Project	SMW WTP - Clyde	**TB Number:**	SMWSTWTP-GLO-CLJ-NV-PLN-000002
Assessment Date	19/11/2024	**Assessment Id**	MSF088
Proposed start date	27/01/2025	**Proposed end date**	29/01/2025

Note - dates of work are subject to change due to ROL' availability, inclement weather etc. However the times used to determine noise/vibration impacts remains relevant.

Date	Revision	Content	Reviewer
19/12/24	A	Preparation of Rev A of the DNVIS	Snr Approvals Advisor (GLC)
15/01/24	B	Update in response to SM/AA Comments	Snr Approvals Advisor (GLC)

Acoustic terms and acronyms

AA	Acoustic Advisor
AMM	Additional mitigation measures – applicable where standard measures have been implemented and NML is still expected to be exceeded.
dB(A)	Unit used to measure 'A-weighted' sound pressure levels. A-weighting is an adjustment made to sound-level measurement to approximate the response of the human ear.
DPE	NSW Department of Planning and Environment
EIS	Environmental Impact Statement
ICNG	Interim Construction Noise Guideline (Department of Environment and Climate Change 2009)
NCA	Noise Catchment Area
Noise level statistics	L_{A90} - The A-weighted sound pressure level exceeded 90% of the monitoring period. This is considered to represent the background noise. L_{Aeq} - The equivalent continuous A-weighted noise level—the level of noise equivalent to the energy average of noise levels occurring over a measurement period. L_{A1} – The A-weighted sound pressure level exceeded 1% of the monitoring period. L_{Amax} – The maximum A-weighted noise level associated with the measurement period.
NML	Noise Management Level
PPV	Peak Particle Velocity – Measurement of ground-borne vibration in units of mm/s
RBL	Rating Background Level - a single figure that represents the background noise level for assessment purposes
ROL	Road Occupancy Licence – granted by Transport for NSW and required for any activity likely to impact on traffic flow.
SWL	Sound Power Level - The A-weighted sound power level is a logarithmic ratio of the acoustic power output of a source relative to 10-12 watts and expressed in decibels. Sound power level is calculated from measured sound pressure levels and represents the level of total sound power radiated by a sound source.
SPL	Sound pressure level - This is the level of noise, usually expressed in dB(A), as measured by a standard sound level meter with a pressure microphone. The sound pressure level in dB(A) gives a close indication of the subjective loudness of noise. A technical definition for the sound pressure level, in decibels, is 20 times the logarithm (base 10) of the ratio of any two quantities related to a given sound pressure to a reference pressure (typically 20 µPa equivalent to 0 dB).
Tonal noise	Noise with perceptible and definite pitch or tone
VDV	Vibration dose value – used when assessing intermittent vibration as it is sensitive to peaks in vibration acceleration and accumulates the vibration energy received over the daytime and night-time periods

1 Introduction

1.1 Overview

The Sydney Metro Western Tunneling Package is being delivered by the Gamuda Australia and Laing O'Rourke Consortium (GLC) and includes twin nine-kilometre tunnels between Sydney Olympic Park and Westmead, excavation of two new metro stations, and a stabling and maintenance facility at Clyde (the Project).

During the Project, there is potential for nearby sensitive receivers to experience adverse impacts relating to noise and vibration. The project utilises KNOWnoise , a project-specific noise prediction tool developed to prepare Detailed noise and vibration impact statement (DNVIS) for site and activity-specific noise works where it triggers CoA D43.

This DNVIS has been prepared using KNOWnoise and addresses key activities proposed to occur within Unwin Street at the Clyde Maintenance and Stabling Facility (MSF) construction site as illustrated in Figure 1. These activities are a critical component of the Approved project and are one element of the Unwin Street Diversion works which was assessed in the initial EIS and later refined as part of Modification 2 of the Planning Approval.

The structure of this DNVIS includes:

- Section 1.2 – Construction works and hours with justification for these works in Section 1.3
- Section 2 – Existing environment
- Section 3 – Assessment framework including noise and vibration management levels
- Section 4 – Construction Noise and Vibration assessment details
- Section 5 – Mitigation and management

1.2 Planned works

GLC plans to carry out the works described in Appendix A in the following steps:

1) Pile FA-4
   a) Drill Pile FA-4
   b) Pour pile FA-4
2) Pile FB-1
   a) Drill Pile FB-1
   b) Pour Pile FB-1
3) Haulage of spoil and road cleanup

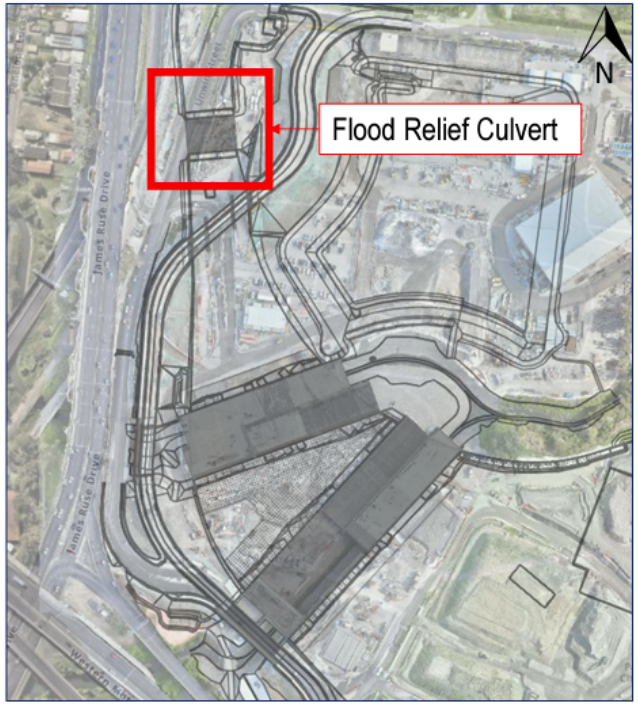
Works are proposed to occur from 27th January 2025 and require a total of 3 evening and night shifts to complete (assuming ideal working conditions and no complications). The works assessed in this DNVIS are proposed to occur during the evening and night time period subject to ROL availability.

