NEEDS TO BE CARRIED OUT TO ENSURE ONGOING SUPPORT TO SLAB EDGES.

ASPHALT PAVEMENTS :

1. UNLESS NOTED OTHERWISE, FLEXIBLE PAVEMENTS SHOWN ON THESE DRAWINGS ARE THE MINIMUM NECESSARY TO SUPPORT LIGHT CAR PARKING FOR A MINIMUM DESIGN LIFETIME.
2. CRACKING OF THE ASPHALT SURFACE AND OTHER DEFECTS SHOULD BE REPAIRED QUICKLY TO PREVENT INGRESS OF WATER TO THE SUBGRADE, WHICH WILL ACCELERATE DETERIORATION OF PAVEMENTS.
3. DRAINAGE GRADES SHOULD BE MAINTAINED TO AVOID PONDING OF SURFACE WATER WHICH MAY CONTRIBUTE TO DETERIORATION.

EXTERNAL PAVEMENT PLAN
SCALE 1:500

5m 0 10 20 30 40 50m
SCALE 1:500 AT A1 SIZE SHEET

FOR TENDER

ISSUED FOR TENDER	22.09.23	A
AMENDMENTS	DATE	ISSUE

ARCHITECT: SBA ARCHITECTS

CLIENT: Hale

PROJECT
MOXON ROAD, MULTI LEVEL WAREHOUSE
45-57 MOXON ROAD, PUNCHBOWL
NSW, 2196

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
DS	RN	AUG '23	DS	A1	AS SHOWN	C013924.01-C800

CONSULT AUSTRALIA

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DRAWING TITLE
EXTERNAL PAVEMENT PLAN

DRAWING No C013924.01-C800 ISSUE A