

Doran Drive Precinct, Castle Hill

Construction Noise and Vibration Management Sub-Plan

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1 INTRODUCTION

This report presents our assessment of the processes which to be followed in order to manage noise and vibration from construction activities associated with the development of 2 Mandala Parade, Castle Hill, also known as "Doran Drive Precinct". This report is pursuant to development consent SSD-15882721, dated 18 August 2022, to address condition C24 for the provision of a Construction Noise and Vibration Management Sub-Plan.

The principal objective of this study is to undertake an evaluation of work to be performed during construction phases of the project and forecast potential impacts of noise and vibration. The evaluation will be used to formulate and streamline effective regulation and mitigation measures.

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

- Specific activities that will be conducted and the associated noise/vibration sources;
- Identification of potentially affected noise/ vibration sensitive receivers;
- The construction noise and vibration requirements, including construction work hours specified in consent conditions C24, D3-D7, and D15-D21 (ref: SSD-15882721);
- Noise/ vibration response procedures;
- Assessment of potential noise/vibration from the proposed, excavation, and construction activities; and
- Contingency plans to be implemented in the event of non-compliances and/or noise complaints.

Technical documents utilised for noise and vibration assessment in this Sub-Plan are:

- SSD-15882721, dated 18 August 2022
- Department of Environment and Climate Change NSW – "Interim Construction Noise Guideline (ICNG)", dated July 2009
- Department of Environment and Conservation NSW – "Assessing Vibration: A Technical Guideline", dated February 2006.
- German Standard DIN 4150-3 (2016) – "Vibration in Buildings - Part 3: Effects on Structures"
- British Standard BS 6472:1992 "Guide to Evaluate Human Exposure to Vibration in Buildings (1Hz to 80Hz)"
- Sydney Metro "Underground Corridor Protection Technical Guidelines", dated April 2021
- Sydney Metro "Technical Services, Sydney Metro at Grade and Elevated Sections Corridor Protection Guidelines", dated September 2018
- Australian Standard 2436-1981 & Australian Standard 2436-2010

Project documents utilised for noise and vibration assessment in this Sub-Plan are:

- Koikas Acoustics document named "Construction Noise and Vibration Plan of Management with Regards to The Sydney Metro Infrastructure – Proposed Mixed-Use Development, 2 Mandala Parade, Castle Hill NSW 2154 (Doran Drive Precinct)" dated Wednesday, 21 December 2022, project number 4214, Version V5, file reference 4214R20200804jtDoranDrivePrecinct_CNVPMv5.docx.
- El Australia document "Impact Assessment Sydney Metro Assets" (E24724.G06_Rev 6) dated 22 June 2022
- GKA Management document "Rail Risk Management Plan – Sydney Metro Northwest Rail Corridor, Highrise Development – 2 Mandala Parade, Castle Hill NSW", dated 16 November 2022, report ref: GKA CAH 001
- Paragon Engineering Document, "Vibration Monitoring Report – The Showground, 2 Mandala Parade, Castle Hill NSW 2154", dated 3 March 2023, ref: PAR-22526-W03[A]
- Drawings utilised for noise and vibration assessment in this Sub-Plan can be found in Appendix 1.

2 SSD-15882721 CONDITIONS OF CONSENT

Conditions relevant to construction noise and vibration impacts can be seen in Table 1 –Consent Satisfaction Table.

Table 1 –Consent Satisfaction Table

Condition	Requirements	Reference
C24	Prior to the commencement of any earthwork or construction, the Applicant must submit to the satisfaction of the Certifier a Construction Noise and Vibration Management Sub-Plan (CNVMP) for the development. The Sub-Plan must include:	-
	(a) identification of the specific activities that will be carried out and associated noise sources at the site.	Section 5.1
	(b) identification of all potentially affected sensitive residential receiver locations;	Section 3.1
	(c) quantification of the rating background noise level (RBL) for sensitive receivers, as part of the Sub-Plan, or as undertaken in the EIS;	Section 4.2.1.1
	(d) the construction noise, ground-borne noise and vibration objectives derived from an application of the EPA Interim Construction Noise Guideline (ICNG), as reflected in conditions of approval;	Section 4.2; Section 4.2.2 Section 4.3
	(e) prediction and assessment of potential noise, ground-borne noise (as relevant) and vibration levels from the proposed construction methods expected at sensitive receiver premises against the objectives identified in the ICNG and conditions of approval;	Section 4.2; Section 4.3 Section 5.2; Section 6; Appendix 3
	(f) where objectives are predicted to be exceeded, an analysis of feasible and reasonable noise mitigation measures that can be implemented to reduce construction noise and vibration impacts;	Section 5.2; Section 5.3; Section 7
	(g) description of management methods and procedures, and specific noise mitigation treatments/measures that can be implemented to control noise and vibration during construction;	Section 7; Section 8; Section 9

	(h) where objectives cannot be met, additional measures including, but not necessarily limited to, the following must be considered and implemented where practicable; reduce hours of construction, the provision of respite from noise/vibration intensive activities, acoustic barriers/enclosures, alternative excavation methods or other negotiated outcomes with the affected community;	Section 7; Section 8; Section 9
	(i) where night-time noise management levels cannot be satisfied, a report must be submitted to the Planning Secretary outlining the mitigation measures applied, the noise levels achieved and justification that the outcome is consistent with best practice;	No night-time works proposed at this stage
	(j) measures to identify non-conformances with the requirements of the Sub-Plan, and procedures to implement corrective and preventative action;	Section 8; Section 11
	(k) suitable contractual arrangements to ensure that all site personnel, including sub-contractors, are required to adhere to the noise management provisions in the Sub-Plan;	Section 7; Section 9.7
	(l) procedures for notifying residents of construction activities that are likely to affect their noise and vibration amenity;	Section 10.2
	(m) measures to monitor noise performance and respond to complaints;	Section 9; Section 10
	(n) measures to reduce noise related impacts associated with offsite vehicle movements on nearby access and egress routes from the site;	Section 7
	(o) procedures to allow for regular professional acoustic input to construction activities and planning; and	Section 8
	(p) effective site induction, and ongoing training and awareness measures for personnel (e.g. toolbox talks, meetings etc).	Section 7; Section 9.7
D3	Construction, including the delivery of materials or machinery to and from the site, may only be carried out between the following hours:	
	(a) between 7am and 6pm, Mondays to Fridays inclusive; and	Section 3

	(b) between 8am and 1 pm, Saturdays.	Section 3
D4	No work may be carried out on Sundays or public holidays.	Section 3
D5	Activities may be undertaken outside of these hours if required:	-
	(a) by the Police or a public authority for the delivery of vehicles, plant or materials; or	No night-time works are proposed
	(b) in an emergency to avoid the loss of life, damage to property or to prevent environmental harm.	No night-time works are proposed
D6	Notification of activities undertaken in the circumstances in Condition D5 must be given to affected residents before undertaking the activities or as soon as is practical afterwards.	Section 7; Section 10
D7	Rock breaking, rock hammering, sheet piling, pile driving and similar activities may only be carried out between the following hours:	-
	(a) 9am to 12pm, Monday to Friday;	Section 3; Section 7
	(b) 2pm to 5pm Monday to Friday; and	Section 3; Section 7
	(c) 9am to 12pm, Saturday.	Section 3; Section 7
D15	The development must be constructed to achieve the construction noise management levels detailed in the Interim Construction Noise Guideline (DECC, 2009). 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 identified in the approved CNVMP.	Section 5.2; Section 5.3; Section 7
D16	The Applicant must ensure construction vehicles (including concrete agitator trucks) do not arrive at the subject site or surrounding residential precincts outside of the construction hours of work outlined under this consent.	Section 7

D17	The Applicant must implement, where practicable and without compromising the safety of construction staff or members of the public, audible movement alarms of a type that would minimise noise impacts on surrounding noise sensitive receivers.	Section 7
D18	The Applicant must ensure that any work generating high noise impact (i.e. work exceeding a NML of LAeq 75dBA) as measured at any sensitive receiver is only 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, where the location of the work is likely to impact the same receivers. For the purposes of this condition 'continuous' includes any period during which there is less than 1 hour respite between ceasing and recommencing any of the work the subject of this condition.	Section 7
D19	Any noise generated during construction of the development must not be offensive noise within the meaning of the Protection of the Environment Operations Act 1997 or exceed approved noise limits for the Site.	Section 12
D20	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 (1992-02) Structural vibration - Effects of vibration on structures (German Institute for Standardisation, 1999);	Section 4.3.2 (note that this standard has since been superseded by DIN 4150-3 (2016))
	(b) for human exposure to vibration, the evaluation criteria set out in the Environmental Noise Management Assessing Vibration: A Technical Guideline (Department of Environment and Conservation, 2006) (as may be updated or replaced from time to time).	Section 4.3.1
D21	Vibratory compactors must not be used within 30 metres of residential or heritage buildings unless vibration monitoring confirms compliance with the vibration criteria specified above. These limits apply unless otherwise outlined in the project specific CNVMP required by this consent.	No rollers are proposed to be utilised on site

3 SITE DESCRIPTION

The construction works include the excavation, piling, and construction works associated with the proposed development at 2 Mandala Parade, Castle Hill.

Typical works anticipated are as follow:

- Excavation using hammering attachments, excavators, and saw cutters.
- Surface miner for bulk excavation.
- Auger piling of foundations.
- Use of mobile diesel cranes and fixed electric tower cranes.
- Erection of building structure (powered hand tools for formwork, concrete pump, vibrators).
- Façade Installation (powered hand tools)
- Landscaping and work zone mobile plant (front end loaders, forklifts, EWP's).
- Internal fit out of apartments (powered hand tools).

The duration of activities on site has been advised by the client to be as follows:

- **Demolition:** This office has been advised that demolition works have been completed prior to the SSD Application, therefore, it will not be assessed in this Sub-Plan.
- **Excavation:** January 2023 – October 2023.
- **Piling:** This office has been advised that piling works have been completed (23/12/2022 – 1/2/2023), however, a retroactive assessment will be presented in this Sub-Plan since no prediction on impacts from piling works was presented in document prepared by Koikas Acoustics, named "Construction Noise and Vibration Plan of Management With Regards to The Sydney Metro Infrastructure – Proposed Mixed-Use Development, 2 Mandala Parade, Castle Hill NSW 2154 (Doran Drive Precinct)", dated Wednesday, 21 December 2022, project number 4214, Version V5, file reference 4214R20200804jtDoranDrivePrecinct_CNVPMv5.docx.
- **Construction:** October 2023 – June 2025.

In accordance with conditions D3-D7 of SSD-15882721, construction hours are the following:

Table 2 - Work Hours

Day	¹ Construction Hours	² Piling/Noisy Work Hours
Monday – Friday	7am – 6pm	9am – 12pm & 2pm – 5pm
Saturday	8am – 1pm	9am – 12pm
Sunday & Public Holidays	No Work Permitted	No Work Permitted

¹Construction, including the delivery of materials or machinery to and from site.

²Rock breaking, rock hammering, sheet piling, pile driving, and similar activities.

3.1 RECEIVER LOCATIONS

Receiver locations are detailed in document prepared by Koikas Acoustics, named "Construction Noise and Vibration Plan of Management With Regards to The Sydney Metro Infrastructure – Proposed Mixed-Use Development, 2 Mandala Parade, Castle Hill NSW 2154 (Doran Drive Precinct)", dated Wednesday, 21 December 2022, project number 4214, Version V5, file reference 4214R20200804jtDoranDrivePrecinct_CNVPMv5.docx.

These locations will be used as a basis for this assessment, as seen below:

Table 3 - Surrounding Sensitive Receivers

Receiver	Comment
C1 – Commercial Receiver	The existing commercial developments located along Doran Drive to the southwest of the project site across the road.
C2 – Commercial Receiver	The existing metro station "Hills Showground" located along Doran Drive, Mandala Parade, and Carrington Road, to the south of the project site across the road.
R1 – Residential Receiver	The future mixed-use development to the west of the site at along De Clambe Drive, and Doran Drive, across the road.
R2 – Residential Receiver	The existing multiple residential developments to the southwest of the site along Carrington Road
R3 – Residential Receiver	The existing multiple residential developments to the south of the site along Carrington Road
R4 – Residential Receiver	The existing residential development to the southeast of the site on the corner of Carrington Road and Middleton Avenue (2-2R Middleton Avenue, Castle Hill)
R5 – Residential Receiver	The existing residential development to the east of the site the corner of Carrington Road and Andalusian Way across the road.
R6 – Residential Receiver	The future mixed-use development to the east of the site along Andalusian Way across the road.
AR1 – Active Recreation Receiver	The martial-arts club/academy to the northwest of the site along Doran Drive.
AR2 – Active Recreation Receiver	The Hills Showground to the north of the site, across the road along Doran Drive, and De Clambe Drive.



- Project Site
- Commercial Receivers
- Residential Receivers
- Active Recreation Receivers

\\SYD-DC01\data\Australia\Jobs\2023\20230121\20230121.2\20230329BJA_R1_Construction_Noise_and_Vibration_Management_Sub-Plan.docx **Figure 1: Site Map (Source: BingMaps)**

4 NOISE AND VIBRATION MANAGEMENT LEVEL

4.1 NOISE DESCRIPTORS

Ambient noise constantly varies in level from moment to moment, so it is not possible to accurately determine prevailing noise conditions by measuring a single, instantaneous noise level.

To quantify ambient noise, a 15-minute measurement interval is typically utilised. Noise levels are monitored on a continuous basis over this period, and statistical and integrating techniques are used to characterise the noise being measured.

The principal measurement parameters are:

L_{eq} - represents the average noise energy during a measurement period. This parameter is derived by integrating the noise levels measured over the measurement period. L_{eq} is important in the assessment of noise impact as it closely corresponds with how humans perceive the loudness of steady state and quasi-steady state noise sources (such as traffic noise).

L_{90} – This is commonly used as a measure of the background noise level as it represents the noise level heard in the quieter periods during the measurement interval. The L_{90} parameter is used to set noise emission criteria for potentially intrusive noise sources since the disturbance caused by a noise source will depend on how audible it is above the pre-existing noise environment, particularly during quiet periods, as represented by the L_{90} level.

L_{10} is used in some guidelines to measure noise produced by an intrusive noise source since it represents the average of the loudest noise levels produced at the source. Typically, this is used to assess noise from licenced venues.

L_{max} is the highest noise level produced during a noise event and is typically used to assess sleep arousal impacts from short term noise events during the night. It is also used to assess internal noise levels resulting from aircraft and railway ground vibration induced noise.

L_1 is sometimes used in place of L_{max} to represent a typical noise level from a number of high-level, short-term noise events.

4.2 EPA INTERIM CONSTRUCTION NOISE GUIDELINE

The EPA Interim Construction Noise Guideline (ICNG) assessment requires:

- Determination of noise management levels (based on ambient noise monitoring).
- Review of operational noise levels at nearby development.
- If necessary, recommendation of noise controls strategies in the event that compliance with noise emission management levels is not possible.

EPA guidelines adopt differing strategies for noise control depending on the predicted noise level at the nearest residences:

- "Noise affected" level. Where construction noise is predicted to exceed the "noise affected" level at a nearby residence, the proponent should take reasonable/feasible work practices to ensure compliance with the "noise affected level". For residential properties, the "noise affected" level occurs when construction noise exceeds ambient levels by more than 10dB(A)Leq(15min).
 - For construction works outside the standard hours of construction of Monday to Friday 7am-6pm, and Saturday 8am-1pm, the management level of BG + 5 should not be exceeded.
- "Highly noise affected level". Where noise emissions are such that nearby properties are "highly noise affected", noise controls such as respite periods should be considered. For residential properties, the "highly noise affected" level occurs when construction noise exceeds 75dB(A)Leq(15min) at nearby residences.
- Section 4.1.2 and 4.1.3 of the EPA Interim Construction Noise Guideline also nominates management levels for other sensitive land uses (other than residences). Criteria relevant to this assessment is detailed below.
 - Commercial: 70dB(A)Leq(15min).
 - Active Recreation: 65dB(A)Leq(15min).
- Since no works are to be conducted outside of proposed construction hours, an assessment of ground-borne noise is not relevant at this stage.

4.2.1 Background Noise Measurements

Unattended noise monitoring is detailed in document prepared by Koikas Acoustics, named "*Construction Noise and Vibration Plan of Management With Regards to The Sydney Metro Infrastructure – Proposed Mixed-Use Development, 2 Mandala Parade, Castle Hill NSW 2154 (Doran Drive Precinct)*", dated Wednesday, 21 December 2022, project number 4214, Version V5, file reference 4214R20200804jtDoranDrivePrecinct_CNVPV5.docx.

Unattended Noise monitoring was conducted from the 10th to the 16th of July 2020, and the noise loggers were installed in the following locations (Fig. 2):

- **Monitoring Location A** - Corner Mandala Parade and Doran Drive;
- **Monitoring Location B** - Corner Andalusian Way and Mandala Parade;
- **Monitoring Location C** - Corner De Clambe Drive and Andalusian Way, and
- **Monitoring Location D** - Corner Doran Drive and De Clambe Drive.

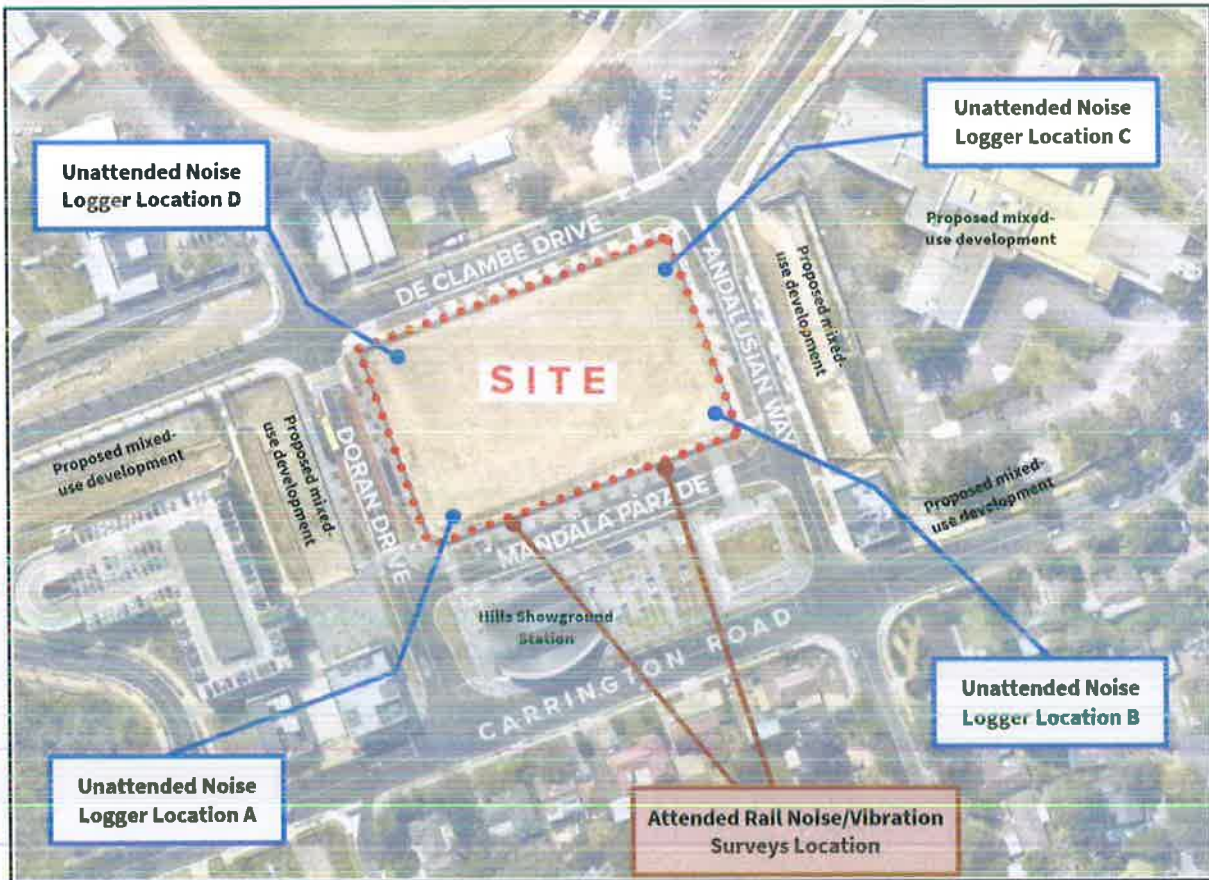


Figure 2. Monitoring Locations (Koikas CNVPM)

4.2.1.1 Measurement Results

The background noise levels established from the unattended noise monitoring are detailed in Table 4.

Table 4 - Summarised Rating Background Noise Level

Location	¹ Time of Day	Rating Background Noise Level dB(A) _{L90(period)}
Monitoring Location A - Corner Mandala Parade and Doran Drive	Day (7am-6pm)	49
Monitoring Location B - Corner Andalusian Way and Mandala Parade	Day (7am-6pm)	49
Monitoring Location C - Corner De Clambe Drive and Andalusian Way	Day (7am-6pm)	52
Monitoring Location D - Corner Doran Drive and De Clambe Drive	Day (7am-6pm)	50

¹The NSW EPA NPI refers to Night as 10pm to 7am Monday to Saturday and 10pm to 8am Sunday and public holidays.

4.2.2 Summary of Noise Management Levels

A summary of the recommended noise levels from the ICNG is presented below in Table 5.

Table 5 - Noise Management Levels (Approved Construction Hours)

Location	¹ Time of Day	"Noise Affected" Level - dB(A) _{Leq(15min)}	"Highly Noise Affected" Level - dB(A) _{Leq(15min)}
Residential Receivers – R2 Monitoring Location A – Corner Mandala Parade and Doran Drive	Day (M-F: 7am-6pm Sat: 8am-1pm)	59	75
Residential Receivers – R3/R4/R5 Monitoring Location B – Corner Andalusian Way and Mandala Parade	Day (M-F: 7am-6pm Sat: 8am-1pm)	59	75
Residential Receivers – R6 Monitoring Location C – Corner De Clambe Drive and Andalusian Way	Day (M-F: 7am-6pm Sat: 8am-1pm)	62	75
Residential Receivers – R1 Monitoring Location D – Corner Doran Drive and De Clambe Drive	Day (M-F: 7am-6pm Sat: 8am-1pm)	60	75
Commercial Receivers – C1/C2	When in use	70	N/A
Active Recreation Receivers – AR1/AR2	When in use	65	N/A

¹The NSW EPA NPI refers to Night as 10pm to 7am Monday to Saturday and 10pm to 8am Sunday and public holidays.