1.3 Justification of the works

The Work proposed as part of this assessment are critical for the delivery of the Sydney Metro Western Tunneling Package. The works encompass piling and concrete pours associated with the wider Unwin Street diversion works, initially assessed in the EIS and later refined via Modification 2 of the Planning Approval.

To undertake the works, an exclusion zone must be implemented around th two piling locations, due to the presence of utilities located above and below ground. Given the size and position of the piling drill head, as well as the necessary safety exclusion zone, the rig must be positioned across two lanes of Unwin St which requires a temporary shutdown for the road alignment. Given the works require a full road closure, working hours would be subject to ROL's provided by the relevant Roads Authority. These works would be completed in accordance with the conditions of respite stipulated by EPL L5.8(e).

This DNVIS has therefore been developed in accordance with CoA D43, given the predicted noise impacts exceed the Noise Management Levels (NML) for the evening and night time period



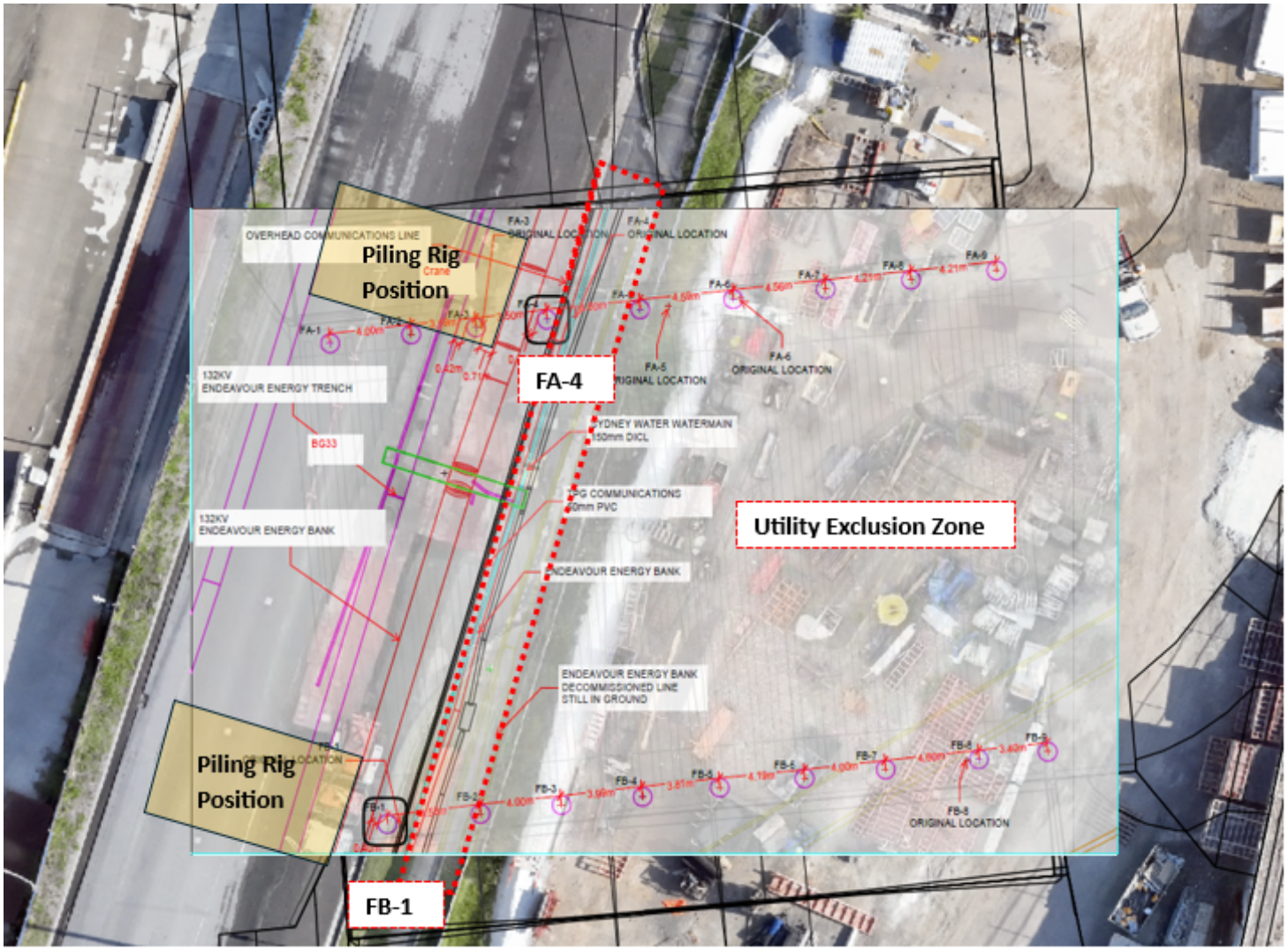


Figure 1 - depicts the work location on Unwin Street (above). (Right) - shows the location of the two piles in question (FA4 - FB-1)

2 Existing environment

2.1 Sensitive receivers

The proposed works are due to occur within Unwin Street, between Clyde Maintenance and Stabling Facility and the Clyde Dive Site. It is bound by James Ruse Drive to the west and so the existing noise levels in this study area are generally controlled by transportation noise from the surrounding road network and the operation of industrial and commercial facilities. The area immediately surrounding the proposed work area is predominantly commercial-industrial, with residential and commercial receivers residing on the western side of James Ruse Driver.

NCA5 - North of the M4 Motorway and west of James Ruse Drive. The catchment is mainly residential. 'Other sensitive' receivers include Rosehill Public School and a number of hotels and child care centres.

NCA6 - South of the M4 Motorway in Granville. The catchment is mostly residential adjacent to the motorway, with some commercial use in the south-east.

2.2 Noise catchment areas

To facilitate the assessment of noise impacts from the project and to apply representative Noise Management Levels (NMLs) to all receivers, receivers adjacent to the Clyde Construction sites have been divided into Noise Catchment Areas (NCAs). The Clyde site contains three noise catchments (NCA05 , NCA06 and NCA07).

NCAs group individual sensitive receivers by representative traits such as existing noise environment and potential exposure to noise and vibration from the Project.

NCAs established as part of the EIS are summarised in Table 1 and illustrated in Figure 1. Background noise monitoring has been completed as part of the EIS to apply appropriate NML to each NCA.

Table 1 Summary of work areas, Noise Catchment Areas and land uses

NCA	Location	Description
5	Clyde Maintenance and Stabling Facility	North of the M4 Motorway and west of James Ruse Drive. The catchment is mainly residential. 'Other sensitive' receivers include Rosehill Public School and a number of hotels and child care centres.
6		South of the M4 Motorway in Granville. The catchment is mostly residential adjacent to the motorway, with some commercial use in the south-east.
7		East of James Ruse Drive, this catchment is mostly commercial and covers Rosehill Gardens racecourse, the Clyde commercial/industrial area, and Silverwater and Newington. Residential receivers and Newington Public School are in the south-east. This catchment is included in both the Clyde and Silverwater precincts.

3 Assessment framework

3.1 Approved construction hours

Working hours are set by CoA D35 to D36 as summarised in Table 2. Use of power saws, rock breakers, drills and other tonal or impulsive activities are defined as annoying under the Interim Construction Noise Guideline (ICNG) and are 'highly noise intensive works'.

Table 2 Approved construction hours

CoA	Construction activity	Monday to Friday	Saturday	Sunday / Public holiday
D35	Approved construction	7:00 am to 6:00 pm	8:00 am to 6:00 pm	No work (unless approved under EPL or out-of-hours work protocol)
D36	Highly noise intensive works	8:00 am to 6:00 pm[1]	8:00 am to 1:00 pm[1]	No work (unless approved under EPL or out-of-hours work protocol)

Notes:

1. if continuously, then not exceeding three hours, with a minimum cessation of work of not less than one hour.

3.2 Noise assessment criteria

3.2.1 Construction noise

The ICNG describes noise in excess of the background level as potentially having an adverse impact on sensitive receivers and increasing the likelihood of complaint. During standard construction hours, where construction noise is within 10 dB(A) of the RBL, impacts would be acceptable.

Where construction noise is more than 10 dB(A) above the RBL during standard construction hours, a residential receiver is considered noise affected and the proponent should undertake all reasonable and feasible steps necessary to manage the impact and consult with the affected community.

Above a $L_{Aeq,\ 15\ minute}$ noise level of 75 dB(A), a receiver is highly affected, requiring consideration of additional mitigation measures including alternative accommodation in the night period.

Outside standard construction hours, construction noise at a residential receiver more than 5 dB(A) above the RBL is taken to be noise affected. Table 1 (reproduced from Table 2 of the ICNG) sets out the NMLs for residences and how they are to be applied.

In addition, annoying noise such as rock hammers, impact piling, or other impulsive noise sources usually result in greater annoyance than continuous construction noise. A 5 dB(A) penalty is applicable to such activities prior to comparison with the NMLs.

3.2.2 Sleep disturbance

The CNVS requires maximum noise levels to be analysed in terms of the extent and number of times the maximum noise exceeds specific noise trigger levels, in general accordance with the Noise Policy for Industry (NPfI) (EPA 2017). These triggers are:

- LAeq, 15 minute 40 dBA or the prevailing RBL plus 5 dB, whichever is greater, and the
- LAmax 52 dBA or the prevailing RBL plus 15 dB, whichever is greater.

The NPfI also recommends the DECCW (2011) Road Noise Policy (RNP) be reviewed for further risk assessment. The RNP recommends maximum internal noise levels below 50–55 dB(A) are unlikely to awaken people from sleep and one or two noise events per night, with maximum internal noise levels of 65–70 dB(A), are not likely to affect health and wellbeing significantly.

Table 3 Residential noise management levels

Time of day	NML $L_{Aeq\ (15\ min)}$ *	How to apply
Standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq\ (15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: - times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences); - if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5 dB	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community.

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

Other sensitive land uses, such as schools and offices, typically find noise from construction disruptive when the properties are being used (such as during work and school times). The noise management levels for non-residential receivers set in accordance with the Interim Construction Noise Guideline are provided in Table 4. These levels apply only during hours when the non-residential premises are being used.

The difference between an internal noise level and the external noise level is about 10 dB(A), which provides a conservative assumption that windows are open for ventilation. Buildings where windows are fixed or cannot otherwise be opened may achieve a greater noise level performance.

Table 4 Non-residential sensitive land uses noise management levels

Land use	Noise assessment location	NML ($L_{Aeq,15min}$)
Classrooms at schools and other educational institutions	Internal	45
Places of worship		
Active recreation areas (such as sporting activities and activities which generate their own noise or focus for participants)	External	65
Passive recreation areas (contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External	60
Industrial premises	External	75
Office, retail outlets	External	70

3.3 Project construction noise management levels

The Project specific construction noise management levels for residential receivers have been established in line with the ICNG, based on the RBLs relevant to each NCA. These are presented in Table 5. NMLs for non-residential sensitive receivers are described in Table 4.

Table 5 Project specific construction NMLs

NCA	Noise Management Level, $L_{Aeq\ 15\ minute}$						
	Approved hours		Outside approved hours				
	Noise affected	Highly noise affected	Day	Evening	Night	Sleep disturbance (CNVS)	
						$L_{Aeq,\ 15\ minute}$	L_{Amax}
4	61	75	56	53	46	56	65
5	60	75	55	54	50	59	65
6	62	75	57	56	49	59	65
7	56	75	51	49	46	56	65

As part of planning for out of hours works, standard mitigation measures, as described in the NVMP, are implemented where reasonable and feasible. However, after these measures have been applied, noise and vibration levels may continue to exceed the NMLs.