If noise levels exceed the management levels identified in the tables above, reasonable, and feasible noise management techniques will be reviewed.

4.3 VIBRATION

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

- For human exposure to vibration, Department of Environment and Conservation NSW "Assessing Vibration: A Technical Guideline" (Feb 2006) is based on the guidelines contained in BS 6472:1992 "Guide to Evaluate Human Exposure to Vibration in Buildings (1Hz to 80Hz)" for low probability of adverse comment.
- For structural damage vibration, German Standard DIN 4150-3 (2016) – "Vibration in Buildings Part 3: Effects on Structures".
- For structural damage to Sydney Metro Assets:
 - Sydney Metro "Underground Corridor Protection Technical Guidelines", dated April 2021 for vibration assessment on underground assets.
 - Sydney Metro "Technical Services, Sydney Metro at Grade and Elevated Sections Corridor Protection Guidelines", dated September 2018 for vibration assessment on elevated or at grade assets.

4.3.1 Assessing Amenity

Department of Environment and Conservation NSW "Assessing Vibration: A Technical Guideline" (Feb 2006) is based on the guidelines contained in BS 6472:1992. This guideline provides procedures for assessing tactile vibration and regenerated noise within potentially affected buildings.

The recommendations of this guideline should be adopted to assess and manage vibration from the site. Where vibration exceeds, or is likely to exceed, the recommended levels then an assessment of reasonable and feasible methods for the management of vibration should be undertaken.

Table 6 - BS 6472 Vibration Criteria

		RMS acceleration (m/s ²)		RMS velocity (mm/s)		Peak velocity (mm/s)	
Place	Time	Preferred	Maximum	Preferred	Maximum	Preferred	Maximum
Continuous Vibration							
Residences	Daytime	0.01	0.02	0.2	0.4	0.28	0.56
Offices	Day or night-time	0.02	0.04	0.4	0.8	0.56	1.1
Workshops		0.04	0.08	0.8	1.6	1.1	2.2
Impulsive Vibration							
Residences	Daytime	0.3	0.6	6.0	12.0	8.6	17.0
Offices	Day or night-time	0.64	1.28	13	26	18	36
Workshops		0.64	1.23	13	26	18	36

Note 1: Continuous vibration relates to vibration that continues uninterrupted for a defined period (usually throughout the daytime or night-time), e.g., continuous construction or maintenance activity. (DECC, 2006).

Note 2: Impulsive vibration relate to vibration that builds up rapidly to a peak followed by a damped decay and that may or may not involve several cycles of vibration (depending on frequency and damping), with up to three occurrences in an assessment period, e.g., occasional loading and unloading, or dropping of heavy equipment. (DECC, 2006).

4.3.2 Structure Borne Vibrations

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 gives 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 below 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 are below the guidelines listed below, 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 activities or sources. 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 7 - (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 Paragraph 2 of 5.1.2 shall be observed.

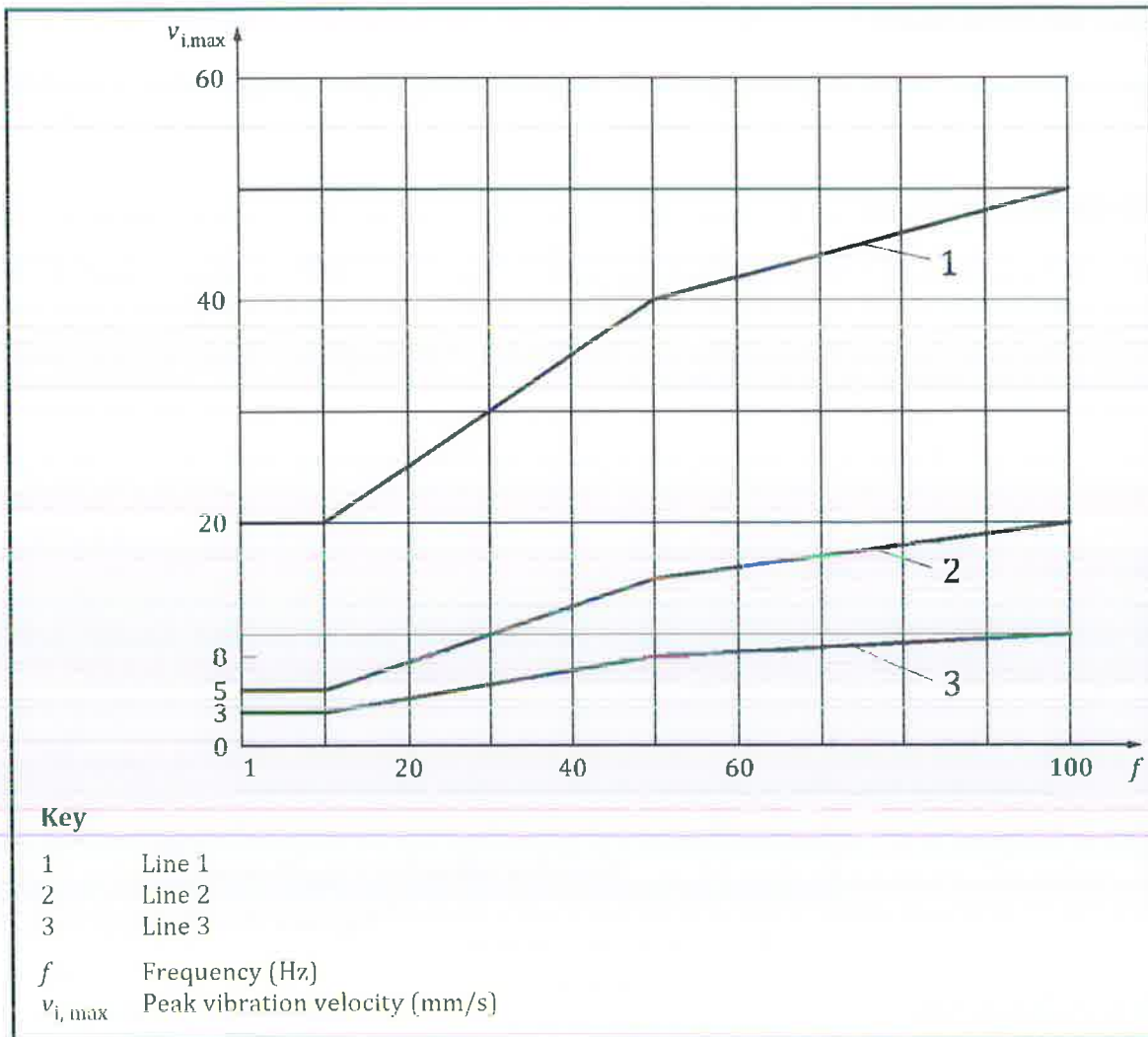


Figure 3. Graph presenting all three vibration curves (Source: DIN4150-3 (2016))

4.3.3 Sydney Metro Vibration Assessment

Sydney Metro “Underground Corridor Protection Technical Guidelines” dated April 2021 will be used to determine vibration criteria and vibration impacts at Sydney Metro The Hills Showground Station for all underground assets, since the station cavern and tracks are buried assets.

Sydney Metro “Technical Services, Sydney Metro at Grade and Elevated Sections Corridor Protection Guidelines” dated September 2018 can only be used for at grade or elevated sections of the rail corridor, therefore not applicable to the underground assets (cavern and track), but it is applicable to the station precinct above ground.

4.3.3.1 Vibration Criteria at Ground Level (Station Precinct)

Section 6.7 of Sydney Metro “Technical Services, Sydney Metro at Grade and Elevated Sections Corridor Protection Guidelines” dated September 2018 has the following criterion for structural vibration:

Any development that occurs within a screening distance of 25 m horizontally from first reserve must consider the vibration on the Metro infrastructure with the following assessment criteria of maximum peak particle velocity (PPV):

- The peak particle velocities at any Metro at grade or elevated structures resulting from demolition works, driving or withdrawal of piles or any other construction activities which can induce vibration shall not exceed 15 mm/sec.

4.3.3.2 Vibration Criteria at Below Ground Level (Station Cavern and Tracks)

Section 9.3.1 of Sydney Metro "Underground Corridor Protection Technical Guidelines" dated April 2021 has the following criterion for structural vibration:

The recommended limits for transient vibration to ensure minimal risk of cosmetic damage to reinforced or framed structures and industrial and heavy commercial buildings apply to Sydney Metro infrastructure.

Sources of vibration that are considered in the standard include demolition, piling, ground treatments (e.g. compaction), construction equipment, tunnelling and industrial machinery.

Continuous rock-breaking/hammering and sheet piling, vibratory rollers, excavators and the like can give rise to dynamic magnification due to resonance.

An adjusted peak particle component velocity (PPV) of 20 mm/s at 4 Hz and above applies to any development that occurs within 25 m horizontally from first reserve of Sydney Metro infrastructure as a conservative vibration damage screening level. An Alert level of 15 mm/s shall apply for monitoring and management purposes.

Atypical construction methods should be assessed on a case-by-case basis with reference to the Standards.

In order to assess the likelihood of cosmetic damage due to vibration, AS2187 specifies that the highest of the orthogonal vibration components (transverse, longitudinal and vertical directions) would be compared with the guidance vibration velocity limits.

Table 10.2 Minimum monitoring requirement for development activities near rail tunnels – within existing rail tunnels

Type of instrument	Deep open excavations	Foundation works – shallow or deep	New underground excavation or new tunnel
Tunnel convergence	Yes	Yes	Yes
Tiltmeter	Yes	If required by Sydney Metro	Yes
Crackmeter	Yes	Yes	Yes
Vibration sensor	Yes	Yes	Yes

4.3.4 Summary of Sydney Metro Vibration Criteria

Table 8 -Summary of Sydney Metro Vibration Criteria

Asset	Max PPV mm/s	Component
Ground Level (Station Precinct)	15mm/s	¹ Not indicated
Below Ground (Station Cavern & Tracks)	20mm/s (at or above 4Hz)	Highest Orthogonal Component (x, y, z)

¹Due to no component requirement being indicated, the highest orthogonal component (x, y, z) will be used to determine Max PPV mm/s.

5 NOISE ASSESSMENT

5.1 ACTIVITIES TO BE CONDUCTED AND THE ASSOCIATED NOISE LEVELS

We have been advised of the typical equipment/processes anticipated to be used for the construction of the subject development. Noise impacts from these activities on the amenity of the surrounding identified sensitive receivers, will be predicted in this section.

The A-weighted sound power levels for the anticipated equipment/processes are outlined in Table 9 below.

Table 9 - Sound Power Levels (SWL)

Equipment/Process	Sound Power Level (SWL) dB(A)
Excavation/Piling	
Excavator with Hydraulic Hammer Attachment	123*
Jackhammer	121*
Concrete Saw	117*
Hand Tools (Pneumatic)	116
Excavator with Bucket Attachment	114
CFA/Auger Pile	111
Concrete/Shotcrete Pump	108
Trucks > 20 tonne	107
Manitou/Forklift/EWP	106
Backhoe	104
Hand Tools (electric)	102
Construction	
Hand Tools (Pneumatic)	116
Cement Mixing Truck	109
Concrete/Shotcrete Pump	108
Trucks > 20 tonne	107
Manitou/Forklift/EWP	106
Cherry Picker	105
Electric Tower Crane	105
Diesel Tower/Mobile Crane	104
Hand Tools (electric)	102
Drilling	94*

***Includes 5 dB(A) addition for characteristics of noise source.**

The noise levels presented in the above table are derived from the following sources (details in Appendix 2):

- On-site measurements.
- Table D2 of Australian Standard 2436-1981 & Table A1 of Australian Standard 2436-2010.
- Data held by this office from other similar studies.

5.2 NOISE EMISSION PREDICTIONS

5.2.1 Methodology

Noise generated by plant and equipment will be managed to generally comply with the nominated acoustic criteria, and where this noise goal may be exceeded, noise will be managed based on principles consistent with Australian Standard 2436.

Australian Standard AS2436 does not provide specific noise management targets. The guideline focuses on strategies for developing feasible and reasonable mitigation methodologies, management controls and community liaison to reach realistic compromises between the needs of construction activities and potentially affected receivers.

For the control and regulation of noise from construction sites AS2436:2010 *"Guide to noise control on construction, maintenance and demolition sites"* nominates the following:

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

Predictions of noise levels at the sensitive receivers identified have been made of the construction processes with the potential to produce significant noise.

It is noted that:

- Many of the noise sources are present over a small period of the day or may be present for a few days with a significant intervening period before the activity occurs again.
- The distance between the noise source and the receiver.
- The screening effect provided by the placement of a solid hoarding around the whole perimeter of the site. Receivers on lower levels will have the most reduction through barriers whilst receivers overlooking the site might not have any reduction in noise levels due to line of sight to the works.
- The screening effect provided by any remaining building structure or building shell. In particular, noise from works done on higher level will be substantially screened by the remaining building structure to receivers located on lower levels.

5.2.2 SoundPlan™ 8.0 Noise Modelling

Noise emission calculations, noise levels have been predicted at the receiver locations using SoundPlan™ 8.0 modelling software implementing the ISO 9613-2:1996 '*Acoustics – Attenuation of Sound during Propagation Outdoors – Part 2: General Method of Calculation*' noise propagation standard.

Digital Ground Elevation data are sourced from the Intergovernmental Committee on Surveying and Mapping (ICSM) - Elvis - Elevation and Depth - Foundation Spatial Data website. Receiver building spatial data (heights and elevations) are sourced from Geoscape Australia.

Noise enhancing meteorological conditions have been adopted as recommended by the NPfl, noting that the ISO 9613 modelling approach assumes that all receivers are "downwind" (i.e., that noise enhancing wind conditions are always in effect).

Ground absorption was conservatively calculated with a ground factor of 0 for all areas excepting localised lawns and greenery surrounding the site with a ground factor of 0.6 as recommended in *Engineering Noise Control* (Bies & Hanson).

The figures presented in Appendix 3 detail computational noise modelling for closest noise sensitive receivers and façades relating to the construction noise emissions of the site through the presentation of a façade noise map onto the respective buildings and a grid noise map at an elevation of 1.5m mapped to the ground model.

5.3 DISCUSSION – NOISE

Exceedances to the highly noise affected management level are predicted for various activities due to the proximity to adjacent properties and high noise levels of the proposed activities. The exceedances are the greatest for hydraulic hammering, jackhammering, concrete sawing, and the use of pneumatic tools during excavation/piling stages.

Once excavation/piling works have been completed, general construction works are expected to generally be of a lower noise level with some activities below the ICNG highly affected noise management levels. A further noise reduction would be expected for any internal works once façade works have been completed. Nevertheless, exceedances are still encountered during this stage when using pneumatic tools, and the operation of cranes and heavy vehicles, including concrete pumps.

Specific recommendations are detailed in Section 7.

Due to the proximity to adjacent receivers, noise monitoring is recommended in case any complaints arise, to ensure that noise levels to surrounding receivers may be managed.

In the event that noise levels generate complaints, it is recommended to install minimum 3 noise monitors at receivers **C1**, **C2**, and **R5**. The recommended locations of noise loggers are detailed below:

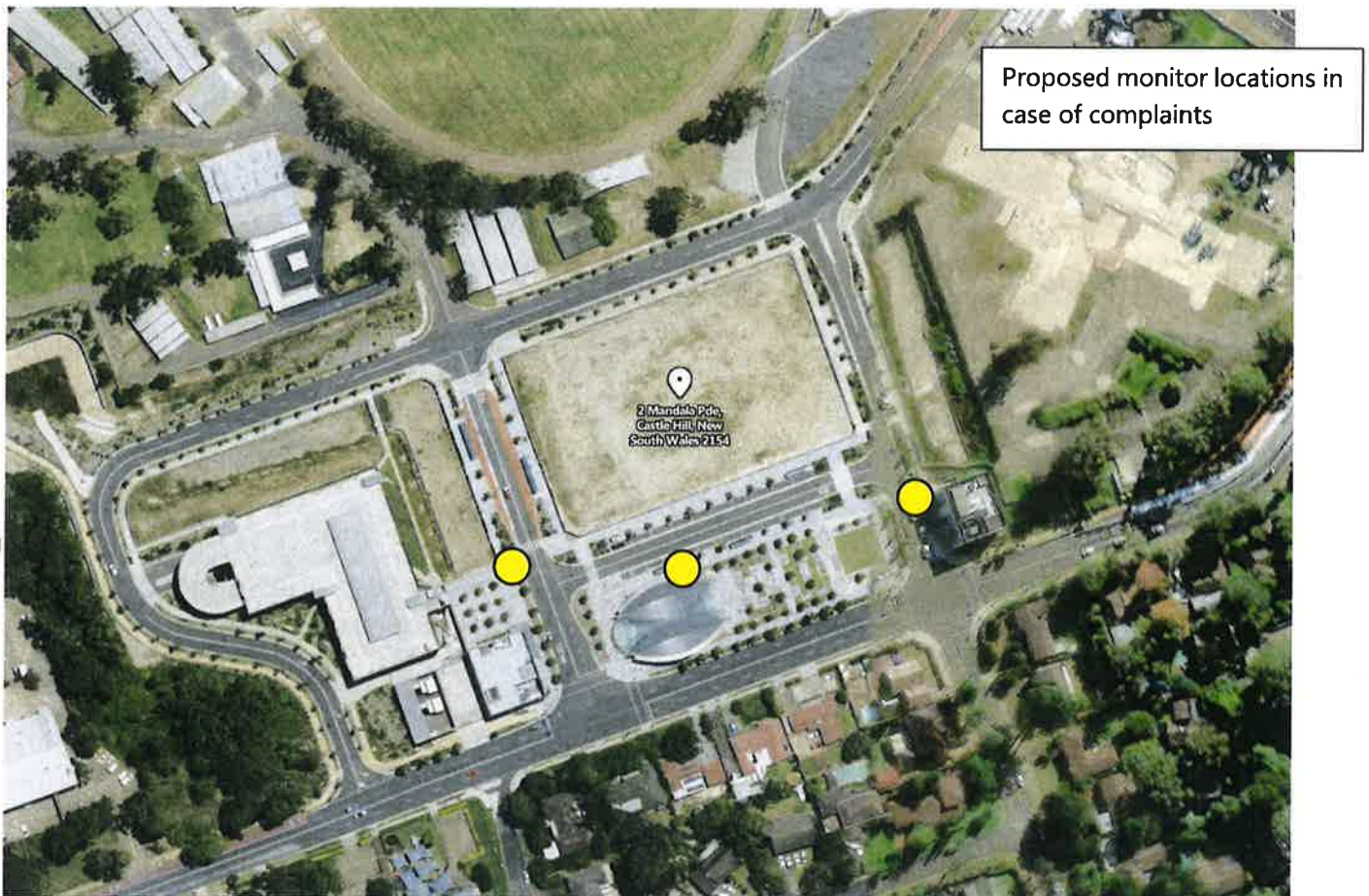


Figure 4. Noise Monitoring Locations

6 ASSESSMENT OF VIBRATION

6.1 SENSITIVE RECEIVERS

Nearest vibration receivers for the excavation, piling, and construction activities associated with the project site are below:

- **C1, C2, and R5**

6.2 VIBRATION PRODUCING ACTIVITIES

Proposed activities that have the potential to produce ground vibration is excavation, hammering, and piling works. It is noted that that soil is comprised mostly of sandstone, and hammering into rock is expected.

6.3 RECOMMENDED VIBRATION CRITERIA

6.3.1 Residential Receivers

In the event of complaints, it is recommended that vibration monitoring is taken place at **R5**. It is recommended to adopt maximum 5mm/s PPV criteria to protect residential buildings adjacent to the project site based on requirements of DIN 4150-3.

R5

- Alarm Level – 4mm/s PPV at vibration at receiver location, SMS alarm message will be sent to operator, project manager and acoustic engineer if magnitude of vibration events exceed this level. Project manager shall respond immediately by taking courteous work methodology.
- Stop work level -5mm/s PPV at vibration at receiver location, SMS alarm message will be sent to operator, project manager and acoustic engineer if magnitude of vibration events exceed this level. Project manager shall stop the work at amenity of geophone immediately.

6.3.2 Sydney Metro Receivers

As per Section 4.3.3, Sydney Metro has monitoring guidelines to be followed when assessing vibration impacts into their assets, and they can be divided into Ground Level/Elevated assets, and Underground assets.

C1/C2 (Ground Level) – Highest Orthogonal Component

- Alarm Level – 10.5mm/s PPV at vibration at receiver location, SMS alarm message will be sent to operator, project manager and acoustic engineer if magnitude of vibration events exceed this level. Project manager shall respond immediately by taking courteous work methodology.
- Stop work level -15mm/s PPV at vibration at receiver location, SMS alarm message will be sent to operator, project manager and acoustic engineer if magnitude of vibration events exceed this level. Project manager shall stop the work at amenity of geophone immediately.

C2 (Below Ground Level) – Highest Orthogonal Component at or above 4Hz

- Alarm Level – 14mm/s PPV at vibration at receiver location, SMS alarm message will be sent to operator, project manager and acoustic engineer if magnitude of vibration events exceed this level. Project manager shall respond immediately by taking courteous work methodology.
- Stop work level -20mm/s PPV at vibration at receiver location, SMS alarm message will be sent to operator, project manager and acoustic engineer if magnitude of vibration events exceed this level. Project manager shall stop the work at amenity of geophone immediately.

6.4 SAFEGUARDS TO PROTECT SENSITIVE STRUCTURES

It is impractical to predict the vibrations induced by the excavation/construction operations on site at potentially affected receivers. This is because vibration level is principally proportional to the energy impact which is unknown nature of terrain in the area (type of soil), drop weight, height etc.

6.5 VIBRATION MONITORING

It is noted that vibration monitoring is already in place, being conducted by Paragon Engineering, with two vibration sensors placed along the southern boundary of the project site, as per recommended by EI Australia Impact Assessment Sydney Metro Assets (E24724.G06_Rev 6) dated 22 June 2022. The methodology presented in both reports is acceptable.

However, in the event that vibration levels generate complaints, it is recommended to install additional 3 vibration monitors along **C1**, **C2**, and **R5** receivers (or where complaints originate from) Structural damage into nearby buildings should **always** be considered when piling/rock breaking/excavating/hammering, as complaints are not always a reflection of structural impacts, therefore, monitoring directly the Sydney Metro assets (cavern/tracks) is recommended, if possible.