In this case, additional mitigation measures outlined in the CNVS, which largely focus on engagement with affected sensitive receivers, should be implemented where reasonable and feasible, unless other agreements are in place with the impacted receiver.

Triggers and additional mitigation measures for airborne noise are taken from the Project's OOHW Protocol and summarised in Table 6. Further details of specific additional mitigation measures are described in the CNVS.

Table 6 Triggers for additional mitigation measures – Airborne noise (Sydney Metro 2020)

Construction hours	Class	dB above NML	Additional management measures
Approved hours Monday – Friday: 7am – 6pm Saturday: 8am to 6pm	N	0 to 10	-
	CA	10 to 20	LB
	MI	20 to 30	LB, M, SN
	HI	30	LB, M, SN
Evening Monday – Friday: 6pm – 10pm Saturday: 7am – 8am, 6pm – 10pm Sunday / PH: 8am – 6pm	N	0 to 10	LB
	CA	10 to 20	LB, M
	MI	20 to 30	LB, M, SN, RO
	HI	30	LB, M, SN, IB, PC, RO
Night Monday – Saturday: 10am – 7am Saturday: 10pm –8am) Sunday / PH: 6pm –7am	N	0 to 10	LB
	CA	10 to 20	LB, M, SN, RO
	MI	20 to 30	LB, M, SN, IB, PC, RO, AA
	HI	30	LB, M, SN, IB, PC, RO, AA

Notes: PC Phone Calls and emails; M Monitoring; IB Individual briefings; AA Alternative accommodation; SN Specific notification; LB Letterbox drops; RO Project specific respite offer

N Noticeable CA Clearly audible MI Moderately intrusive HI Highly intrusive

3.4 Vibration management

3.4.1 Human comfort

When assessing human exposure to construction-related vibration, the DNVS requires vibration goals to be established using *Environmental Noise Management Assessing Vibration: A Technical Guideline* (DECC 2006), which provides criteria for the assessment of vibration impacts on humans.

Construction activities typically generate vibration of an intermittent nature, which is assessed using a Vibration Dose Value (VDV). Acceptable values of vibration doses are presented in Table 7 for sensitive receivers.

Table 7 VDV Vibration criteria

Receiver type	Low probability of adverse comment ($m/s^{1.75}$)	Adverse comment possible ($m/s^{1.75}$)	Adverse comment probable ($m/s^{1.75}$)
Residential buildings – 16 hour day (7am to 11pm)[1]	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings – 8 hour night (11pm to 7am)[1]	0.13	0.26	0.51

Note 1: Day time and night time as described in BS6472:1992 (as referenced in the CNVS), i.e. a daytime period of 16 h or a night time period of 8 h, for example 23.00 h to 07.00 h.

3.4.2 Buildings

Potential building damage from construction vibration requires the application of values in BS 7385 Part 2-1993 *Evaluation and measurement for vibration in buildings* Part 2. These values are presented in Table 8 and relate to transient vibration which does not give rise to resonant responses in structures, and to low-rise buildings.

Table 8 Guideline values for vibration velocity for the effects of short-term vibration on structures (BS 7385).

Line	Type of building	Peak component particle velocity in frequency range of predominant pulse	
		4 Hz to 15 Hz	15 Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz to 50 mm/s at 40 Hz and above

Where vibration may give rise to magnification due to resonance, especially at lower frequencies where lower guide values apply, the guide values may be reduced by 50%. The DNVS describes rock breaking/hammering and sheet piling activities as having potential to cause dynamic loading in some structures (e.g. residences).

For activity involving rock breakers, piling rigs, vibratory rollers, excavators, vibration predominantly occurs at frequencies in the 10 Hz to 100 Hz range. On this basis, a conservative vibration damage screening level is:

- Reinforced or framed structures: 25.0 mm/s
- Unreinforced or light framed structures: 7.5 mm/s

3.4.3 Heritage

No heritage structures were found to be structurally unsound across WTP. On this basis, a conservative cosmetic damage objective of 2.5mm/s peak component particle velocity (from DIN 4150) would not apply. Instead, the guideline values from Table 8 would be applicable.

3.4.4 Additional mitigation measures

The CNVS recommends additional mitigation measures where all standard mitigation measures to minimise vibration at the nearest receivers have been implemented and vibration is still predicted to exceed the maximum guideline values. The Additional Mitigation Measures Matrix (AMMM) for vibration from the CNVS is presented in Table 9.

Table 9 Additional Vibration Mitigation Measures (CNVS)

Construction hours	Mitigation measures where predicted vibration levels exceed maximum levels
Approved hours Monday – Friday: 7am – 6pm, Saturday: 8am to 6pm	LB, M, RO
Evening Monday – Friday: 6pm – 10pm Saturday: 7am – 8am, 6pm – 10pm Sunday / PH: 8am – 6pm	LB, M, IB, PC, RO, SN
Night Monday – Saturday: 10am – 7am Saturday: 10pm –8am) Sunday / PH: 6pm –7am	LB, M, IB, PC, RO, SN, AA

4 Impact assessment

4.1 Modelling method

Predictions of noise impacts were performed using KNOWnoise , a project-specific noise assessment tool developed by Hutchison Weller for the CTP Project. KNOWnoise calculates the maximum $L_{Aeq,15minute}$ noise level for each identified receiver for each proposed activity using predictions from SoundPlan noise modelling software. Predictions include geometric spreading, air and ground absorptions as well as topographical and structural screening and reflection.