The recommended locations of the geophones are detailed below:

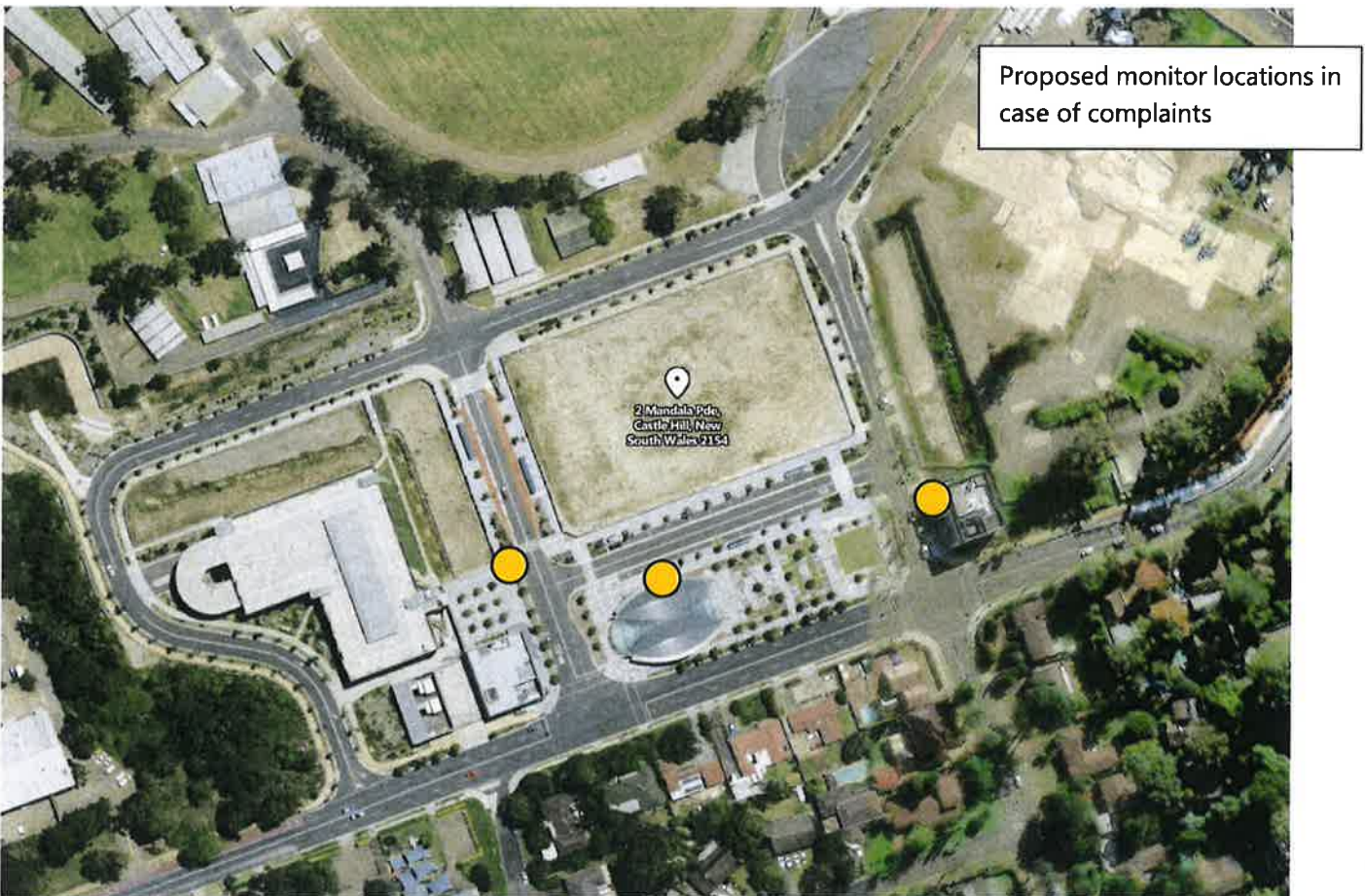


Figure 5. Vibration Monitoring Locations

The monitors are proposed to be fitted with GSM modem and SMS alarms for vibration exceedance. In addition, the vibration loggers will be downloaded remotely using the GSM modem.

6.5.1 Download of Vibration Logger

Downloading of the vibration logger will be conducted on a regular basis. In the event exceedance of vibration criteria or alarms occurs, downloading of logger will be conducted more frequently. Results obtained from the vibration monitor will be presented in a graph formant and will be forwarded to client for review. It is proposed that reports are provided fortnightly with any exceedance in the vibration criteria reported as detailed in this report.

6.5.2 Presentation of Vibration Logger Results

A fortnightly report shall be submitted to client via email summarising the vibration events. The vibration exceedance of limit is recorded the report shall be submitted within 24 hours. Complete results of the continuous vibration logging will be presented in fortnight reports including graphs of collected data.

6.5.3 Persons to Receive Alarms

The following personnel will receive GSM alarms:

- Acoustic consultant/advlsor (1 person)
- Excavation site foreman
- Construction foreman (where applicable)
- Construction nominated two representatives

7 RECOMMENDATIONS

In light of the above assessment, and to mitigate any potential noise and vibration impacts from the development at Doran Drive Precinct, Castle Hill, we recommend the following management controls be implemented:

- The scheduling of construction activities is recommended to be undertaken to reasonably minimise impacts to all surrounding residents.
 - Where hydraulic hammering, jackhammering, concrete sawing, and the use of pneumatic tools are required and will generate noise levels exceeding the noise management levels, the recommended hours below should be considered:
 - Monday – Friday: 9am – 12pm & 2pm – 5pm
 - Saturday: 9am – 12pm

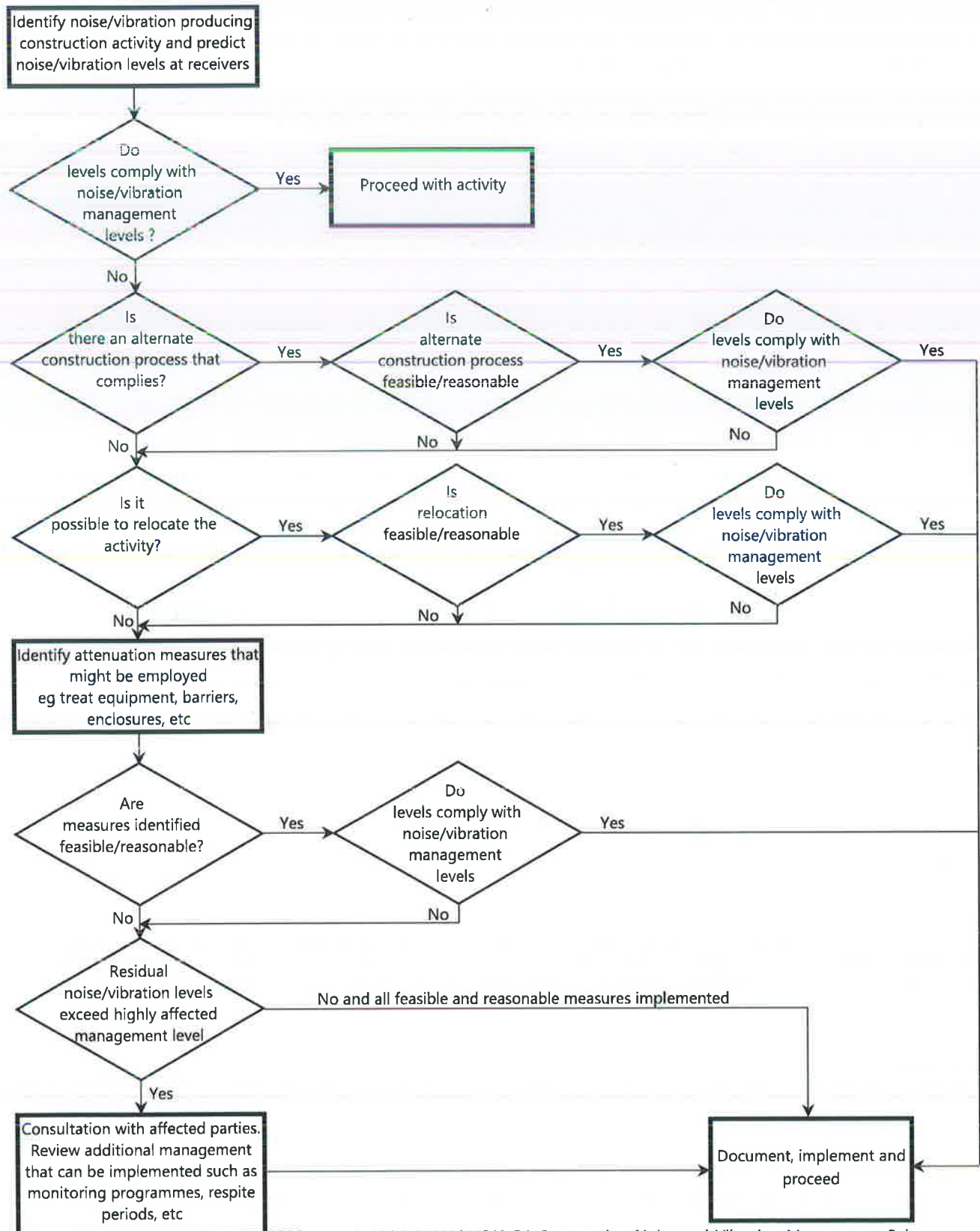
Note that demolition and piling works have been finalised, and excavation will not last for the entirety of the construction period, being limited to the extent mentioned in Section 3.

- Community consultation is proposed be undertaken throughout the construction process. In this regard regular letterbox drops detailing site progress and scheduled works is proposed. In particular, these should detail the extent and times of piling works, and hydraulic hammering, jackhammering, concrete sawing, and the use of pneumatic tools which is planned to be undertaken.
- Quiet work methods/technologies:
 - The primary noise generating activity at the site will be the hydraulic hammering, jackhammering, concrete sawing, and the use of pneumatic tools. As much as practicable, use of quieter methods is to be adopted.
 - Excavation is conducted initially using excavator with bucket (quietest excavation method), then use of rock rippers (as opposed to hydraulic hammers/rock saws) when rock strength permits. Use of the loudest excavation equipment (hydraulic hammers/rock saws) is used only with other options are not available.
 - Concrete pump trucks should generally be located within the bounds of the site, should be away from residential premises as much as possible, and should not arrive or leave site after prescribed construction hours.
 - Hammering should not be used on site, if possible, use alternative methods.
- A 2.1m solid hoarding must be placed around the whole perimeter of the site, with no gaps/penetrations.
- In the case of complaints, locations representative of the most affected receivers immediately bounding the site are recommended to be monitored for vibration and noise.
- Materials handling/vehicles:
 - Trucks and forklifts in general use on site are to use a non-tonal reversing beacon where possible (subject to OH&S requirements) to minimise potential disturbance of surrounding receivers;
 - Avoid careless dropping of construction materials into empty trucks.
 - Trucks, trailers and delivery vehicles are to turn off engines when idling to reduce noise impacts (unless required for concrete pumping or similar).
- Complaints handling:
 - An after-hours contact number is displayed outside of the building site, so that in the event that surrounding development believes that a noise breach is occurring, they may contact the site.
 - In the event of complaint, the procedures outlined in Sections 8 and 10 are adopted.
- Site Induction:
 - A copy of the Noise Management Sub-Plan is to be available to contractors. The location of the Noise Management Sub-Plan should be advised in any site induction.
 - Site induction should also detail the site contact to be notified in the event of noise complaint.

8 CONTROL OF CONSTRUCTION NOISE AND VIBRATION – PROCEDURAL STEPS

The flow chart that follows illustrates the process to be followed to minimise the impact associated with these activities.

Noise and vibration sources with the potential to exceed the management level set out in Section 4 have been identified in Sections 5 and 6, recommendations are discussed in Section 7.



9 ADDITIONAL NOISE AND VIBRATION CONTROL METHODS

In the event of complaints, there are a number of noise mitigation strategies available which can be considered. The determination of appropriate noise control measures will be dependent on the particular activities and construction appliances. This section provides an outline of available methods.

9.1 SELECTION OF ALTERNATE APPLIANCE OR PROCESS

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

9.2 STATIC PLANT

If required, additional noise reduction can be achieved by erecting solid barriers around static plant such as tower crane motors, diesel generators and any stationary concrete pumps. Noting that noise from the operation of this plant is predicted to be generally below noise management levels, such treatment would be considered precautionary.

Tower cranes to have solid barriers installed around the perimeter of crane engines and residential grade exhaust mufflers fitted.

9.2.1 Acoustic Barrier

Given the position of adjacent developments, it is unlikely that noise screens will provide significant acoustic benefit for above ground receivers but will provide noticeable improvement for those on ground level.

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

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

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

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

9.3 EXCAVATOR NOISE & HYDRAULIC HAMMERING

Where feasible, the use of a crusher attachment for excavators should be considered as an alternative to hydraulic/pneumatic hammers. The use of a ripper attachments is in preference to hammering closer to boundaries, where feasible.

9.4 CONCRETE PUMPS, PILING PLANT

Noise from concrete pumps/cement mixers and piling rigs have the potential to result in intermittent exceedances of allowable noise levels. It is noted that screw piling is proposed and it is highly recommended above hammer or vibro-piling.

Concrete pumps should be placed as close as possible to the middle of the site (where feasible) to reduce proximity to the nearby receivers or otherwise near to site boundary hoardings which will also maximise noise reduction from screening.

9.5 VIBRATORY COMPACTORS

Consent condition D21 stipulates that vibratory compactors must not be used closer than 30 metres from residential buildings unless vibration monitoring confirms compliance with the vibration criteria.

No vibratory compactors are proposed, however if required, vibration sample testing is to be undertaken prior to the use of any compactor plant to confirm that vibration criteria are not exceeded at the nearest receiver property and vibration levels do not cause adverse impact to surrounding residents.

9.6 OTHER ACTIVITIES

In the event of complaint, noise management techniques identified in this report should be employed to minimise the level of noise impact if management levels are found to be exceeded. This may include additional community consultation and re-scheduling of loud construction processes.

Notwithstanding above, general management techniques and acoustic treatments may be implemented on a case-by-case basis to reduce noise emissions to surrounding receivers.

9.7 GENERAL RECOMMENDATIONS

Other noise management practices which may be adopted are discussed below. In addition, notification, reporting and complaints handling procedures should be adopted as recommended in this report.

9.7.1 Treatment of Specific Equipment

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

9.7.2 Material Handling

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

9.7.3 Selection of Alternate Appliance or Process

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

9.7.4 Establishment of Site Practices

This involves the formulation of work practices to reduce noise generation. This includes locating fixed plant items as far as possible from receivers as well as rotating plant and equipment to provide respite to receivers. Construction vehicles accessing the site should not queue in residential streets and should only use the designated construction vehicle routes. Loading of these vehicles should occur as far as possible from any sensitive receiver.

9.7.5 Management Training

All site managers should be aware of noise and vibration limits, applicable control measures and methods. They should ensure that all agreed noise and vibration measures are carried out by employees and sub-contractors.

A copy of the Noise Management Plan is to be available to contractors, and site inductions should detail the site contact in the event of noise complaints.

9.7.6 Respite Periods

We note that development consent condition D7 provides specific time periods in which plant or activities with the potential to exceed noise management levels are permitted to operate. This inherently provides periods, subsequently reducing the occurrence and severity of noise impacts to surrounding receivers.

The respite periods would apply to very noisy works exceeding the highly noise affected management levels or as stipulated for the activities included in Condition D7.

9.8 NOISE MONITORING TECHNIQUES

Where noise monitoring is undertaken (either by attended short term measurements or long-term unattended noise monitoring), it should be conducted at a practical location representative of the impact to nearby noise sensitive receivers. Where this is not possible, noise measurements of construction processes should be taken such that noise levels can be accurately predicted to receivers. Any reporting of noise measurement results may include the following information:

- The date and time that the measurements were undertaken.
- The location of measurements, noise receivers and construction processes. A site map should be included for clarity.
- A description of the construction processes being undertaken during the measurement period.
- The measured noise construction noise levels, and the noise level at the façade of nearby receivers (if noise levels are predicted).
- A comparison to the NSW EPA Interim Construction Noise Guideline noise management levels.

9.9 VIBRATION MONITORING TECHNIQUES

Vibration monitoring should be conducted as specified in Section 6.5 and Section 9.5.

10 COMPLAINTS

10.1 DEALING WITH OFFENSIVE NOISE LEVELS

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

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

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

The investigation of offensive noise shall involve where applicable:

- Noise measurements 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.
- 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 being generated then the guidelines should be modified 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.

10.2 ESTABLISHMENT OF DIRECT COMMUNICATION WITH AFFECTED PARTIES

In order for any construction noise management programme to work effectively, continuous communication may be 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 adjustment of control methods and criteria for the benefit of all parties.

The objective 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 a Constructions Complaints Register which will be used to address any construction noise related problems should they arise.

Consultation should be undertaken prior to works through the builder. This includes correspondence with all affected parties.

10.3 DEALING WITH COMPLAINTS

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

the case of exceedances of the vibration limits all work potentially producing vibration shall cease until the exceedance is investigated.

The effectiveness of any changes shall be verified before continuing. Documentation and training of site staff shall occur to ensure the practices that produced the exceedances are not repeated. If a noise complaint is received the complaint should be recorded on a Noise Complaint Form. The complaint form should list:

- The name and 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.
- Summary of feedback to the complainant.

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

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 being generated then the guidelines should be modified 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.

10.4 REPORTING REQUIREMENTS

The following shall be kept on site:

- A register of complaints received/communication with the local community shall be maintained and kept on site with information as detailed in this report.
- Where noise/vibration complaints require noise/vibration monitoring, results from monitoring shall be retained on site at all times.
- Any noise exceedances occurring including, the actions taken and results of follow up monitoring.
- A report detailing complaints received and actions taken shall be presented to the construction liaison committee.

11 CONTINGENCY PLANS

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

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

Complaints associated with noise/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 telephone number.

12 CONCLUSION

An assessment of noise and vibration from construction works associated with site located at 2 Mandala Parade, Castle Hill, also known as "Doran Drive Precinct" has been presented within this report.

The principal issues which addressed in this report are:

- Specific activities that will be conducted and the associated noise/vibration sources;
- Identification of potentially affected noise/ vibration sensitive receivers;
- The construction noise and vibration requirements, including construction work hours specified in consent conditions C24, D3-D7, and D15-D21 (ref: SSD-15882721);
- Noise/ vibration response procedures;
- Assessment of potential noise/vibration from the proposed, excavation, and construction activities; and
- Contingency plans to be implemented in the event of non-compliances and/or noise complaints.

The assessment of noise and vibration indicates that construction activities associated with the project development may generate noise levels that will require some additional management. Adoption of the controls detailed in this report and adherence to the requirements of development consent will ensure that noise impacts will be minimised.

Vibration goals have also been set in this report to minimise structural damage risk for existing structures close to the project site and to protect human comfort, including impacts onto Sydney Metro assets.

Noting the above, we find the construction noise and vibration management requirements of development consent SSD-15882721 to be satisfied.

Please contact us should you have any further queries.

Yours faithfully,



Acoustic Logic Pty Ltd
Bruno Lobato Da Jornada

APPENDIX 1 – CONSTRUCTION METHODOLOGY DRAWINGS

PILES SETOUT PLAN

Approved Design Document			
Project Name: [Name]			
Project Number: [Number]			
Project Location: [Location]			
Project Description: [Description]			
Author:	Checked:	Drawn:	Scale:
Date:	Date:	Date:	

1. This drawing is a technical drawing and should be used in accordance with the relevant standards and specifications.



- Legend:
- Symbol 1: [Description]
 - Symbol 2: [Description]
 - Symbol 3: [Description]
 - Symbol 4: [Description]
 - Symbol 5: [Description]
 - Symbol 6: [Description]

Scale: 1:1000
 Drawing No: [Number]
 Revision: [Number]

Notes:

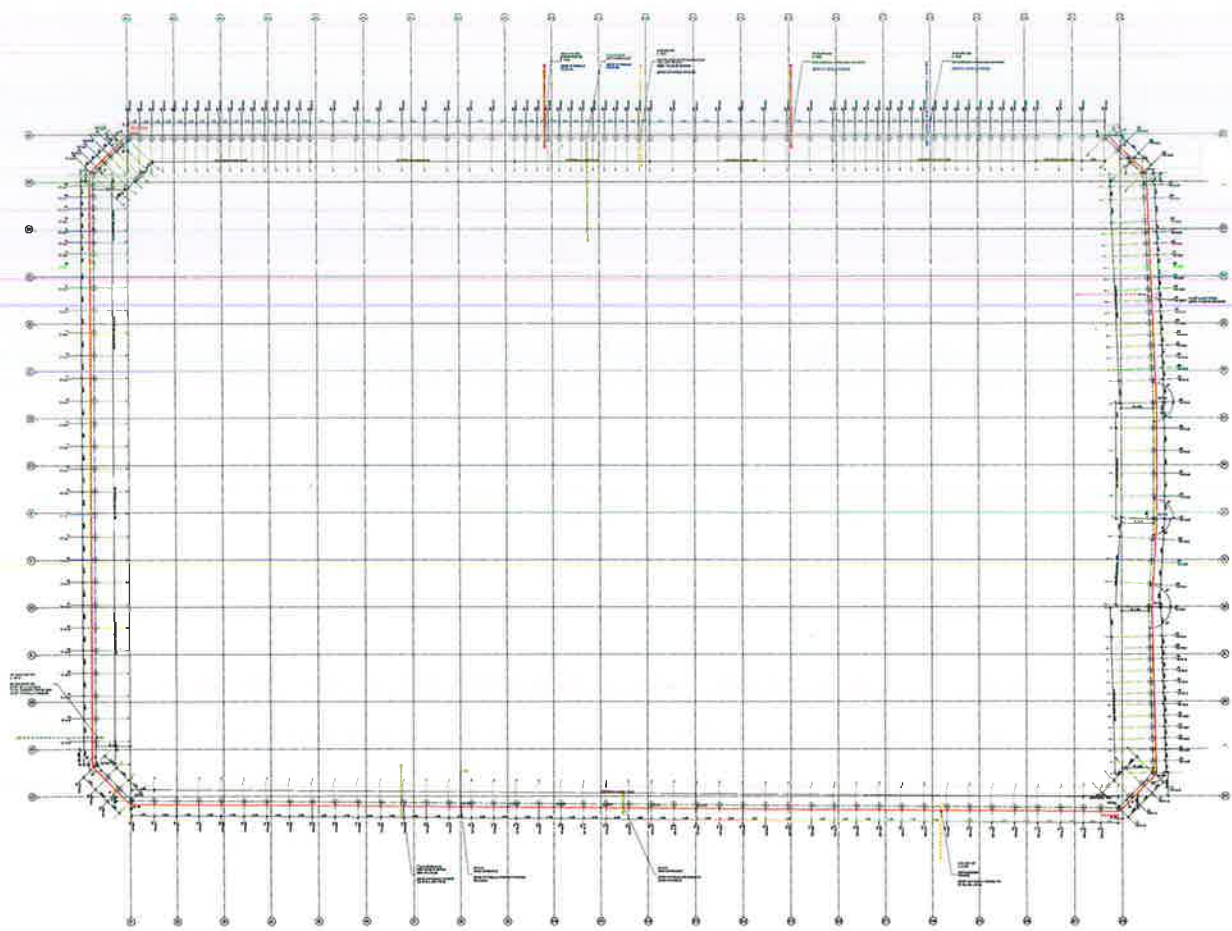
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- Note 2: [Text]
- Note 3: [Text]
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Project Information:

Project Name: [Name]
 Project Number: [Number]
 Project Location: [Location]
 Project Description: [Description]

Approval:

Author: [Name] Checked: [Name] Drawn: [Name]
 Date: [Date] Date: [Date] Date: [Date]

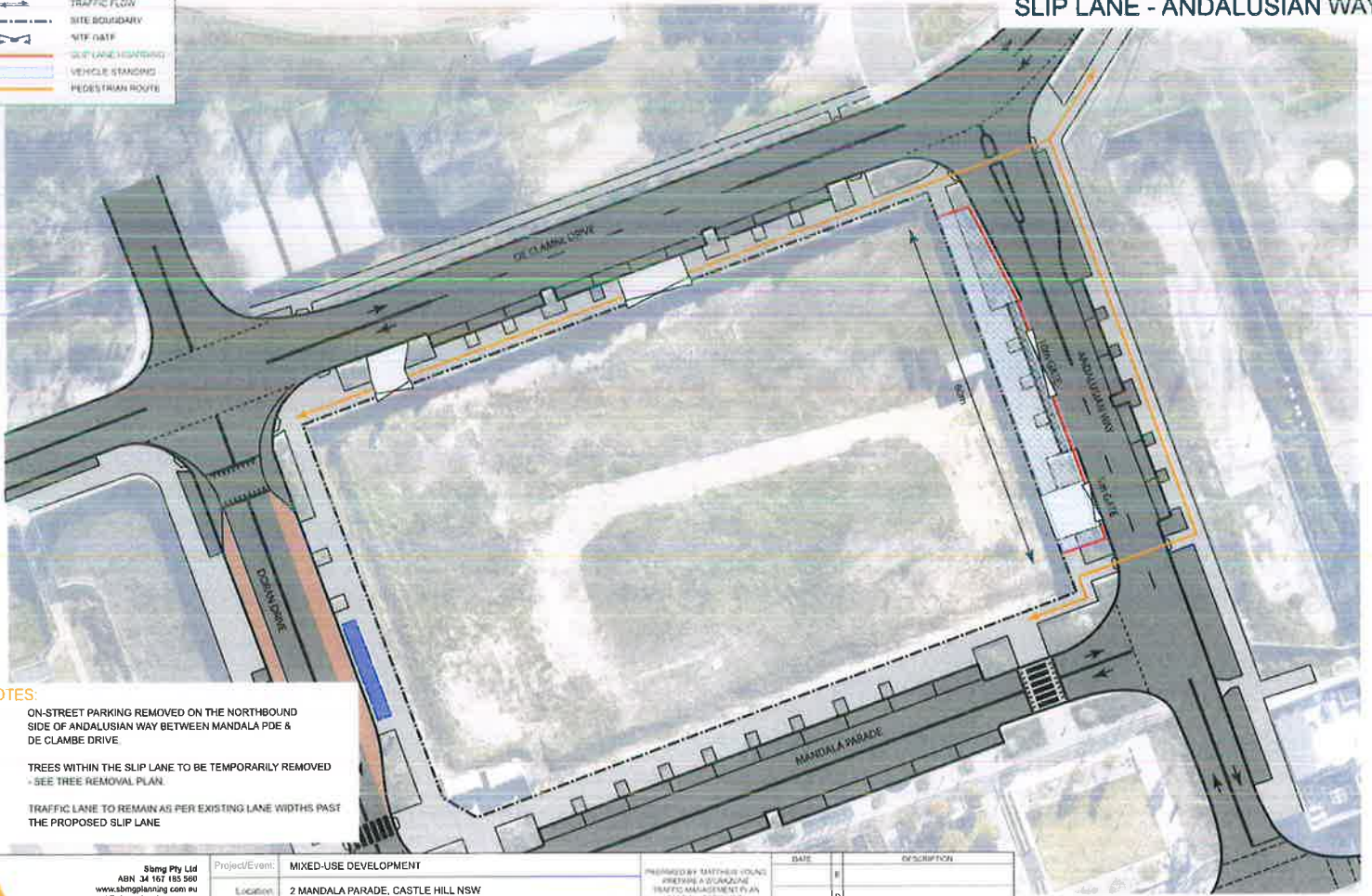


SLIP LANE STAGE 1

SITE OVERVIEW SLIP LANE - ANDALUSIAN WAY

LEGEND:

	TRAFFIC FLOW
	SITE BOUNDARY
	NTP DATE
	SLIP LANE HIGHLIGHTING
	VEHICLE STANDING
	PEDESTRIAN ROUTE



- NOTES:**
- ON-STREET PARKING REMOVED ON THE NORTHBOUND SIDE OF ANDALUSIAN WAY BETWEEN MANDALA PDE & DE CLAMBE DRIVE.
 - TREES WITHIN THE SLIP LANE TO BE TEMPORARILY REMOVED - SEE TREE REMOVAL PLAN.
 - TRAFFIC LANE TO REMAIN AS PER EXISTING LANE WIDTHS PAST THE PROPOSED SLIP LANE.

SBMG PLANNING

SBMG Pty Ltd
 ABN 34 157 185 560
 www.sbmplanning.com.au
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 m. 0457 379 389

Project/Event:	MIXED-USE DEVELOPMENT		
Location:	2 MANDALA PARADE, CASTLE HILL NSW		
Client:	DEICORP PTY LTD		
Plan No:	SBMG02509-09	B	Date: 11TH JANUARY 2023

PREPARED BY: MATTHEW YOUNG
 PREPARE A STORAGE
 TRAFFIC MANAGEMENT PLAN
 CARD No: TCM0001574

SCALE:

DATE	DESCRIPTION
11/01/23	e ANDALUSIAN WAY ADJUSTMENT
14/12/22	A INITIAL SUBMISSION

SCALE: NORTH SCALE

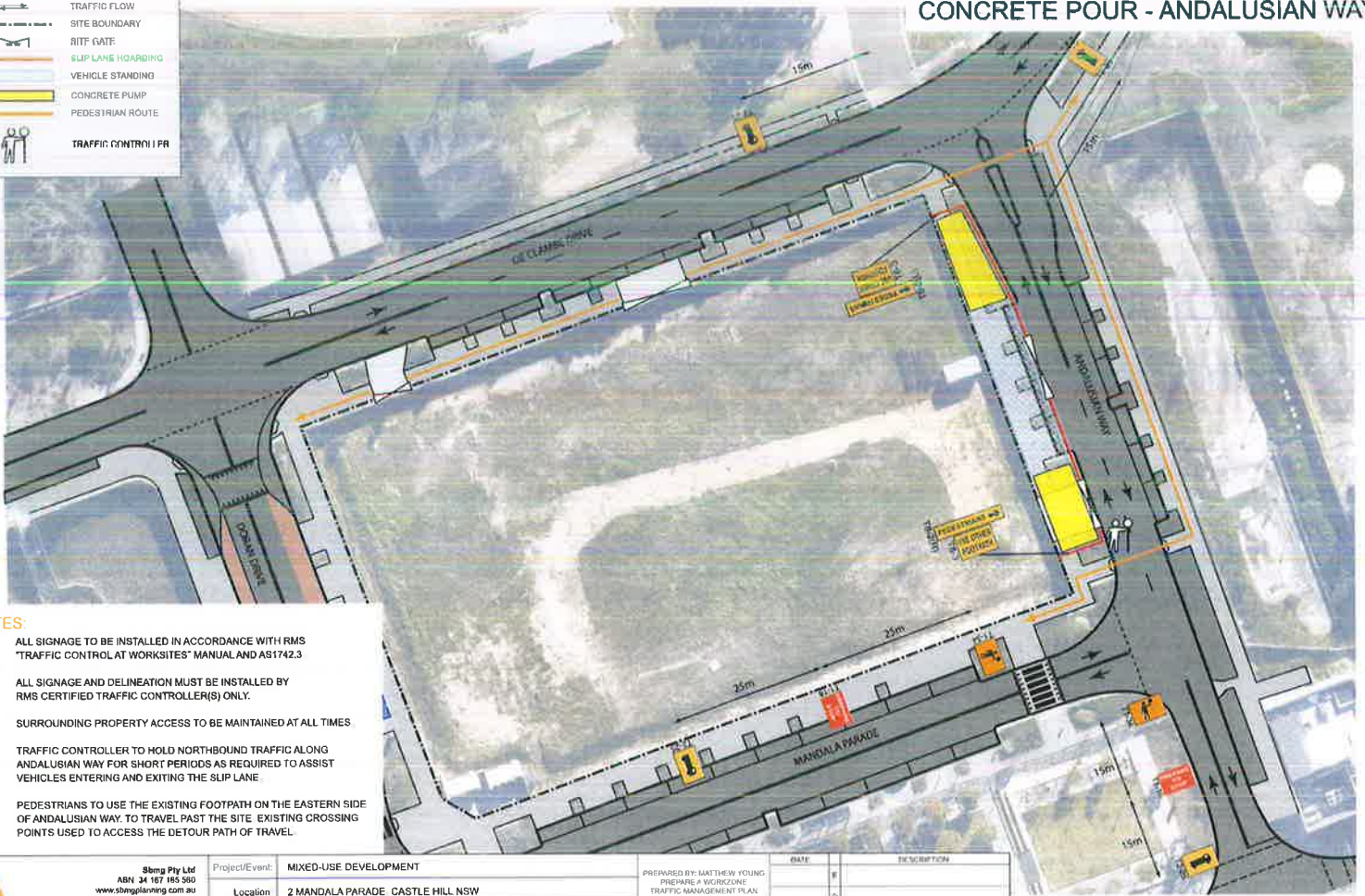


CONCRETE POUR STAGE 1

TRAFFIC CONTROL PLAN CONCRETE POUR - ANDALUSIAN WAY

LEGEND:

	TRAFFIC FLOW
	SITE BOUNDARY
	SLIP LANE HOARDING
	VEHICLE STANDING
	CONCRETE PUMP
	PEDESTRIAN ROUTE
	TRAFFIC CONTROLLER



NOTES:

1. ALL SIGNAGE TO BE INSTALLED IN ACCORDANCE WITH RMS 'TRAFFIC CONTROL AT WORKSITES' MANUAL AND AS1742.3
2. ALL SIGNAGE AND DELINEATION MUST BE INSTALLED BY RMS CERTIFIED TRAFFIC CONTROLLER(S) ONLY.
3. SURROUNDING PROPERTY ACCESS TO BE MAINTAINED AT ALL TIMES
4. TRAFFIC CONTROLLER TO HOLD NORTHBOUND TRAFFIC ALONG ANDALUSIAN WAY FOR SHORT PERIODS AS REQUIRED TO ASSIST VEHICLES ENTERING AND EXITING THE SLIP LANE
5. PEDESTRIANS TO USE THE EXISTING FOOTPATH ON THE EASTERN SIDE OF ANDALUSIAN WAY TO TRAVEL PAST THE SITE. EXISTING CROSSING POINTS USED TO ACCESS THE DETOUR PATH OF TRAVEL.



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 ABN 24 187 185 380
 www.sbmglanning.com.au
 mail@sbmgplanning.com.au
 m 0467 370 380

Project/Event:	MIXED-USE DEVELOPMENT		
Location:	2 MANDALA PARADE, CASTLE HILL NSW		
Client:	DEICORP PTY LTD		
Plan No:	SBMG02509_11	B	Date: 11TH JANUARY 2023
SCALE: NOT TO SCALE			

PREPARED BY: MATTHEW YOUNG
 PREPARE A WORKSITING
 TRAFFIC MANAGEMENT PLAN
 CARD No: TC19048874

SAVED: *[Signature]*

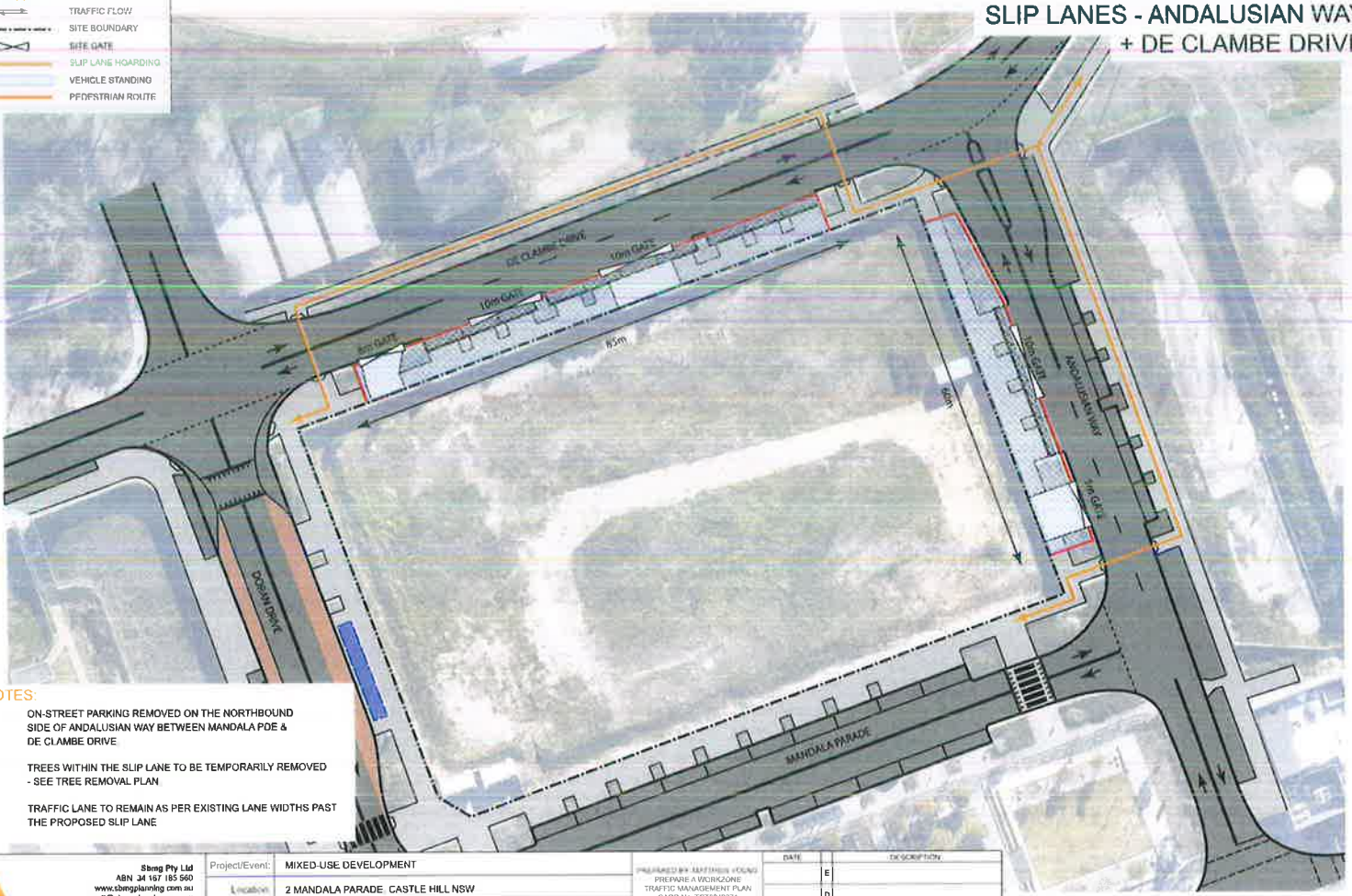
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14/12/22	#	INITIAL SUBMISSION

SLIP LANES STAGE 2

SITE OVERVIEW SLIP LANES - ANDALUSIAN WAY + DE CLAMBE DRIVE

LEGEND:

	TRAFFIC FLOW
	SITE BOUNDARY
	SITE GATE
	SLIP LANE HOARDING
	VEHICLE STANDING
	PEDESTRIAN ROUTE



- NOTES:**
1. ON-STREET PARKING REMOVED ON THE NORTHBOUND SIDE OF ANDALUSIAN WAY BETWEEN MANDALA POE & DE CLAMBE DRIVE
 2. TREES WITHIN THE SLIP LANE TO BE TEMPORARILY REMOVED - SEE TREE REMOVAL PLAN
 3. TRAFFIC LANE TO REMAIN AS PER EXISTING LANE WIDTHS PAST THE PROPOSED SLIP LANE



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Project/Event:	MIXED-USE DEVELOPMENT		
Location:	2 MANDALA PARADE CASTLE HILL NSW		
Client:	DEICORP PTY LTD		
Plan No:	SBMG02509-09	B	Date: 11TH JANUARY 2023
SCALE: NOT TO SCALE			

PREPARED BY: RAFFI THIRU (PLANNING)
PREPARE A WORKING
TRAFFIC MANAGEMENT PLAN
CARD No: TGT2048174

DRAWN: *[Signature]*



DATE	DESCRIPTION
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D	
C	
11/01/23	B ANDALUSIAN WAY ADJUSTMENT
14/12/22	A INITIAL SUBMISSION

CONCRETE POUR STAGE 2

NOTES

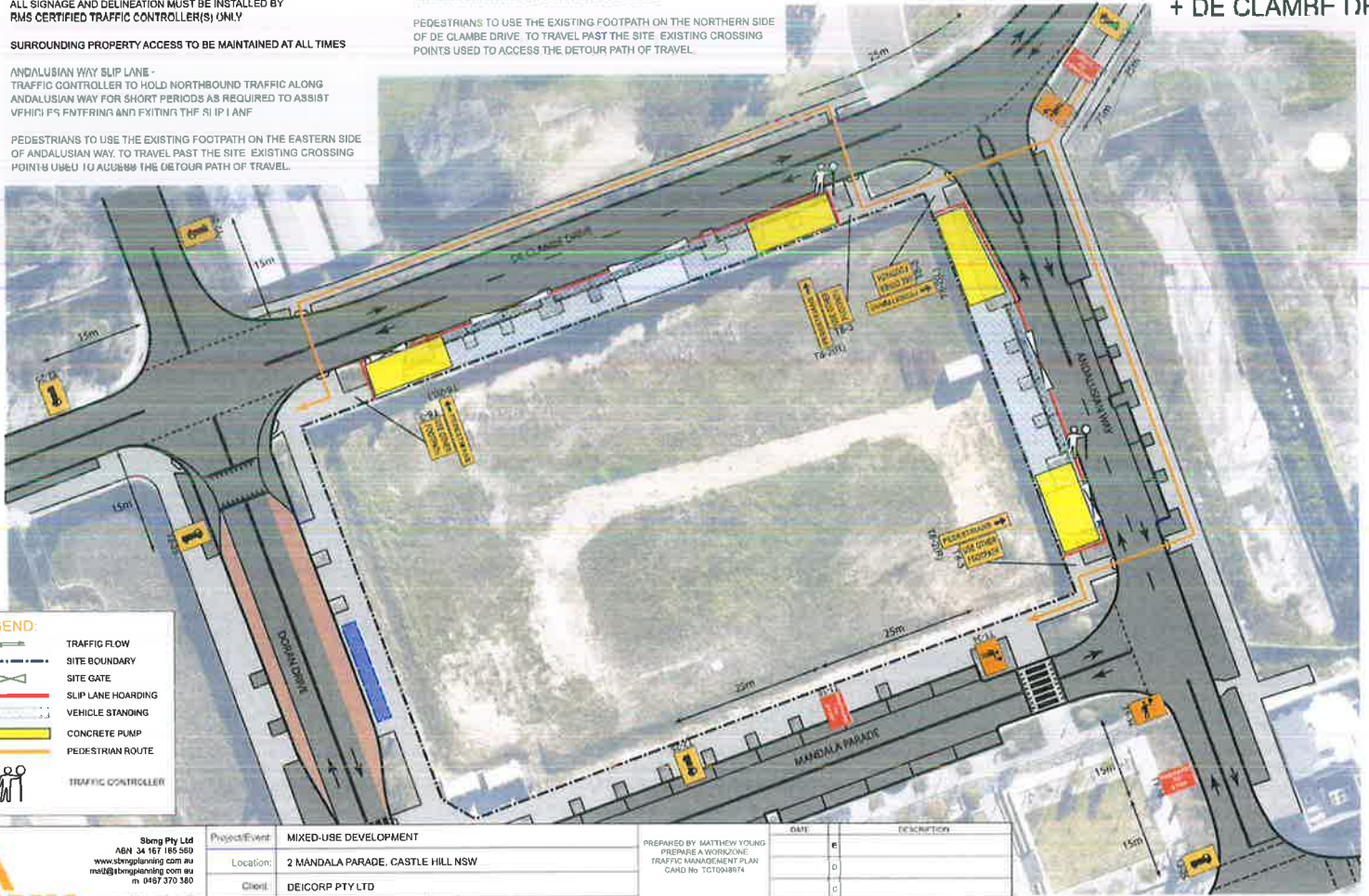
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2. ALL SIGNAGE AND DELINEATION MUST BE INSTALLED BY RMS CERTIFIED TRAFFIC CONTROLLER(S) ONLY
3. SURROUNDING PROPERTY ACCESS TO BE MAINTAINED AT ALL TIMES
4. ANDALUSIAN WAY SLIP LANE - TRAFFIC CONTROLLER TO HOLD NORTHBOUND TRAFFIC ALONG ANDALUSIAN WAY FOR SHORT PERIODS AS REQUIRED TO ASSIST VEHICLES ENTERING AND EXITING THE SLIP LANE

PEDESTRIANS TO USE THE EXISTING FOOTPATH ON THE EASTERN SIDE OF ANDALUSIAN WAY. TO TRAVEL PAST THE SITE. EXISTING CROSSING POINTS USED TO ACCESS THE DETOUR PATH OF TRAVEL.