The following components were incorporated in the model:

- Topography – Based on terrain data of 1 m resolution.
- Individual sensitive receivers – Worst-affected fa ade of each building to 700 metres from the works
- Construction noise sources –Activities and equipment provided by GLC were included in the noise model as individual sources across the nominated work areas for each activity. The maximum predicted LAeq noise level within each work area was identified for each receiver.
- Cumulative impacts – all activities with overlapping time periods are included in cumulative results
- Source height – construction noise sources assumed to be at 1.5 metres above ground level.
- Ground Absorption – Ground assumed to be mixed hard and soft with absorption factor of 0.5
- Meteorology –worst-case meteorological conditions (gentle breeze from source to receiver and stable conditions).
- Residential building structures are included in the model, meaning screening provided by neighboring houses is considered.
- Results are shown for all floors of assessed buildings with the worst-case fa ade result assumed for the whole floor.

The sound power levels and ultimate predicted noise levels will depend on the number of plant items operating at any one time and their precise location relative to a sensitive receiver. In practice, the predicted levels will vary due to plant moving around the site and not operating intensively or concurrently for a 15 minute assessment period. Shielding and reflection provided by buildings will also vary as plant moves around the site. Therefore, predicted noise levels are conservative.

4.2 Organisation of Noise and Vibration assessment for the proposed works

This DNVIS has been sectioned as below to assist with interpreting Noise and Vibration impacts:

- Section 4.3 - 4.7 - Summarises the predicted noise and vibration impacts by stage of works
- Section 5 - Details the mitigation measures and any specific mitigation measures to be emplaced.
- Appendix A - Lists the plant and equipment (including % usage) for each stage of works
- Appendix B - Presents the predicted noise impacts visually on a map for each stage of works
- Appendix C - Provides the noise and vibration impacts for all sensitive receivers affected for each stage of works

4.3 Drilling of Pile FA-4

4.3.1 Predicted noise levels

Predicted impact classes for the are illustrated graphically in Appendix B. Each identified receiver in the study area has been coloured to highlight the predicted level of impact.

Detailed predicted noise levels for each potentially affected receiver are presented Appendix C.

Table 10 presents the worst-case predicted noise level of 62 dB(A) during the works, resulting in 0 receivers classed as highly noise affected.

Table 10 Summary of maximum predicted noise level and highly affected receivers for the proposed works.

Maximum cumulative predicted $L_{Aeq,\ 15\ minute}$ noise level	62 dB(A)
Number of highly noise affected receivers (75 dB)	0

With reference to the CNVS, the number of senstive receivers classified in each impact class for each assessment period are summarised in the following tables.

Table 11 Summary of NML exceedance ranges for standard hours.

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 10 dB above NML	2
Clearly Audible	10 20 dB above NML	0
Moderately Intrusive	20 30 dB above NML	0
Highly Intrusive	30 dB above NML	0

Table 12 Summary of NML exceedance ranges for outside standard hours - weekend.

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 10 dB above NML	14
Clearly Audible	10 20 dB above NML	0
Moderately Intrusive	20 30 dB above NML	0
Highly Intrusive	30 dB above NML	0

Table 13 Summary of NML exceedance ranges for outside standard hours - evenings.

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 10 dB above NML	16
Clearly Audible	10 20 dB above NML	0

Impact class	Predicted noise level	Predicted number of receivers
Moderately Intrusive	20 30 dB above NML	0
Highly Intrusive	30 dB above NML	0

Table 14 Summary of NML exceedance ranges for outside standard hours - nights.

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 10 dB above NML	33
Clearly Audible	10 20 dB above NML	2
Moderately Intrusive	20 30 dB above NML	0
Highly Intrusive	30 dB above NML	0

In the event works are planned for more than two consecutive nights, sleep disturbance has been considered. Table 15 summarises the number of residents predicted to exceed the sleep disturbance screening criterion. Further analysis is also provided to indicate the number of receivers expected to be woken, at LAmax noise levels greater than 65 dBA.

Where exceedances of the awakening criteria are predicted, additional care should be taken, and mitigation measures implemented in line with the CNVS.

Table 15 Summary of predicted exceedances of sleep disturbance screening criterion and awakening criterion.

Criterion	Predicted number of receivers
Potentially Sleep Disturbed (exceed RBL 15 screening criterion)	12
Exceed 65 dBA awakening criterion	1

4.3.2 Vibration

The CNVS requires attended vibration measurements at commencement of vibration generating activities to confirm vibration levels satisfy the criteria for that activity.

There are no vibration impacts expected at sensitive receivers for this stage of the proposed works.

Table 16 Predicted exceedances of vibration criteria

Impact classification	Number of potentially affected receivers
Human comfort	0
Cosmetic damage	0
Heritage structure	0

4.4 Pouring of Pile FA-4

4.4.1 Predicted noise levels

Predicted impact classes for the works are illustrated graphically in Appendix B. Each identified receiver in the study area has been coloured to highlight the predicted level of impact.

Detailed predicted noise levels for each potentially affected receiver are presented Appendix C.

Table 17 presents the worst-case predicted noise level of 62 dB(A) during the works, resulting in 0 receivers classed as highly noise affected.

Table 17 Summary of maximum predicted noise level and highly affected receivers for the works.

Maximum cumulative predicted $L_{Aeq,\ 15\ minute}$ noise level	62 dB(A)
Number of highly noise affected receivers (>75 dB)	0

With reference to the CNVS, the number of senstive receivers classified in each impact class for each assessment period are summarised in the following tables.

Table 18 Summary of NML exceedance ranges for standard hours.

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 <= 10 dB above NML	1
Clearly Audible	10 <= 20 dB above NML	0
Moderately Intrusive	20 <= 30 dB above NML	0
Highly Intrusive	> 30 dB above NML	0

Table 19 Summary of NML exceedance ranges for outside standard hours - weekend.

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 <= 10 dB above NML	14
Clearly Audible	10 <= 20 dB above NML	0
Moderately Intrusive	20 <= 30 dB above NML	0
Highly Intrusive	> 30 dB above NML	0

Table 20 Summary of NML exceedance ranges for outside standard hours - evenings.