5. DE CLAMBE DRIVE SLIP LANE - TRAFFIC CONTROLLER TO HOLD WESTBOUND TRAFFIC ALONG DE CLAMBE DRIVE FOR SHORT PERIODS AS REQUIRED TO ASSIST VEHICLES ENTERING AND EXITING THE SLIP LANE

PEDESTRIANS TO USE THE EXISTING FOOTPATH ON THE NORTHERN SIDE OF DE CLAMBE DRIVE. TO TRAVEL PAST THE SITE. EXISTING CROSSING POINTS USED TO ACCESS THE DETOUR PATH OF TRAVEL.

TRAFFIC CONTROL PLAN CONCRETE POUR - ANDALUSIAN WAY + DE CLAMBE DR



LEGEND:

- TRAFFIC FLOW
- SITE BOUNDARY
- SITE GATE
- SLIP LANE HOARDING
- VEHICLE STANDING
- CONCRETE PUMP
- PEDESTRIAN ROUTE
- TRAFFIC CONTROLLER

SBMG
PLANNING

Project/Event:	MIXED-USE DEVELOPMENT		
Location:	2 MANDALA PARADE, CASTLE HILL NSW		
Client:	DEICORP PTY LTD		
Plan No:	SBMG02509-14	B	Date: 11TH JANUARY 2023

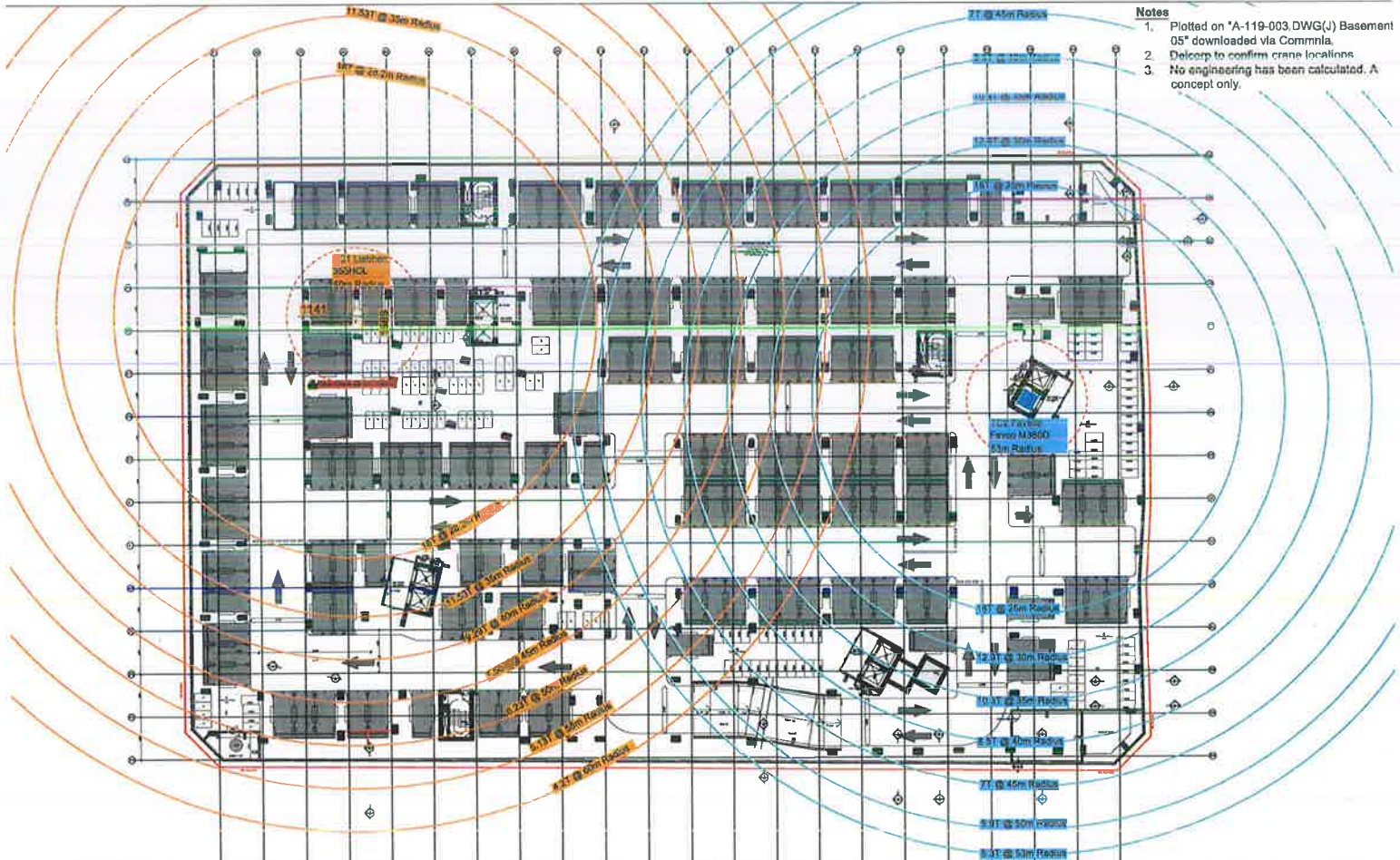
PREPARED BY: MATTHEW YOUNG
PREPARE A WORKING
TRAFFIC MANAGEMENT PLAN
CAND No: TCT0048874

SIGNED: *Matthew Young*

DATE	DESCRIPTION
11/01/23	B ANDALUSIAN WAY ADJUSTMENT
14/12/22	A INITIAL SUBMISSION

SCALE: NOT TO SCALE

CRANE RADIUS PLAN



Notes

1. Plotted on 'A-119-003.DWG(J) Basement 05' downloaded via Commila
2. Delcorp to confirm crane locations
3. No engineering has been calculated. A concept only.

Date	Description	By	Chk

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Crane	Model	Jib	Max Capacity	Towers	Hoist Speed	Luff Speed	Slew Speed
TC1	355HC-L	60m	16 tonnes	500HC	171m/min	1.8m/min-max	0.7rev/min
TC2	M380D	53m	16 tonnes	305C	160m/min	1m/min-max	1rev/min

Project: Showground Doran Drive

Client:

Title: RRS-365-Delcorp Showground Doran Drive- 355HC-L & M380D-Radius-BS-P1

Drawn: Rhye Noronha
Checked: Tony Noronha
Approved: Tony Noronha

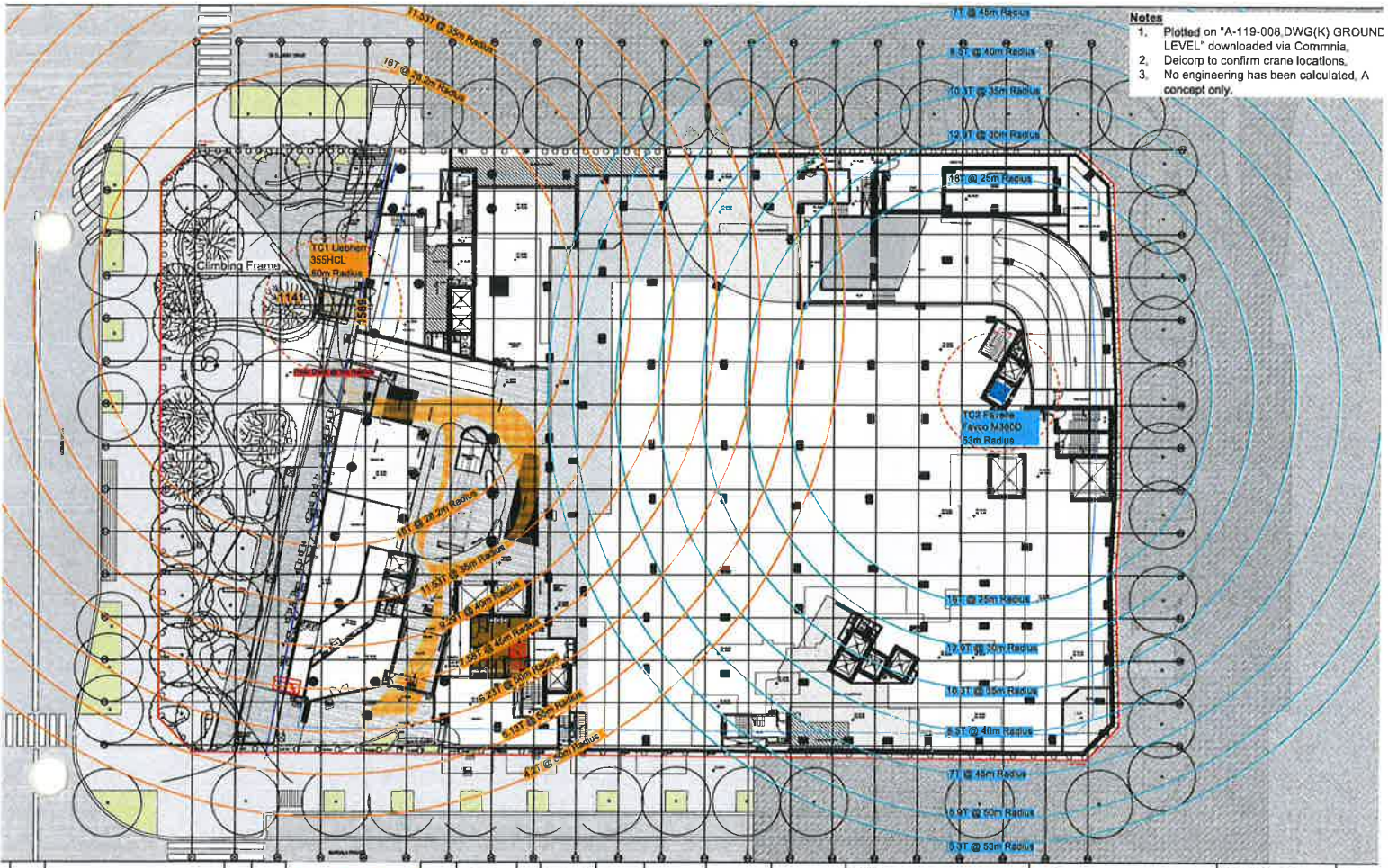
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Sheet Number: Sheet 01

Scale: 1:400 Date: 01/03/2023

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Do not scale off this drawing. If you need dimensions please contact Resolution.



- Notes**
1. Plotted on "A-119-008.DWG(K) GROUND LEVEL" downloaded via Commnia.
 2. Deicorp to confirm crane locations.
 3. No engineering has been calculated. A concept only.

Date	Description	By	Chk

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Crane	Model	Jib	Max Capacity	Towers	Hoist Speed	Luff Speed	Slew Speed
TC1	355HC-L	60m	16 tonne	500HC	171m/min	1.8min-max	0.7rev/min
TC2	M380D	53m	16 tonne	305C	160m/min	1min-max	1rev/min

Project: Showground Ocean Drive

Client:

Site: RRS-365-Deicorp Showground Doran Drive- 355HC-L & M380D-Radius-GF-P1

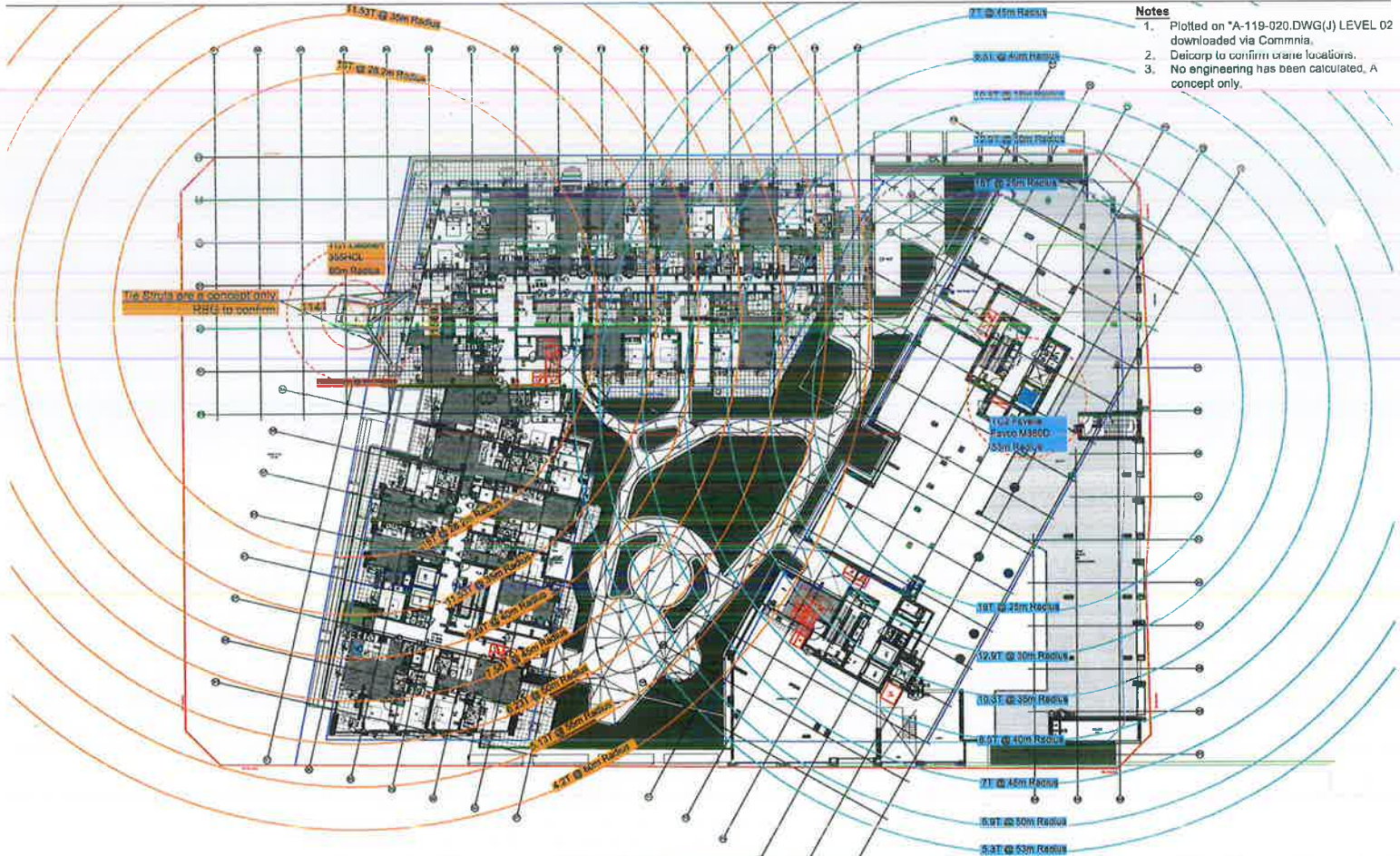
Drawn: Rihya Noronha
 Checked: Tony Noronha

Approved: Tony Noronha

Drawing Number: RRS-365
 Sheet Number: Sheet 02
 Scale: 1:400
 Date: 01/03/2023

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- Notes**
1. Plotted on *A-119-020.DWG(J) LEVEL 02 downloaded via Commnia.
 2. Deicorp to confirm crane locations.
 3. No engineering has been calculated. A concept only.

Date	Description	By	Chk
01/03/23	Issued for information	RN	TN

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Crane	Model	Jib	Max Capacity	Towers	Hoist Speed	Luff Speed	Slew Speed
TC1	355HC-L	60m	16 tonne	500HC	171m/min	1.8m/min-max	0.7rev/min
TC2	M380D	53m	16 tonne	305IC	160m/min	1m/min-max	1rev/min

Project: Showground Doran Drive

Site: RRS-365-Deicorp Showground Doran Drive- 355HC-L & M380D-Radius-L2-P1

Drawing Number: RRS-365

Sheet Number: Sheet 03

Scale: 1:400

Date: 01/03/2023

Client: DEICORP

Drawn by: Rhye Noronha

Checked by: Tony Noronha

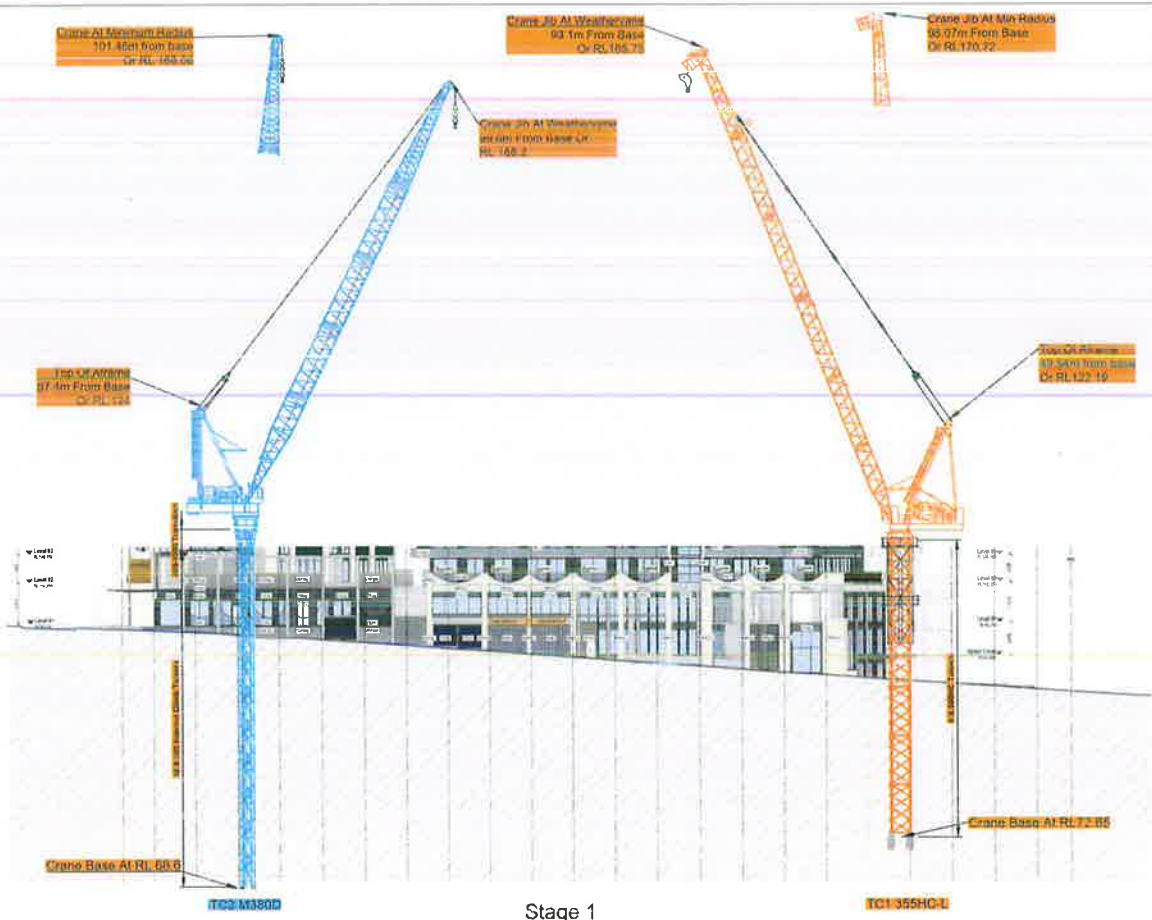
Approved by: Tony Noronha

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CRANE ELEVATION NORTH

- Notes**
1. Plotted on PDF drawing only. "A-210-101_B_North Elevation" for further accurate drawings, A DWG is to be supplied.
 2. Plotted on crane base RL's provided by Jacob Walls via Outlook.
 3. No engineering has been provided. A concept only.
 4. For further information please contact RRS.

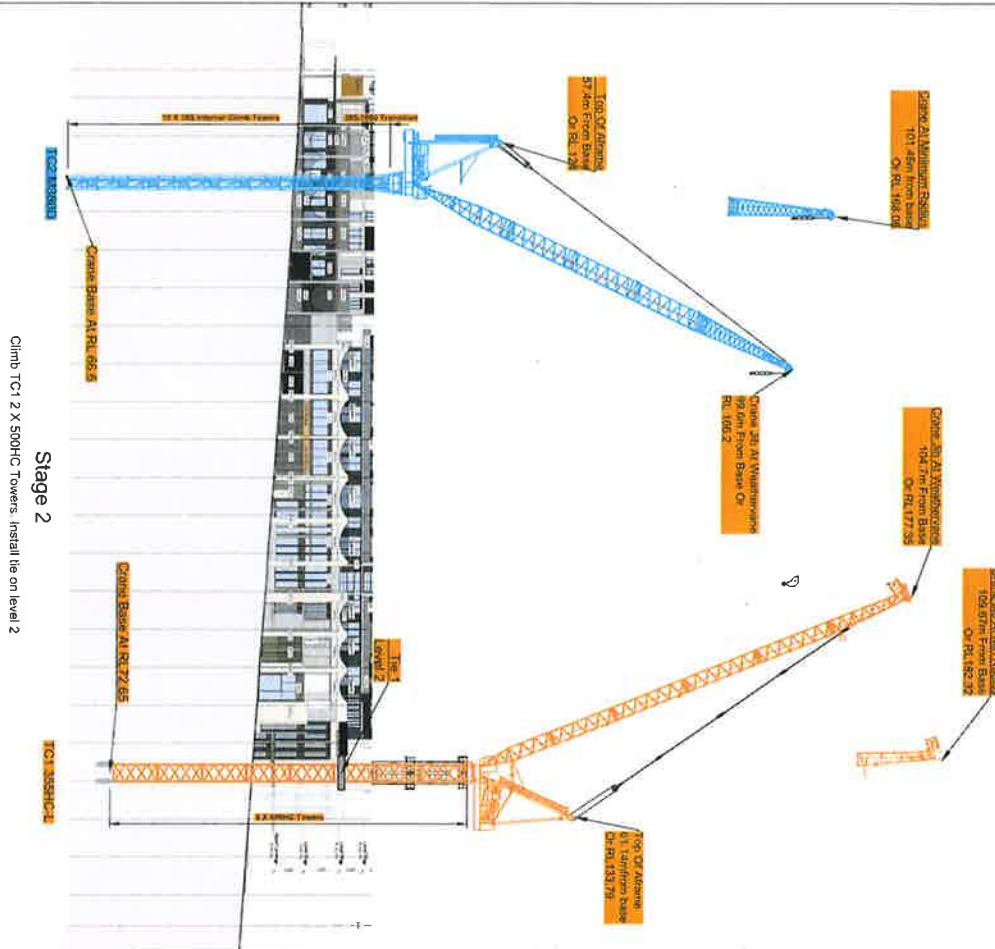


Stage 1
Initial Freestanding heights. Both Tower Cranes

Crane	Model	Jib	Max Capacity	Towers	Hoist Speed	Luff Speed	Slew Speed	Project:	Title:	Drawing Number:
TC1	355HC-L	60m	16 tonne	500HC	171m/min	1.8min-max	0.7rev/min	Showground Doran Drive	RRS-366-Deicorp Showground Doran Drive-355HCL&M380D Elevation-North-P1	RRS-366
TC2	M380D	53m	18 tonne	306IC	180m/min	1min-max	1rev/min			Sheet Number: Sheet 01
								Client:	Drawn: Rhys Noronha Checked: Tony Noronha Approved: Tony Noronha	Scale: 1:450 Date: 01/03/2023
								PRELIMINARY ONLY - NOT FOR CONSTRUCTION		

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- Notes**
1. Plotted on PDF drawing only. "A-210-101_B_North Elevation" for further accurate drawings. A DWG is to be supplied.
 2. Plotted on crane base RL's provided by Jacob Wells via Outlook.
 3. No engineering has been provided. A concept only.
 4. For further information please contact RRS.