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 <= 10 dB above NML	16
Clearly Audible	10 <= 20 dB above NML	0

Impact class	Predicted noise level	Predicted number of receivers
Moderately Intrusive	20 <= 30 dB above NML	0
Highly Intrusive	> 30 dB above NML	0

Table 21 Summary of NML exceedance ranges for outside standard hours - nights.

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 <= 10 dB above NML	31
Clearly Audible	10 <= 20 dB above NML	1
Moderately Intrusive	20 <= 30 dB above NML	0
Highly Intrusive	> 30 dB above NML	0

In the event works are planned for more than two consecutive nights, sleep disturbance has been considered. Table 22 summarises the number of residents predicted to exceed the sleep disturbance screening criterion. Further analysis is also provided to indicate the number of receivers expected to be woken, at LAmax noise levels greater than 65 dBA.

Where exceedances of the awakening criteria are predicted, additional care should be taken, and mitigation measures implemented in line with the CNVS.

Table 22 Summary of predicted exceedances of sleep disturbance screening criterion and awakening criterion.

Criterion	Predicted number of receivers
Potentially Sleep Disturbed (exceed RBL + 15 screening criterion)	12
Exceed 65 dBA awakening criterion	1

4.4.2 Vibration

The CNVS requires attended vibration measurements at commencement of vibration generating activities to confirm vibration levels satisfy the criteria for that activity.

There are no vibration impacts expected at sensitive receivers for this stage of the proposed works.

Table 23 Predicted exceedances of vibration criteria

Impact classification	Number of potentially affected receivers
Human comfort	0
Cosmetic damage	0
Heritage structure	0

4.5 Drill Pile FB-1

4.5.1 Predicted noise levels

Predicted impact classes for the works are illustrated graphically in Appendix B. Each identified receiver in the study area has been coloured to highlight the predicted level of impact.

Detailed predicted noise levels for each potentially affected receiver are presented Appendix C.

Table 18 presents the worst-case predicted noise level of 60 dB(A) during the works, resulting in 0 receivers classed as highly noise affected.

Table 18 Summary of maximum predicted noise level and highly affected receivers for the works.

Maximum cumulative predicted $L_{Aeq,\ 15\ minute}$ noise level	60 dB(A)
Number of highly noise affected receivers (>75 dB)	0

With reference to the CNVS, the number of senstive receivers classified in each impact class for each assessment period are summarised in the following tables.

Table 19 Summary of NML exceedance ranges for standard hours.

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 <= 10 dB above NML	0
Clearly Audible	10 <= 20 dB above NML	0
Moderately Intrusive	20 <= 30 dB above NML	0
Highly Intrusive	> 30 dB above NML	0

Table 20 Summary of NML exceedance ranges for outside standard hours - weekend.

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 <= 10 dB above NML	8
Clearly Audible	10 <= 20 dB above NML	0
Moderately Intrusive	20 <= 30 dB above NML	0
Highly Intrusive	> 30 dB above NML	0

Table 21 Summary of NML exceedance ranges for outside standard hours - evenings.

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 <= 10 dB above NML	11
Clearly Audible	10 <= 20 dB above NML	0

Impact class	Predicted noise level	Predicted number of receivers
Moderately Intrusive	20 <= 30 dB above NML	0
Highly Intrusive	> 30 dB above NML	0

Table 22 Summary of NML exceedance ranges for outside standard hours - nights.

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 <= 10 dB above NML	19
Clearly Audible	10 <= 20 dB above NML	0
Moderately Intrusive	20 <= 30 dB above NML	0
Highly Intrusive	> 30 dB above NML	0

In the event works are planned for more than two consecutive nights, sleep disturbance has been considered. Table 23 summarises the number of residents predicted to exceed the sleep disturbance screening criterion. Further analysis is also provided to indicate the number of receivers expected to be woken, at LAmax noise levels greater than 65 dBA.

Where exceedances of the awakening criteria are predicted, additional care should be taken, and mitigation measures implemented in line with the CNVS.

Table 23 Summary of predicted exceedances of sleep disturbance screening criterion and awakening criterion.

Criterion	Predicted number of receivers
Potentially Sleep Disturbed (exceed RBL + 15 screening criterion)	12
Exceed 65 dBA awakening criterion	1

4.5.2 Vibration

The CNVS requires attended vibration measurements at commencement of vibration generating activities to confirm vibration levels satisfy the criteria for that activity.

There are no vibration impacts expected at sensitive receivers for this stage of the proposed works.

Table 24 Predicted exceedances of vibration criteria

Impact classification	Number of potentially affected receivers
Human comfort	0
Cosmetic damage	0
Heritage structure	0

4.6 Pour Pile FB-1

4.6.1 Predicted noise levels

Predicted impact classes for the work are illustrated graphically in Appendix B. Each identified receiver in the study area has been coloured to highlight the predicted level of impact.

Detailed predicted noise levels for each potentially affected receiver are presented Appendix C.

Table 25 presents the worst-case predicted noise level of 59 dB(A) during the works, resulting in 0 receivers classed as highly noise affected.

Table 25 Summary of maximum predicted noise level and highly affected receivers for the works.

Maximum cumulative predicted $L_{Aeq,\ 15\ minute}$ noise level	59 dB(A)
Number of highly noise affected receivers (>75 dB)	0

With reference to the CNVS, the number of senstive receivers classified in each impact class for each assessment period are summarised in the following tables.

Table 26 Summary of NML exceedance ranges for standard hours.

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 <= 10 dB above NML	0
Clearly Audible	10 <= 20 dB above NML	0
Moderately Intrusive	20 <= 30 dB above NML	0
Highly Intrusive	> 30 dB above NML	0

Table 27 Summary of NML exceedance ranges for outside standard hours - weekend.

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 <= 10 dB above NML	6
Clearly Audible	10 <= 20 dB above NML	0
Moderately Intrusive	20 <= 30 dB above NML	0
Highly Intrusive	> 30 dB above NML	0

Table 28 Summary of NML exceedance ranges for outside standard hours - evenings.

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 <= 10 dB above NML	11
Clearly Audible	10 <= 20 dB above NML	0

Impact class	Predicted noise level	Predicted number of receivers
Moderately Intrusive	20 <= 30 dB above NML	0
Highly Intrusive	> 30 dB above NML	0

Table 29 Summary of NML exceedance ranges for outside standard hours - nights.

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 <= 10 dB above NML	18
Clearly Audible	10 <= 20 dB above NML	0
Moderately Intrusive	20 <= 30 dB above NML	0
Highly Intrusive	> 30 dB above NML	0

In the event works are planned for more than two consecutive nights, sleep disturbance has been considered. Table 30 summarises the number of residents predicted to exceed the sleep disturbance screening criterion. Further analysis is also provided to indicate the number of receivers expected to be woken, at LAmax noise levels greater than 65 dBA.

Where exceedances of the awakening criteria are predicted, additional care should be taken, and mitigation measures implemented in line with the CNVS.

Table 30 Summary of predicted exceedances of sleep disturbance screening criterion and awakening criterion.

Criterion	Predicted number of receivers
Potentially Sleep Disturbed (exceed RBL + 15 screening criterion)	12
Exceed 65 dBA awakening criterion	1

4.6.2 Vibration

The CNVS requires attended vibration measurements at commencement of vibration generating activities to confirm vibration levels satisfy the criteria for that activity.

There are no vibration impacts expected at sensitive receivers for this stage of the proposed works.

Table 31 Predicted exceedances of vibration criteria

Impact classification	Number of potentially affected receivers
Human comfort	0
Cosmetic damage	0
Heritage structure	0

4.7 Haulage of Spoil and Road Cleanup

4.7.1 Predicted noise levels

Predicted impact classes for the works are illustrated graphically in Appendix B. Each identified receiver in the study area has been coloured to highlight the predicted level of impact.

Detailed predicted noise levels for each potentially affected receiver are presented Appendix C.

Table 32 presents the worst-case predicted noise level of 58 dB(A) during the works, resulting in 0 receivers classed as highly noise affected.

Table 32 Summary of maximum predicted noise level and highly affected receivers for the works.

Maximum cumulative predicted $L_{Aeq,\ 15\ minute}$ noise level	58 dB(A)
Number of highly noise affected receivers (>75 dB)	0

With reference to the CNVS, the number of senstive receivers classified in each impact class for each assessment period are summarised in the following tables.

Table 33 Summary of NML exceedance ranges for standard hours.

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 <= 10 dB above NML	0
Clearly Audible	10 <= 20 dB above NML	0
Moderately Intrusive	20 <= 30 dB above NML	0
Highly Intrusive	> 30 dB above NML	0

Table 34 Summary of NML exceedance ranges for outside standard hours - weekend.

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 <= 10 dB above NML	5
Clearly Audible	10 <= 20 dB above NML	0
Moderately Intrusive	20 <= 30 dB above NML	0
Highly Intrusive	> 30 dB above NML	0

Table 35 Summary of NML exceedance ranges for outside standard hours - evenings.

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 <= 10 dB above NML	8
Clearly Audible	10 <= 20 dB above NML	0

Impact class	Predicted noise level	Predicted number of receivers
Moderately Intrusive	20 <= 30 dB above NML	0
Highly Intrusive	> 30 dB above NML	0

Table 36 Summary of NML exceedance ranges for outside standard hours - nights.

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 <= 10 dB above NML	17
Clearly Audible	10 <= 20 dB above NML	0
Moderately Intrusive	20 <= 30 dB above NML	0
Highly Intrusive	> 30 dB above NML	0

In the event works are planned for more than two consecutive nights, sleep disturbance has been considered. Table 37 summarises the number of residents predicted to exceed the sleep disturbance screening criterion. Further analysis is also provided to indicate the number of receivers expected to be woken, at LAmax noise levels greater than 65 dBA.

Where exceedances of the awakening criteria are predicted, additional care should be taken, and mitigation measures implemented in line with the CNVS.

Table 37 Summary of predicted exceedances of sleep disturbance screening criterion and awakening criterion.

Criterion	Predicted number of receivers
Potentially Sleep Disturbed (exceed RBL + 15 screening criterion)	12
Exceed 65 dBA awakening criterion	0

4.7.2 Vibration

The CNVS requires attended vibration measurements at commencement of vibration generating activities to confirm vibration levels satisfy the criteria for that activity.

There are no vibraion impacts expected at sensitive receivers for this stage of the proposed works.

Table 38 Predicted exceedances of vibration criteria

Impact classification	Number of potentially affected receivers
Human comfort	0
Cosmetic damage	0
Heritage structure	0

5 Mitigation Measures

The Project represents a risk of adverse impacts on sensitive receivers, particularly when working close to the project boundary and outside approved hours.

Where short term noise impacts are unavoidable, mitigation measures described in the CEMP and NVMP should be implemented together with the recommendations in Table 39. Additional mitigation measures fro each receiver are identified in Appendix B and summarised in Table 40