Stage 2
Climb TC1 2 X 500HC Towers. Install tie on level 2



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Crane	Model	Jib	Max Capacity	Towers	Hoist Speed	Luff Speed	Slew Speed
TC1	355HC-L	60m	15 tonne	500HC	171m/min	1.8min-max	0.7rev/min
TC2	M380D	53m	16 tonne	305C	160m/min	1min-max	1rev/min

Project: Showground Doran Drive

Client:



Title: RRS-366-Deicorp Showground Doran Drive-355HC&M380D Elevation-North-Stage 2-P1

Drawn:

Rhys Noronha

Checked: Tony Noronha

Approved:

Tony Noronha

Drawing Number: RRS-366

Sheet Number: Sheet 02

Scale: 1:450

Date: 01/03/2023

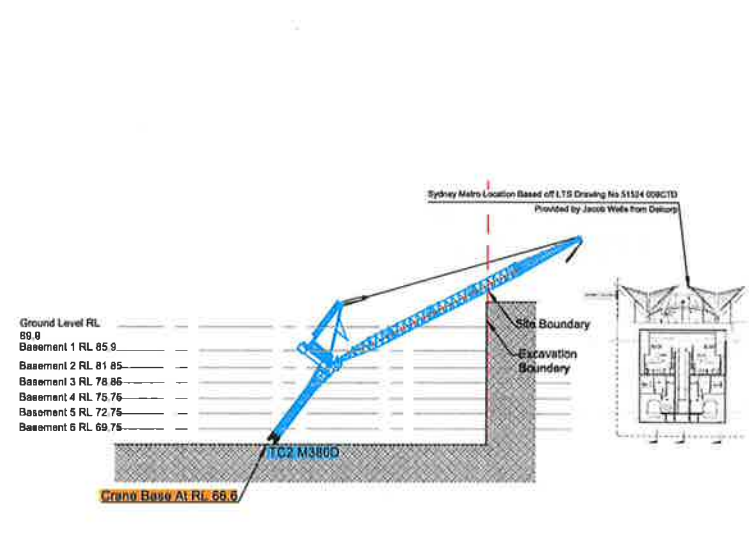
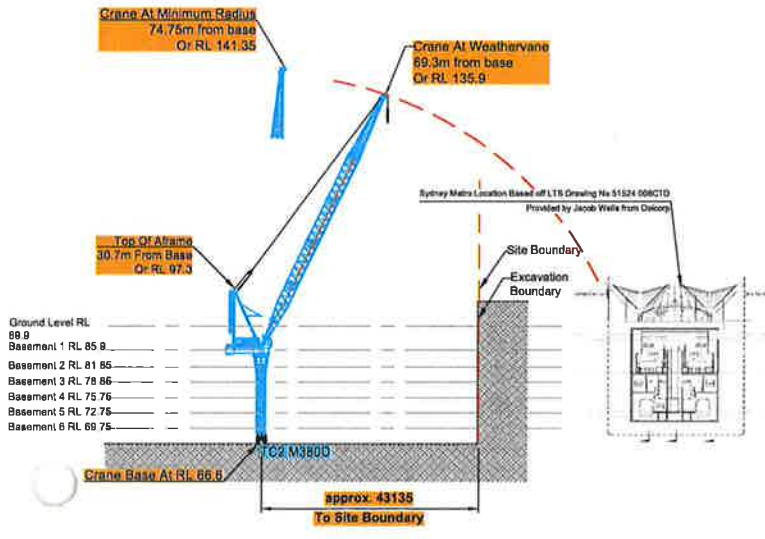
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Date	Description	By	Chk
01/03/2023	Issued for information	RN	TN

CRANE ELEVATION WEST

- Notes**
1. Plotted on PDF drawing only. "Grid 16 Section" for further accurate drawings. A DWG is to be supplied.
 2. Plotted on crane base RL's provided by Jacob Wells via Outlook.
 3. No engineering has been provided. A concept only.
 4. For further information please contact RRS.



Date	Description	By	Chk
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Crane	Model	Jib	Max Capacity	Towers	Hoist Speed	Luff Speed	Swiv Speed
TC2	M380D	53m	16 tonne	3051C	160m/min	1min-max	1rev/min

Project:
Showground Doran Drive

Client:

Title:
RRS-365-Dekor Showground Doran Drive-M380D Elevation-West-Stage1-P1

Drawn:
Patty Mercado

Checked:
Rhye Noronha

Approved:
Tony Noronha

Drawing Number:
RRS-372

Sheet Number:
Sheet 01

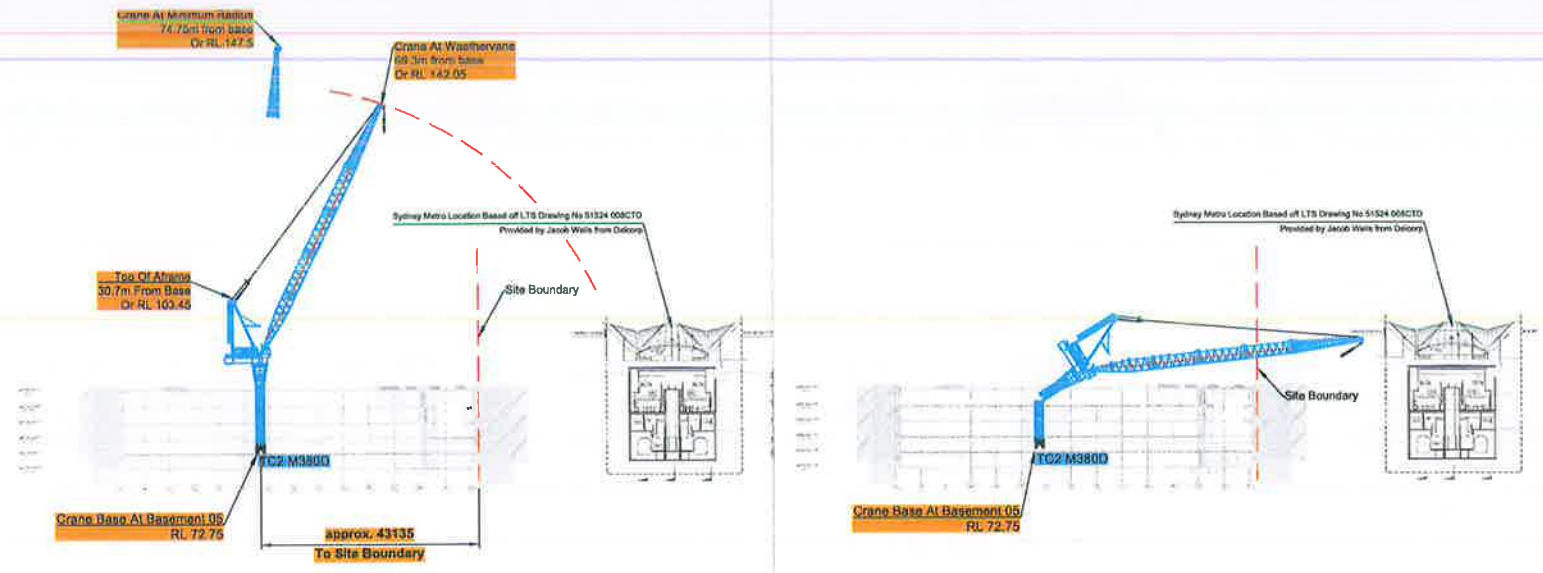
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Date:
21/03/2023

PRELIMINARY ONLY - NOT FOR CONSTRUCTION

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- Notes**
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 - Plotted on crane base RL's provided by Jacob Wells via Outlook.
 - No engineering has been provided. A concept only.
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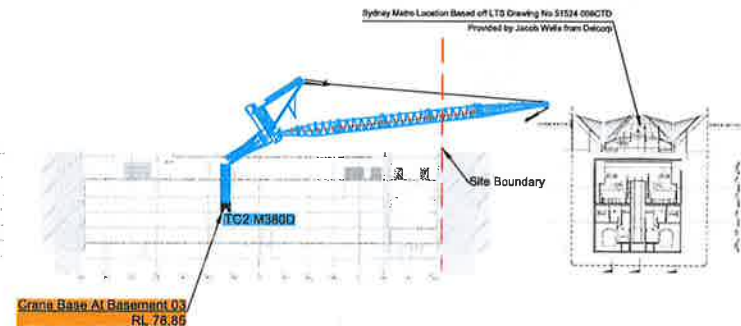
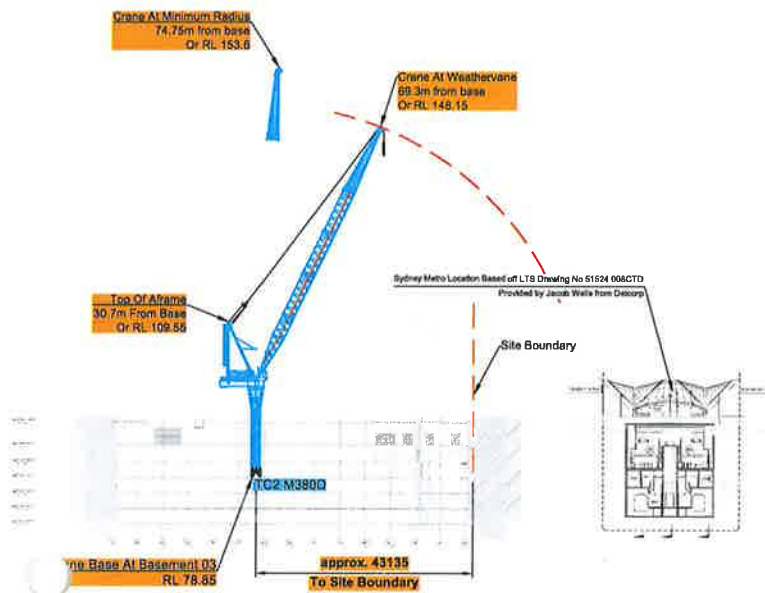
Crane	Model	Jib	Max Capacity	Towers	Hoist Speed	Luff Speed	Slew Speed
TC2	M360D	53m	16 tonnes	305C	160m/min	1min-max	1rev/min

RRS RESOLUTION RIGGING SERVICES	<small>Unless agreed by Resolution Rigging Services Pty Ltd in writing, intellectual property rights in any information or data supplied is owned by Resolution Rigging Services.</small>	Project: Showground Doran Drive	Title: RRS-366-Dalcorp Showground Doran Drive-M360D Elevation-West-Stage2-P1
Client:		Drawn: Patty Mercado	Approved: Tony Noronha
Date:	Description:	Checked: Rhye Noronha	Scale: 1:750
By:	Chk:	PRELIMINARY ONLY - NOT FOR CONSTRUCTION	

Drawing Number: RRS-372	Sheet Number: Sheet 02	Scale: 1:750	Date: 21/03/2023
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Do not scale off this drawing. If you need dimensions please contact Resolution.

- Notes**
1. Plotted on PDF drawing only. "Grid 16 Section" for further accurate drawings. A DWG is to be supplied.
 2. Plotted on crane base RL's provided by Jacob Wells via Outlook.
 3. No engineering has been provided. A concept only.
 4. For further information please contact RRS.



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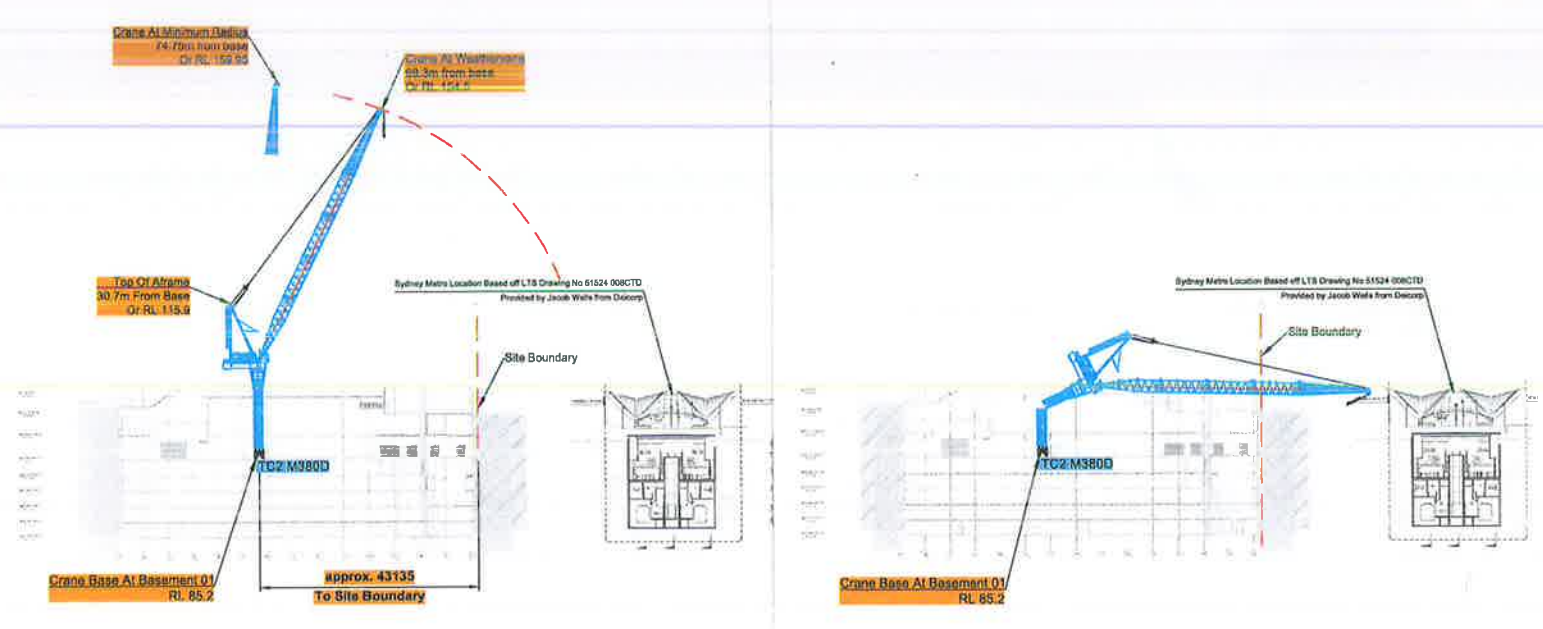
Crane	Model	Jib	Max Capacity	Towers	Hoist Speed	Luff Speed	Slew Speed
TC2	M380D	S3m	16 tonna	305IC	160m/min	1min-max	1rev/min

Project: Showground Doren Drive	Title: RRS-366-Dalcorp Showground Doren Drive-M380D Elevation-West-Stage3-P1	Drawing Number: RRS-372
Client: 	Drawn: Patty Mercado	Sheet Number: Sheet 03
	Checked: Rbya Noronha	Scale: 1:750
	Approved: Tony Noronha	Date: 21/03/2023

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- Notes**
1. Plotted on PDF drawing only. "Grid 16 Section" for further accurate drawings. A DWG is to be supplied.
 2. Plotted on crane base RL's provided by Jacob Wells via Outlook.
 3. No engineering has been provided. A concept only.
 4. For further information please contact RRS.



Crane	Model	Jib	Max Capacity	Towers	Hoist Speed	Luff Speed	Slew Speed	Project	Title	Drawing Number
TC2	M380D	53m	16 tonna	305C	160m/min	1min-max	1rev/min	Showground Doran Drive	RRS-366-Daicorp Showground Doran Drive-M380D Elevation-West-Stage4-P1	RRS-372
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									Checked: Rhys Noronha	Scale: 1:750
									Approved: Tony Noronha	Date: 21/03/2023

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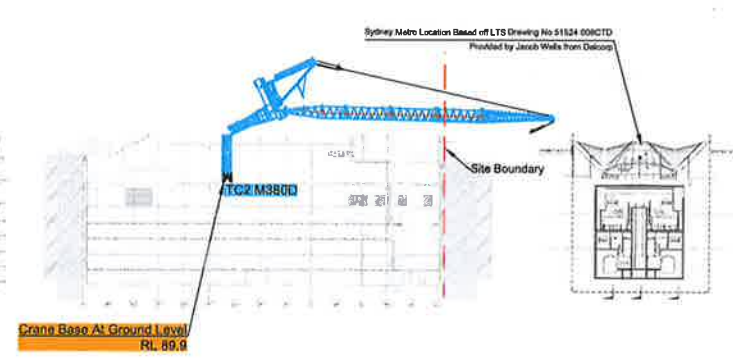
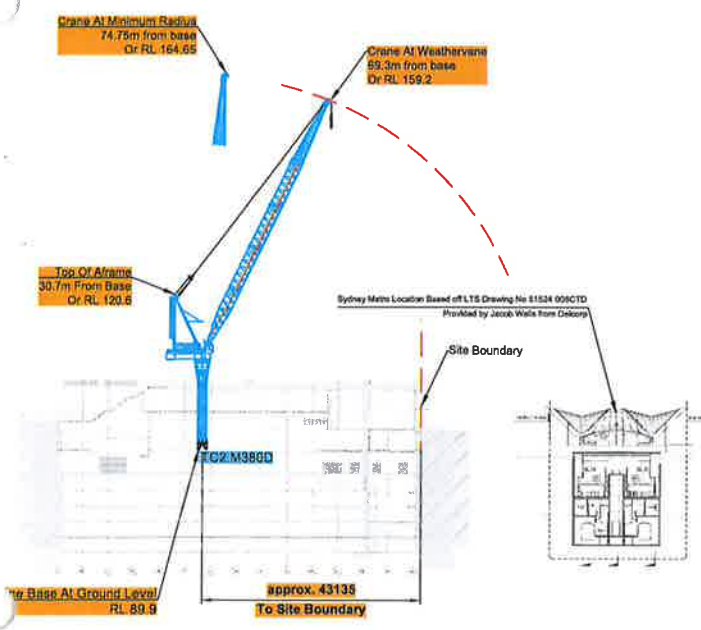
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- Notes**
1. Plotted on PDF drawing only. "Grid 16 Section" for further accurate drawings. A DWG is to be supplied.
 2. Plotted on crane base RL's provided by Jacob Wells via Outlook.
 3. No engineering has been provided. A concept only.
 4. For further information please contact RRS.



					Crane	Model	Jib	Max Capacity	Towers	Hoist Speed	Luff Speed	Slew Speed	Project:	Title:	Drawing Number:									
					TC2	M380D	63m	16 tonne	305IC	160m/min	1min-max	1rev/min	Showground Doran Drive	RRS-366-Deconco Showground Doran Drive-M380D Elevation-West-Stage5-P1	RRS-372									
				<small>Unless signed by Resolution Rigging Services Pty Ltd in writing, no liability or responsibility is accepted for any information or data supplied to clients by Resolution Rigging Services</small>									Client:	Drawn:	Checked:	Approved:	Scale:	Date:						
														Patty Mercado Rhye Noronha	Tony Noronha	1:750	21/03/2023							
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Date	Description	By	Chk																					
17/02/23	Issued for information																							

Do not scale off this drawing. For project Resolution please contact Resolution

APPENDIX 2 – CONSTRUCTION NOISE EMISSION LEVELS

This section provides the noise emission levels adopted for the plant in the assessment, presenting the equipment list and their respective sound power levels in octave bands used in our noise modelling to predict site noise emissions.

The total dB(A) sound power levels for the equipment items have been obtained from the Transport for NSW Construction Noise and Vibration Strategy (April 2018). We note that equipment having sound power levels greater than those specified should not be permitted to work on site as they are excessively noisy.

Our noise analyses are typically frequency based so model inputs such as sound power levels, surface absorptions, barrier effects are in octave bands. It is noted that the sound power levels are presented in terms of the L_{Aeq} descriptor which indicates the equivalent energy noise level over a period, and it assumes the machinery operates continuously within that time or 100% duty, which may 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 reduced to 33% and correspondingly in the noise modelling the effective sound power will be reduced by the same amount.

The equipment sound power spectra are based on the UK Defra database. Missing item's spectra were filled with similar machinery spectra and by measured spectra taken by this office. Items identified in the document as having special audible characteristics have been penalised by an additional 5dB across all octave bands, and these items have been highlighted in the following table. This equates to 5dB added to the Transport for NSW's maximum permissible machinery sound power level.

For impact piling the sound power levels have been given in both L_{Aeq} and L_{Amax} descriptors to assess impact piling noise.

Additional values were gathered from Table D2 of Australian Standard 2436-1981 & Table A1 of Australian Standard 2436-2010.

The adopted noise emission levels take into account:

- A time correction for expected proportion of a 15-minute interval that the equipment is expected to emit noise, for non-continuously operating plant.
- Penalties for impulsive and tonal noise characteristics.

TABLE A1
TYPICAL SOUND LEVELS OF CONSTRUCTION PLANT AND EQUIPMENT*

Plant description	A-weighted sound power levels L_{wA} dB ref: 10^{-12} W		A-weighted sound pressure levels L_{pA} (mid-point) dB at 10 m
	Typical or Range	Typical (mid-point)	
Asphalt paver	103-112	108	80
Asphalt rotomill	111	111	83
Backhoe	100-108	104	76
Backhoe with auger	100-111	106	78
Bulldozer	102-114	108	80
Cherry picker	105	105	77
Compactor	110-115	113	85
Compressor (silenced)	93-110	101	73
Concrete agitator truck	107-111	109	76
Concrete pencil vibrator	101-105	103	75
Concrete pump truck	103-113	108	80
Concrete saw	112-122	117	89
Concrete vibratory screed	115	115	87
Crane (mobile)	95-113	104	76
Crane (tower)	105	105	77
Excavator	97-117	107	79
Filtration unit (40 000 cfm)	109	109	81
Forklift	106	106	78
Front end loader	110-115	113	85
Generator (diesel)	84-113	99	71
Grader	105-115	110	82
Gritblaster (grit & nozzle air noise)	129	129	101
Hand tools (electric)	95-110	102	74
Hand tools (pneumatic)	114-117	116	88

Plant description	A-weighted sound power levels L_{wA} dB ref: 10^{-12} W		A-weighted sound pressure levels L_{pA} (mid-point) dB at 10 m
	Typical or Range	Typical (mid-point)	
Jack hammers	121	121	93
Loader (wheeled)	99-111	105	77
Machine mounted hydraulic drill	110-115	113	85
Machine mounted percussive drill	116	116	88
Machine mounted pneumatic drill	110-121	116	88
Piling (bored)	111	111	83
Piling (impact sheet) (L_{max})	126-147	137	109
Piling (vibratory)	116-133	125	97
Rock breaker	118	118	90
Roller (vibratory)	103-112	108	80
Scraper	116	116	88
Spreader	95	95	67
Truck (>20 tonne)	107	107	79
Truck (dump)	117	117	89
Truck (water cart)	106-108	107	79
Vehicle (light commercial e.g. 4WD)	100-111	106	78
Welder	100-110	105	77

* Information in Table A1 has been derived from a combination of the following sources and further information can be obtained from them:

- AS 2436--1981 *Guide to noise control on construction, maintenance and demolition sites.*
- BS 5228-1, *Code of practice for noise and vibration control on construction and open sites. Noise.*
- DEFRA--Department for Environment Food and Rural Affairs (United Kingdom), *Update of noise database for prediction of noise on construction and open sites-Phase 3: Noise measurement data for construction plant used on quarries, July 2006.*

NOTE: The sound power data within the column marked 'Typical (mid-point)' can be used to calculate typical noise levels at the nominated assessment locations.

Table 10 - Construction, Demolition and Civil works Machinery Effective Sound Power Levels based on Continuous operation (100% duty)

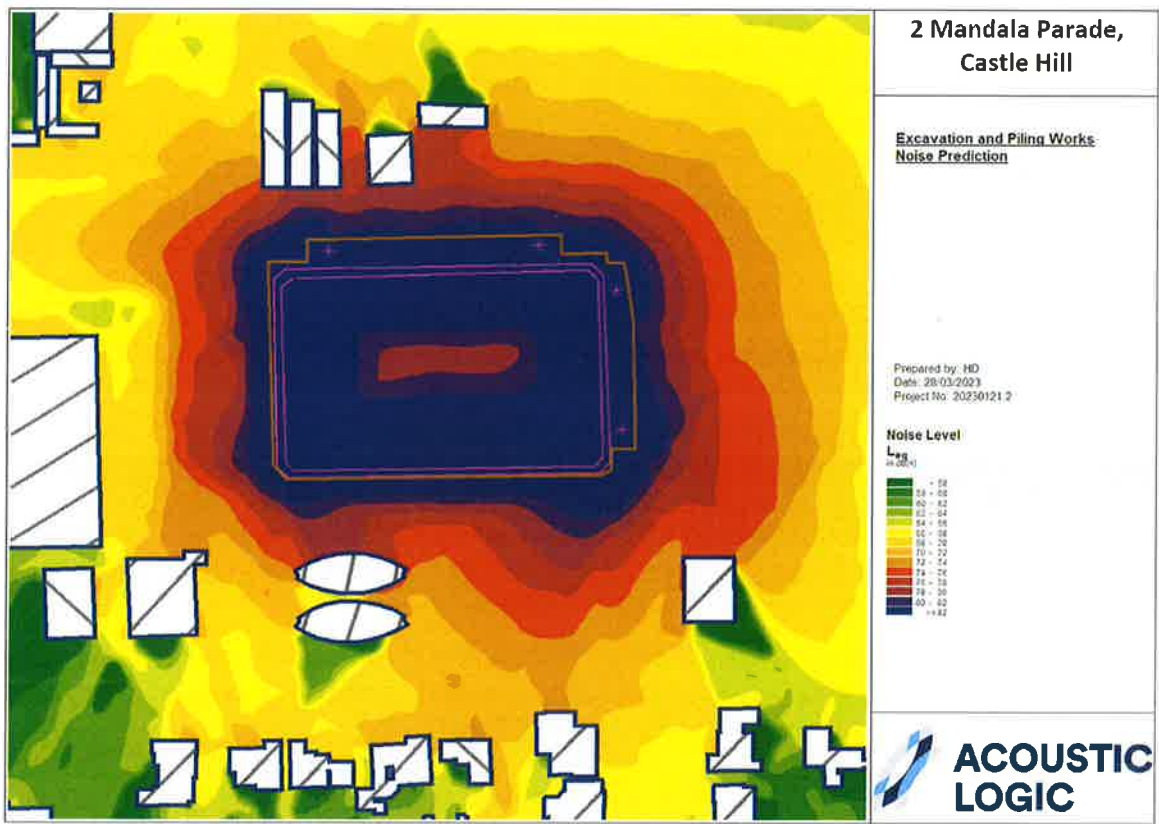
Equipment	Approx. Size/ Weight/Model	Highest Permissible Sound Power Level (dBA) (inc. Penalties)	Duty	Unweighted Octave Band Sound Power Levels, dB (includes Applicable Penalties)							
				63	125	250	500	1000	2000	4000	8000
Asphalt - Truck & Sprayer		106	100%	112	110	104	102	99	97	100	92
Backhoe		111	100%	113	107	103	111	104	103	98	94
Chainsaw – petrol*	4-5hp	114	100%	92	106	103	111	113	114	112	109
Compactor		106	100%	99	101	97	100	100	100	96	93
Compressor		109	100%	127	116	107	102	100	98	101	90
Crane - Fixed		113	100%	120	115	116	112	106	99	93	87
Crane - Franna	20 tonnes	98	100%	108	104	99	91	92	91	84	78
Crane - Mobile		113	100%	115	114	108	109	108	108	99	90
Crane - Truck mounted	20 to 60 tonnes	108	100%	112	109	107	105	103	100	95	87
Crusher – Rock*		118	100%	135	128	121	123	117	113	108	101
Dozer	CAT D9	116	100%	112	116	114	114	111	108	102	94
Dozer	CAT D10	121	100%	130	131	122	114	115	111	109	105
Elevated work platform - scissor lift		98	100%	100	97	94	94	94	91	85	83
Elevated work platform		97	100%	108	106	92	93	90	89	88	79
Excavator - tracked	3 tonnes	90	100%	101	91	88	88	85	83	78	72
Excavator - tracked	6 tonnes	95	100%	102	104	95	89	89	87	82	77
As above + hydraulic hammer*		115	100%	110	113	110	114	117	113	111	106
Excavator - tracked	10 tonnes	100	100%	104	100	99	97	95	92	86	81
As above + hydraulic hammer*		118	100%	124	124	121	116	118	116	114	109

Excavator - tracked	20 tonnes	105	100%	107	114	106	101	98	97	93	90
Excavator - tracked	30 tonnes	110	100%	113	113	107	107	105	102	97	91
As above + hydraulic hammer*		122	100%	125	123	119	123	121	121	118	114
Excavator - tracked	40 tonnes	115	100%	111	114	113	110	110	109	104	97
Grader		113	100%	114	113	109	105	110	104	100	91
Generator - diesel/petrol	6kW	103	100%	115	110	102	98	97	95	92	80
Generator - attenuated	30kW	92	100%	95	95	93	86	85	86	82	79
Grinder*		105	100%	86	80	81	89	99	106	102	102
Jackhammer		113	100%	108	97	93	96	96	101	109	110
Lighting Tower		80	100%	73	73	73	73	73	73	73	73
Lighting - Daymakers		98	100%	110	105	97	93	92	90	87	75
Light Vehicle - 4WD		103	100%	96	96	96	96	96	96	96	96
Line Marking Truck		108	100%	114	112	106	104	101	99	102	94
Loader - Front-end (wheeled)	23 tonnes	112	100%	118	118	107	109	105	103	102	94
Loader - Skidsteer	1/2 tonne	107	100%	112	115	104	106	101	98	92	92
Loaders - Skidsteer	1 tonne	110	100%	113	104	108	108	104	103	97	91
Loader - Tracked	0 to 50 kW	115	100%	108	108	108	108	108	108	108	108
Loaders- Tracked	200 to 300 kW	121	100%	114	114	114	114	114	114	114	114
Pavement Laying Machine		114	100%	117	114	111	110	109	106	104	95
Pavement Profiler		117	100%	116	122	114	112	112	109	105	102
Pile Driver - Vibratory*		121	100%	121	120	117	120	122	120	115	105
Piling Rig - Bored		112	100%	112	120	109	108	106	104	96	89
Piling Rig LMAX - Impact*		151		137	138	143	152	152	148	143	138
Piling Rig LEQ- Impact*		134	100%	124	125	128	135	135	132	127	121
Pump - Concrete		109	100%	115	107	101	102	104	104	97	89
Rattle gun (handheld)		104	100%	82	81	81	87	96	98	98	98
Roller - smooth drum		107	100%	114	112	102	100	102	100	96	90

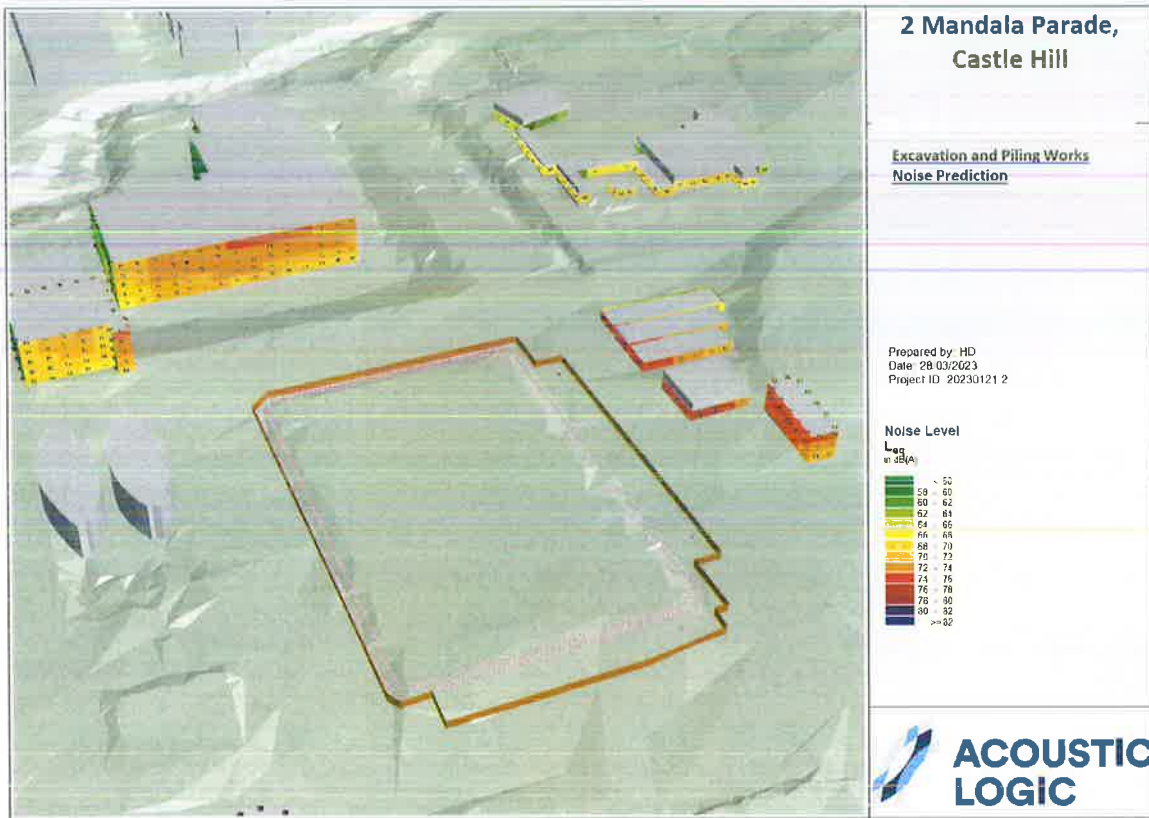
Roller - large pad foot		109	100%	120	111	103	107	105	98	95	89
Roller - Vibratory*	10 tonnes	109	100%	125	116	108	112	110	103	100	94
Saw - Concrete*		118	100%	120	122	114	114	113	114	118	116
Scraper/Grader		113	100%	120	122	113	107	107	105	100	95
Truck - Concrete		109	100%	112	103	95	98	99	107	89	84
Truck - Dump	15 tonnes	110	100%	114	111	111	107	104	103	97	90
Truck - Medium rigid	20 tonnes	103	100%	109	107	101	99	96	94	97	89
Truck - road truck/ truck and dog	30 tonnes	108	100%	123	109	101	100	104	99	98	91
Truck - Vacuum (NDD or non-destructive digger)		109	100%	111	112	97	102	101	104	103	96
Tub Grinder/Mulcher	40-50hp	116	100%	105	106	110	110	112	111	105	96
Vibrator - Concrete*		113	100%	122	120	120	113	109	112	110	105
Water Cart		107	100%	106	107	101	105	99	100	96	91
Welding equipment		110	100%	104	105	106	105	106	103	98	93
Wrench - Impact		111	100%	81	84	89	91	95	101	107	107

APPENDIX 3 – SOUNDPLAN NOISE MAPS

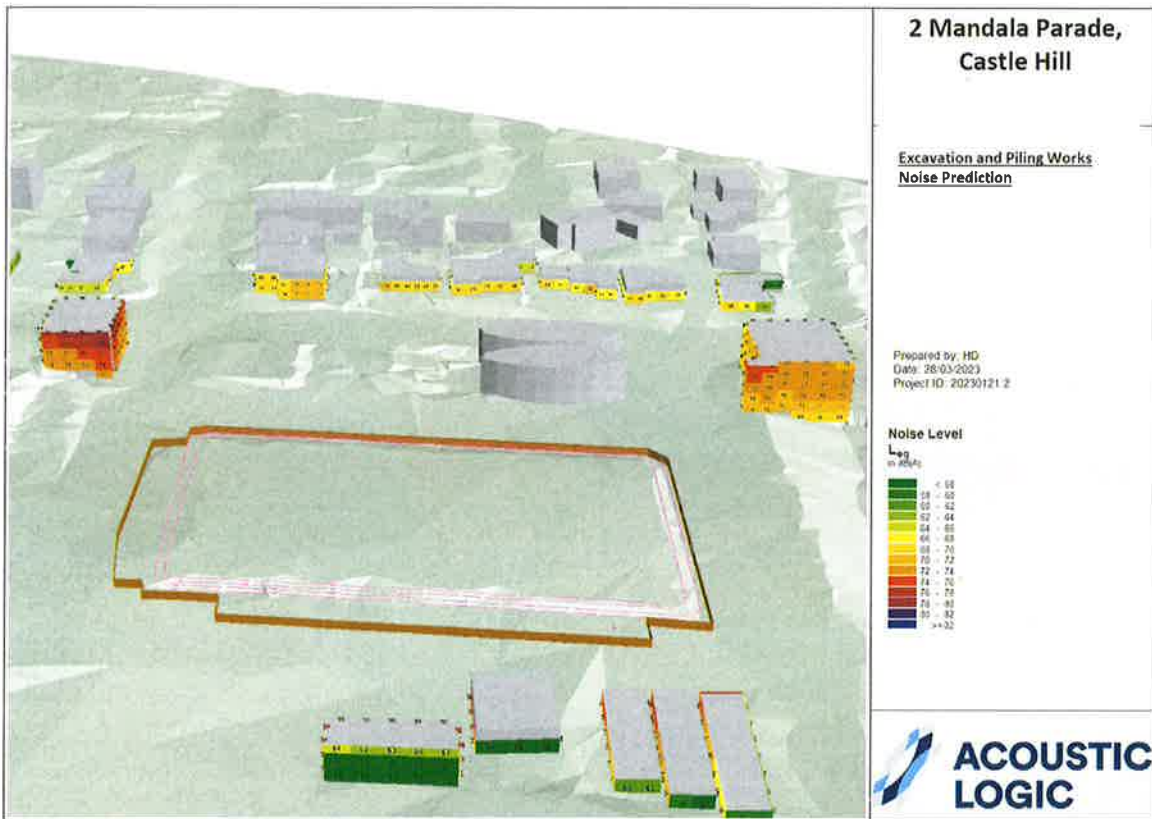
EXCAVATION AND PILING WORKS GRID NOISE MAP



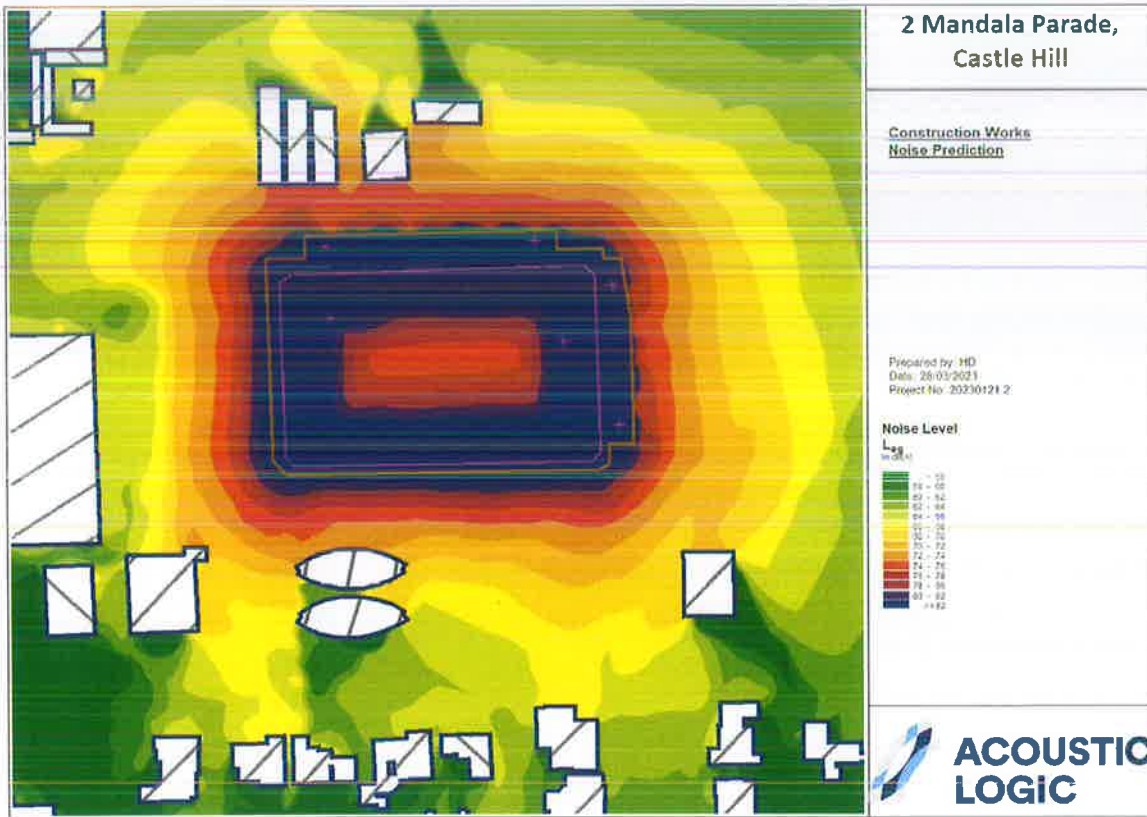
EXCAVATION AND PILING WORKS FAÇADE NOISE MAP VIEW 1



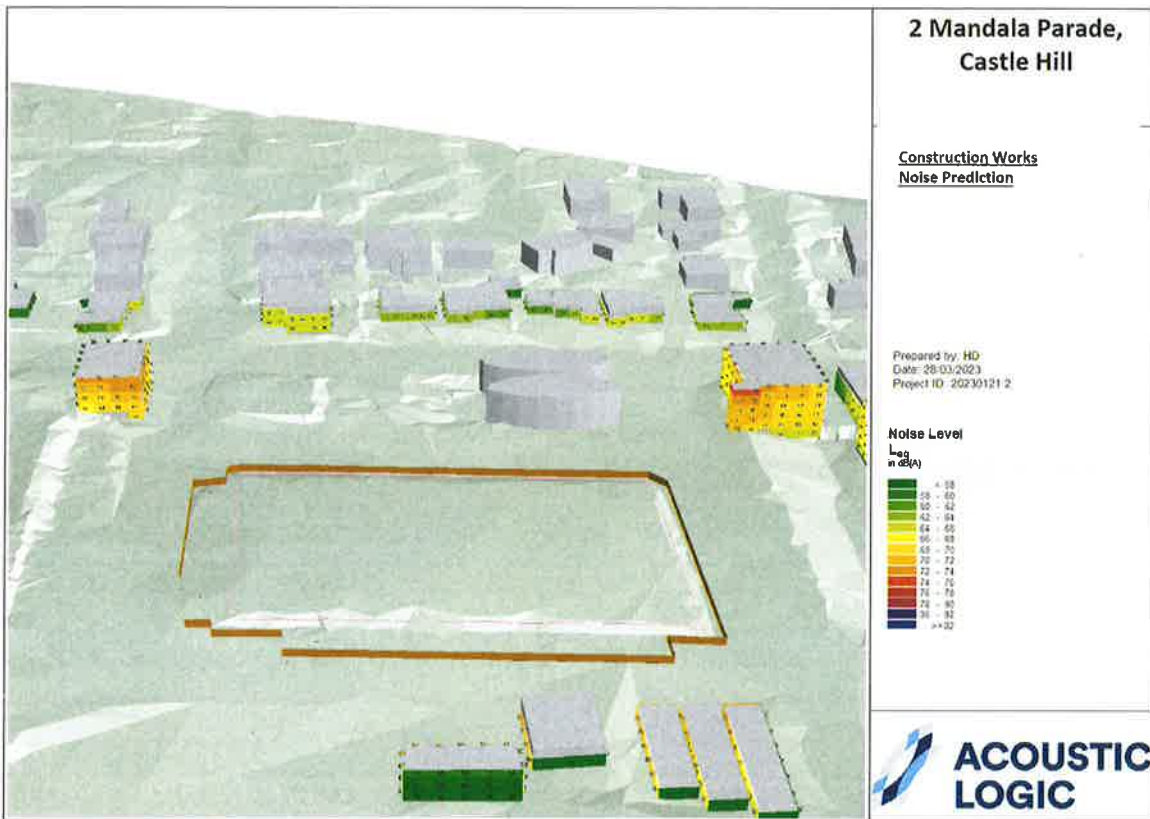
EXCAVATION AND PILING WORKS FAÇADE NOISE MAP VIEW 2



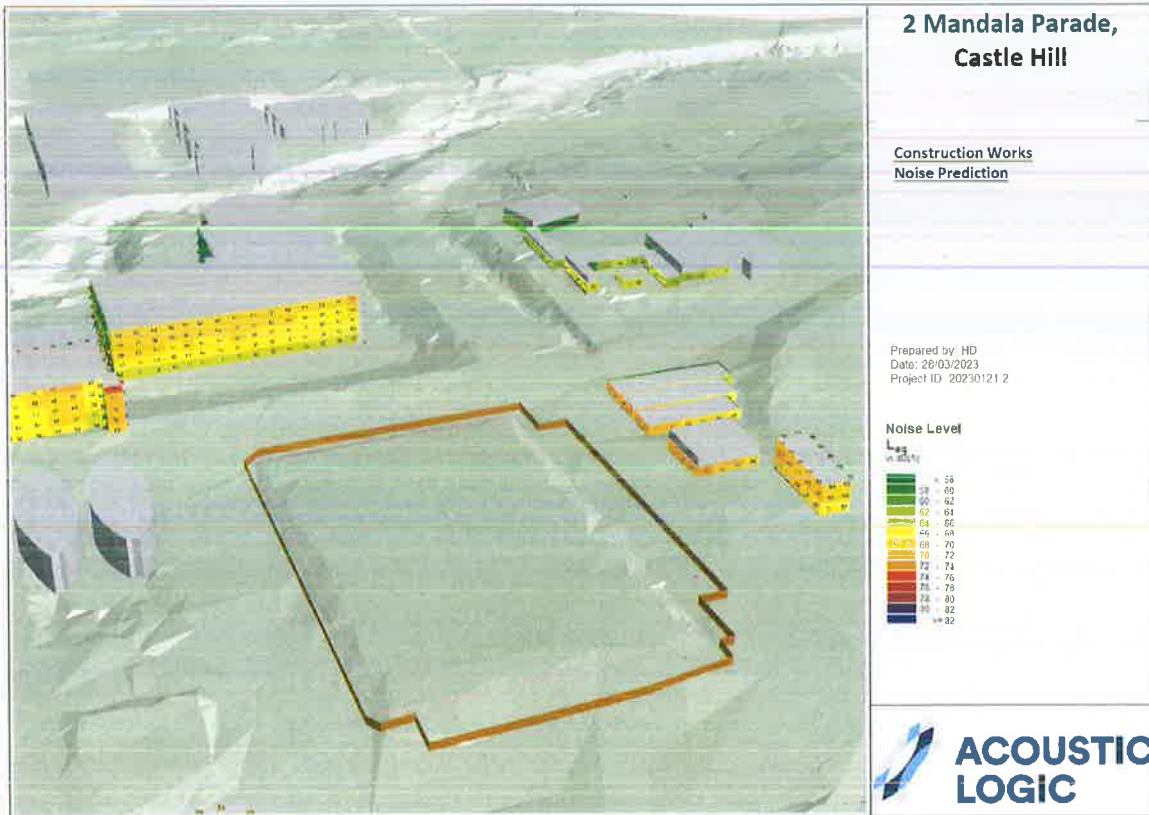
CONSTRUCTION WORKS GRID NOISE MAP



CONSTRUCTION WORKS FAÇADE NOISE MAP VIEW 1



CONSTRUCTION WORKS FAÇADE NOISE MAP VIEW 2



APPENDIX 4 – LIST OF SIMILAR RESIDENTIAL PROJECTS

- OVO Green Square
- Green Square Sydney (Site 5, 7, 15, 16 and 17) - Mirvac
- 55 Coonara Ave, West Pennant Hills – Mirvac
- Lachlan Street, Waterloo – Mirvac
- Riverside Quay - Mirvac
- Australian Technology Park – Mirvac
- Flinders West – Mirvac
- QVM Munro - Mirvac
- Pinnacle, Rhodes – Mirvac
- Yarras Edge Tower 6- Mirvac
- Yarras Edge Tower 9 - Mirvac
- Yarras Edge Tower 11 - Mirvac
- Tullamore Apartments – Mirvac
- 472 & 486 Pacific Highway, St Leonards - Mirvac
- Brisbane Racing Club – Mirvac
- 200 Turbot St, Brisbane City – Mirvac
- Sky at Newstead, Brisbane - Mirvac
- Elizabeth Quay (Inc Ritz Carlton)
- The Pinnacle
- 185 Macquarie Street - Sydney
- Ribbon, W Hotel Sydney
- King Street Wharf
- Darling Island
- The Wharf at Woolloomooloo
- 35 Spring Street
- 17 Spring Street
- 18 Yarra Street - South Yarra
- Victoria One
- Abode 318
- 350 William Street - Melbourne
- Fulton Lane
- The Istana
- 399 Bourke Street
- Platinum Tower
- Marco Apartments
- Australia 108
- 109 Clarendon Street
- Atlas Apartments - Alexandria
- River Place – Brisbane
- River City – Brisbane
- Cathedral Place – Brisbane
- The Republic – Brisbane
- Casino Towers – Brisbane
- Stamford on Kent – City
- The Forum – Canberra
- The Phoenix – Canberra
- The Globe – Canberra
- The National – Canberra
- The Quays – Docklands
- New Quay Promenade – BLD D&E
- Richmond A Place to Live
- Parkville Stages 1 to 8
- 85 Harrington Street, Sydney
- Living Carlton Stages 1 to 4, 6, 7, 9
- Royal Domain Tower
- 505 St Kilda Road - Melbourne
- 545 Station Street – Box Hill
- Stage 2 & 3 Clara - South Yarra
- 5 to 9 and 18 Yarra Street South Yarra
- Projects 3-9, 8, 18, 33, 50 and 55 Claremont Street South Yarra
- Green Square West
- Tip Top - Brunswick

APPENDIX 5 – PERSONNEL QUALIFICATIONS

GEORGE WEI



CIRICULUM VITAE – GEORGE WEI (DIRECTOR)

Qualifications

NSW Fair Trading Approved Building and Development Certifier – Acoustic (Registration No: BDCo4838)

Master Degree of Mechanical Engineering (UNSW)

Bachelor Degree of Mechanical Engineer

Diploma of HVAC Engineering

Member of Australian Acoustical Society

Outline of Experience

George Wei has been employed by Acoustic Logic since January 2004 and has experienced projects in Middle East, Australia, New Zealand, Singapore and United Kingdom. George Wei has built variety experience in the areas of building acoustics, mechanical noise control, environmental noise, traffic noise control, train vibration isolation, hearing protection and real time noise/vibration monitoring.

Whilst employed with Acoustic Logic, George has been responsible for projects of defence, residential, retail, education, cinema, concert, aged care, sports facility, music function, gymnasium, childcare, etc.

Special Areas- Noise and Vibration

George has gained more than 19 years' experience of acoustic consultancy.

Employment History:

<i>Jan 2004 – March 2009</i>	<i>Project Engineer Acoustic Logic Consultancy.</i>
<i>March 2009-August 2017</i>	<i>Senior Acoustic Engineer Acoustic Logic Consultancy.</i>
<i>August 2017- November 2021</i>	<i>Associate Director Acoustic Logic Consultancy.</i>
<i>November 2021- Current</i>	<i>Director Acoustic Logic</i>



Areas of Expertise and Relevant Experience:

- *Building acoustics*
- *MEP noise control*
- *Environmental noise modelling and assessment*
- *Train noise and vibration control*
- *Traffic noise prediction*
- *Concert / Cinema noise isolation.*
- *Helicopter & aircraft noise*
- *Construction noise and vibration*
- *Vibration Isolation*
- *Transmission Loss Testing*
- *Structural Dynamics*

Project Experience

Defence Projects

- * Harman
- * CEA
- * Building 918, Richmond RAAF
- * Building 616, Richmond RAAF
- * RAAF Williamstown

Residential / Commercial / Mixed Use

- * Loftus Lane
- * 275 George St, Sydney
- * Balvidia North Sydney
- * South Bank, Woolli Creek
- * 7D1-7D6, Breakfast Point
- * 710 George St, Sydney.
- * V- Crown Parramatta
- * Meriton Group Projects (Victoria Park, Mascot Central, Gordon, Pymble, Epping, Arncliffe, Brisbane, Gold Coast, Parramatta, Pagewood, Olympic Park, etc)
- * Regents Place, Town Hall
- * Discovery Point, Woolli Creek
- * Hyde Park Gardens
- * Balmain Shores
- * Bennelong Apartments
- * Ikon
- * BP513 & 5F Breakfast Point
- * Newbury and York Apartments, Breakfast Point
- * Pinnacle Rhodes
- * Waterside Rhodes
- * Kiewa Project, Rhodes
- * Top Ryde City
- * Belvedere, North Sydney
- * Pinnacle Rhodes
- * Portside Building, Brisbane

Hospital and Healthcare Projects

- * Randwick Hospital Redevelopment
- * Liverpool Hospital
- * Canberra Hospital
- * Westmead Hospital
- * Wagga Wagga Hospital
- * Orange Hospital
- * Manning Hospital
- * St George's Hospital
- * Royal North Shore

GEORGE WEI
Associate Director

- * *Muswell brook Hospital*

Hotel/ Serviced Apartments

- * *Holiday Inn*
- * *Star City*
- * *Medina – Kent Street/King Street Wharf*
- * *Mercure Hotels - Railway Sq.*
- * *Grande Mecure - Darling Harbour*
- * *Quest Apartments - Mascot, Cronulla, Rosehill*

Commercial Projects

- * *Lend Lease Circular Quay*
- * *Star Casino*
- * *Wynyard Place*
- * *275 George St*
- * *46-51 Waterloo Rd, Macquarie Park*
- * *60 Martin Place*
- * *Penrith Panthers Club*
- * *APRA 1 Martin Place*
- * *UWS Projects (Bankstown, Penrith, etc)*
- * *Manly Wharf*
- * *Ibis Hotel*
- * *Menzies Hotel*
- * *Hydro Majestic Hotel*
- * *T2 Piers, Sydney Airport*
- * *Justice Precinct*
- * *Liverpool Hospital*
- * *Auburn Hospital*
- * *Westmead Hospital*
- * *Norwest precinct*
- * *World Square, Sydney*
- * *Stockland Merrylands*
- * *Sydney Water, Parramatta*
- * *Sydney Water, Potts Hill*
- * *Atlas, Norwest*

Aged Care Projects

- * *ARV Forestville*
- * *Woolooware Shores ARV*
- * *ARV Glenhaven*
- * *ARV Lober Square, Castle Hill*
- * *Malabar Aged Care Centre*
- * *BUPA Princess Highway Sutherland*
- * *St Josephs Coffs Harbour*
- * *Pittwater ACF at 14-16 John St, Avalon*
- * *Aged Care Centre at 75-77 Alexandria Parade, Wahroonga*
- * *Mt Wilga Aged Care*

GEORGE WEI
Associate Director

- * *Acacia St Kirrawee Village*

Child Care Projects

- * *CCC at 203 Darley Road, Randwick*
- * *Kids Korner Greenway Supacenta*
- * *5 South Ave, Double Nay Childcare Nursery*
- * *1-5 Mullane Ave, Baulkham Hills.*
- * *88 Newcastle St, Rose Bay.*
- * *Childcare centre at 77 King St, Sydney.*
- * *20 Gadigal Ave, Zetland, Childcare Centre.*
- * *28 Ramsay Rd, Pennant Hills.*
- * *262 Hawthorne St, Haberfield*
- * *12-14 Pine St, Five Dock.*
- * *614 Polding St, Bossley Park.*
- * *7 Donnelly Rd, Narrembern*
- * *6-8 Waterloo St, Balmain.*
- * *Montessori Academy*

Heritage Buildings

- * *110 Homebush Rd, Strathfield. Childcare Centre for Montessori Academy.*
- * *14 Garthowen Cre, Castle Hill. Childcare Centre for Revelop Projects.*
- * *Cityview Baptist Church, Penrith*
- * *St Basils Randwick.*
- * *AIN Enabling Projects at Sydney Uni*

Higher Education Projects

- * *AIN Enabling Projects at Sydney Uni*
- * *Abercrombie Demolition, Sydney Uni.*
- * *Function Centre, UTS.*
- * *UWS College Teaching Facility, Kingswood campus.*
- * *UWS Nirimba*
- * *New Teaching Facility at UWS College Bankstown campus*

Gym/ Fitness Projects

- * *George Wei has experienced more than 50 Gym projects in recent a few years.*
- * *Fitness First Australia: Manly; Bondi Junction, Maroubra, Sydney, etc.*
- * *Snap Fitness: Double Bay, Maroubra, Waterloo, Pyrmont, etc.*

University Projects

- * *Regiment Redevelopment- Sydney University*
- * *Lees Project – Sydney University*
- * *Union Court redevelopment - ANU*
- * *University of Sydney - Fo7 LEES 1 Building*
- * *University of New South Wales – Gate 2 Student Accommodation*

GEORGE WEI

Associate Director

- * *University of Sydney - Creative Arts Rozelle – Mechanical Services*
- * *Dover Heights High School – New Buildings*
- * *Trinity Grammar – Internal acoustics and plant noise for auditorium*
- * *Fort Street High School – New Music and Drama workshops and Admin building*
- * *UTS Graduate School of Health*
- * *University of Sydney – Conservatorium of Music (Refurb)*
- * *UWS College Teaching Facility – Kingswood Campus*

School Projects

- * *Inner Sydney High School*
- * *Knox Grammar*
- * *Kent Road Public School*
- * *Arthur Phillip High School*
- * *Kellyville South Public School*
- * *Marsden Park Public School*
- * *Central Coast Schools*
- * *St Ives North Public School*

SHANE NICHOLS

Qualifications

Bachelor of Audio Engineering and Sound Production (2013).

2017 – 2021: Project Engineer, Acoustic Logic.

2021 – current: Senior Project Engineer, Acoustic Logic.

Outline of Experience

Whilst at Acoustic Logic Shane has been trained in measurement and analysis of noise and vibration. Shane has worked in detailed assessment of acoustic impacts and has been involved in the design of noise/vibration attenuation systems to meet relevant statutory codes (BCA/NCC, EPA guidelines and Australian Standards).

His work involves the investigation, design and construction supervision of noise control measures associated with mechanical services and building works.

Whilst being employed with Acoustic Logic, Shane has been responsible for noise and vibration engineering for residential, hospital, commercial and special projects including:

- Building acoustics and building services noise control.
- Environmental noise modelling and assessment.
- Traffic, train and aircraft noise prediction.
- Industrial Noise Control.
- Construction Noise and Vibration.
- Gymnasium Noise and Vibration.
- NSW Office of Liquor and Gaming acoustic assessment.
- Testing and assessment of walls/floors/glazing/building services.

Project Experience

A sample of projects Shane has been or is currently involved with as an Engineer include the following:

Aged Care Projects

- 707 – 717 Old Northern Road, Dural.
- RSL Lifecare Teloca House, 120 Audley Street, Narranderra.
- ARV Goodwin Village, 250-290 Jersey Road, Woollahra.
- Woodberry Village, 129 Lanhams Road, Winston Hills.
- Lithgow Aged Care, Stage 1, Lithgow.
- Uniting Mayflower, Westmead.

Residential Projects

- 202 – 210 Elizabeth Street, Sydney.
- Peninsula, 177-181 Albany Street, Point Frederick.
- Centrale, 1-7 Dehli Road, North Ryde.
- Ivanhoe Estate, Macquarie Park.
- The Langston, 12-22 Langston Place, Epping.
- Veridian, Kogarah.
- Stuart Flats Redevelopment, Griffith, ACT.
- Granville Place, Granville.
- Aerotel Refresh Hotel, Mascot.
- The Establishment, Block 4 & 5, Section 224, Gungahlin, ACT.
- Amici, Block 3, Section 246, Gungahlin, ACT.
- 813-913 Wallgrove Road, Horsley Park.

Commercial Projects

- Lake Macquarie Fair, Lake Macquarie.
- Glenmore Park Shopping Centre, Glenmore Park.
- Clarendon Hotel, 244 Hawkesbury Valley Way, Clarendon.
- Woolworths, Kirrawee – 24-38 Flora Street, Kirrawee.
- Quay Quarter Tower (QQT), 50 Bridge Street, Sydney.
- Spring Farm Community Centre.
- RAAF Base, Glenbrook.
- Parkway Drive Hotel, Stage 1 & stage 2, Frenchs Forest.
- National Museum of Australia, Canberra.
- Federal Court of Australia, 184 Phillip Street, Sydney.
- Sydney Ferries and Balmain Shipyard, Sydney.
- Apple Store – 367 George Street, Sydney.
- Australian Embassy, Rabat, Morocco.

Hospital Buildings

- Liverpool Hospital, Health and Academics Precinct.
- Bankstown Hospital, Emergency Department Expansion.
- Randwick Hospital Redevelopment.
- Mudgee Hospital, Mudgee.
- Canberra Hospital Expansion.
- Liverpool Hospital, Multi-Storey Carpark Redevelopment.

School Buildings

- Penrith Christian School, Penrith.
- Penshurst West Public School, Penshurst.
- J07 Department, Sydney University.
- F13 Anderson Stuart Building, Sydney University.
- Western Sydney University (WSU), Bankstown.

Green Star Acoustic Testing

- Gosford Australian Tax Office, 99 Georgiana Terrace, Gosford.
- Connect Corporate Centre – Stage 3, Mascot.

Gym Noise and Vibration

- Zadi Gym, 72 Mary Street, Surry Hills and 27-35 Grosvenor Street, Neutral Bay.
- Snap Fitness, 165-167 Maroubra Road, Maroubra.
- Plus Fitness, 181-183 Great Western Highway, Mays Hill.
- F45, Shop 3/20 Victoria Road, Parramatta.
- F45, 490 Northbourne Avenue, Dickson.
- EMF, Westfield, Belconnen, ACT.
- Crossfit 168, 259-261 Sussex Street, Sydney.
- Signature Fitness, 31 Newland Street, Bondi Junction.
- Plus Fitness, 2 Laurel Street, Carramar.

BRUNO LOBATO DA JORNADA

Qualifications & Experience

Master of Architectural Science (Audio & Acoustics) (High-Performance Buildings) – 2021

Bachelor of Science (Recording Arts) – 2017

2021 - current Project Engineer, Acoustic Logic

2017 - 2018 Acoustics Assistant, Walter's-Storyk Design Group (WSDG)

2017 - 2017 Studio Assistant/Recording Engineer, Platinum Sound Recording Studios

Outline of Experience

Since starting at Acoustic Logic in 2021, Bruno has had a vast experience in the field of acoustics, with successful projects in both NSW and ACT. Bruno has developed and performed acoustic design and specifications for development applications, certification for construction and occupation/compliance with the National Construction Code/Australian Standards and relevant statutory regulations such as local Council Development Control Plans and state legislation.

Bruno has been responsible for onsite inspections, noise/vibration measurements, monitoring, and analysis, and preparation of technical reports regarding noise/vibration assessments. Bruno is mostly focused on building and environmental acoustics (noise emission, noise intrusion, and compliance), reverberation modelling, and vibration control from external and internal sources.

A summary of experience includes:

- Building Acoustics
- Mechanical Services
- Environmental Noise
- Construction Noise and Vibration
- Auditoria Acoustics
- Studio Design and Electroacoustics
- Vibration Isolation
- Transmission Loss Testing
- Traffic Noise
- Aircraft & Helicopter Noise
- Train, Tram noise and vibration
- Gymnasium Noise Impact and Control
- Liquor and Gaming Noise Emission assessments

Bruno Lobato da Jornada

Project Engineer

Project Experience

A sample of projects Bruno has been or is currently involved with include the following:

- Bankstown Airport Northeast Precinct – acoustic specification/detailed design and construction advice for northeast precinct.
- Shell Cove Precinct D - acoustic specification/detailed design and construction advice for new residential precinct.
- Doran Drive Plaza Precinct – acoustic specification/detailed design and construction advice for new residential precinct.
- Westmead Uniting Aged Care - acoustic specification/detailed design and construction advice for new aged care development.
- Green Square Stage 9A and 9B – peer review, acoustic specification/detailed design finalisation and construction advice for new residential development.
- Sydney Swans Headquarters – construction vibration monitoring during renovation works.
- 2 Chifley Square – construction noise and vibration investigation along with preparation of construction noise and vibration management plan and subsequent monitoring services.
- Meriton Pagewood Centro – acoustic specification/detailed design and construction advice for new residential precinct along with preparation of construction noise and vibration management plan and subsequent monitoring services, including monitoring for Sydney Water pipe assets.
- Meriton Carter Street Precinct – construction advice and certification for new residential precinct.
- Meriton Allegra Apartments – construction advice and certification for new residential precinct.
- Brigidine College St Ives – acoustic specification/detailed design and noise impact assessment for school renovation/expansion.
- Richmond Christian College Ballina – noise impact assessment for school renovation/expansion.
- Meadowbank Public School & Marsden High School – acoustic certification for school renovation/expansion.
- Richie's IGA Taren Point – acoustic certification and advice for mechanical ventilation plant.
- Plumpton Market Place – acoustic certification and advice for mechanical ventilation plant.
- SYD1p5 AirTrunk Amethyst – acoustic certification and advice for mechanical services plant.
- Woolworths Metro Parramatta – acoustic design and advice for chiller plant room.
- Woolworths Matraville – acoustic investigation for operational noise.
- Concord Hospital Redevelopment – reverberation testing and advice.
- Little Zak's Academy Gosford – childcare noise emission assessment.
- Body By Brando Bondi Junction – gymnasium noise impact assessment.
- C.eX Woolgoolga Bowling Club – licensed premises renovation/expansion noise emission assessment.

Bruno Lobato da Jornada

Project Engineer

- Beecroft Bowling Club – licensed premises renovation/expansion noise emission assessment.
- Metropolitan Hotel – licensed premises renovation/expansion noise emission assessment.
- Camden Valley Inn – licensed premises renovation/expansion noise emission assessment.
- Lismore Workers Club – licensed premises redevelopment noise emission assessment and acoustic specification/detailed design.