Table 39 Standard mitigation measures

Measure	Description
Community consultation	• Potentially affected receivers will be notified of OOH works in accordance with project requirements. • Where practicable, works will be scheduled to not conflict with major events as determined through regular/routine community consultation.
Site induction	• All workers will be inducted to the project prior to commencing work and will be cognisant of their noise and vibration obligations under the NVMP.
Behavioural practices	• Avoid unnecessary shouting or loud radios onsite. • Avoid dropping materials from height.
Equipment selection	• Priority given to the use of quieter and less vibration emitting construction methods and plant alternatives where feasible and reasonable. • The noise levels of plant and equipment would meet the maximum noise requirements of the CNVS.
Use and siting of plant	• Locate compounds away from sensitive receivers and discourage access from local roads. • Plant used intermittently to be throttled down or shut down. • Noise-emitting plant to be directed away from sensitive receivers where possible. • Stationary plant should be located behind a structure or enclosed if practicable. • Deliveries should be made as far as practical from sensitive receivers. Dedicated loading/unloading sites should be shielded where possible, if close to receivers. • Plan traffic flow, parking and loading/unloading areas to minimise reversing. • Avoid compression breaking on approach to the site. • Where additional activities or plant may result in marginal noise increases and speed works up, consider concentrating activities at one location and complete works as quickly as possible.
Non-tonal reversing alarms.	• Non-tonal reversing beepers (or an equivalent mechanism) would be fitted on all permanent construction vehicles and plant for any out of hours work.
Noise monitoring	• Monitoring should be completed to verify the assumptions of this DNVIS where triggered.
Vibration monitoring	• Attended vibration measurements should be completed at commencement of vibration generating activities predicted to occur within safe working distances for cosmetic damage. • Where monitoring demonstrates maximum levels exceeded, consider alternative methodologies/equipment

Table 40 Additional Mitigation Measures

Code	easre	Description
AA	Alternative accommodation	Alternative accommodation options may be provided for residents living in close proximity to construction works that are likely to incur unreasonably high impacts over an extended period of time. Alternative accommodation will be determined on a case-by-case basis.
M	Monitoring	Where it has been identified that specific construction activities are likely to exceed the relevant noise or vibration goals, noise or vibration monitoring may be conducted at the affected receiver(s) or a nominated representative location (typically the nearest receiver where more than one receiver have been identified). Monitoring can be in the form of either unattended logging or operator attended surveys. The purpose of monitoring is to inform the relevant personnel when the noise or vibration goal has been exceeded so that additional management measures may be implemented.
IB	Individual briefings	Individual briefings are used to inform stakeholders about the impacts of high noise activities and mitigation measures that will be implemented. Communications representatives from the contractor would visit identified stakeholders at least 48 hours ahead of potentially disturbing construction activities. Individual briefings provide affected stakeholders with personalised contact and tailored advice, with the opportunity to comment on the project.
LB	Letterbox drops	For each Sydney Metro project, a newsletter is produced and distributed to the local community via letterbox drop and the project mailing list. These newsletters provide an overview of current and upcoming works across the project and other topics of interest. The objective is to engage and inform and provide project-specific messages. Advanced warning of potential disruptions (e.g. traffic changes or noisy works) can assist in reducing the impact on the community. Content and newsletter length is determined on a project-by-project basis. Most projects distribute notifications on a monthly basis. Each newsletter is graphically designed within a branded template.
RO	Respite offer	The purpose of a project specific respite offer is to provide residents subjected to lengthy periods of noise or vibration respite from an ongoing impact.
PC	Phone calls	Phone calls and/or emails detailing relevant information would be made to identified/affected stakeholders within 7 days of proposed work. Phone calls and/or emails provide affected stakeholders with personalised contact and tailored advice, with the opportunity to provide comments on the proposed work and specific needs etc.
SN	Specific notifications	Specific notifications would be letterbox dropped or hand distributed to identified stakeholders no later than 7 days ahead of construction activities that are likely to exceed the noise objectives. This form of communication is used to support periodic notifications, or to advertise unscheduled works.

5.1 Impliment Project Specific Mitigation Measures

As of 15th January 2025, and based on the level of impact anticipated for the proposed works relative to the affected sensitive receiver the following activity specific mitigation measures have been employed by GLC:

- Inclusion of these activity specific work details in the January and February 2025 monthly notifications.
- GLC would provide door knocking to all nearby residents (commencing 16th January 2025) to inform them of the proposed works, to understand individual circumstances that may need accommodating, or to receive any feedback on the works.
- An Out-of-hours E-blast (Email) in the week prior to works commencing (detailed and specific to the affected receivers) and weekly during the works (should it be postponed)

Appendix A Proposed activities and associated sound power levels

Note - all stages of works are proposed to begin from 27 January 2025 and be completed over the course of XXX number of nights. Works have been modeled for evening and night time periods, however the specific times works would commence would be subject to the conditions of the ROL's obtained. Further, the dates used in the modeling are not prescriptive on account external factors heavily influence the successful completion of works (i.e unexpected finds, inclement weather etc).

Stage 1a - Drill Pile FA-4

FA-4 pile drilling activities within the northern headstock of the flood relief culvert

Equipment	Quantity	Usage	Reduction	SWL
Crawler crane 100 tonne	1	50%	3	93
Elevated Working Platform	1	30%	3	81
Excavator (25 tonne)	1	40%	3	98
Piling rig (Cassegrand C6xp2)	1	100%	0	108
Generator (400 kVA)	1	100%	3	91
Hand Tools (electric)	2	20%	0	90

Activity Sound Power Level: 109

Stage 1b - Pour Pile FA-4

Concrete pouring activities of pile FA-4

Equipment	Quantity	Usage	Reduction	SWL
Concrete Truck / Agitator - discharging	2	30%	3	94
Crawler crane 100 tonne	1	50%	3	93
Piling rig (Cassegrand C6xp2)	1	100%	0	108
Generator (400 kVA)	1	100%	3	91
Grout pump	1	100%	3	94

Activity Sound Power Level: 109

Stage 2a - Drill Pile FB-1

Drill piling activities for FB-1

Equipment	Quantity	Usage	Reduction	SWL
Crawler crane 100 tonne	1	50%	3	93
Elevated Working Platform	1	30%	3	81
Excavator (25 tonne)	1	40%	3	98
Piling rig (Cassegrand C6xp2)	1	50%	0	105
Generator (400 kVA)	1	100%	3	91
Hand Tools (electric)	2	20%	0	90

Activity Sound Power Level: 106

Stage 2b - Pour Pile FB-1

Concrete pour activities associated with pile FA-1

Equipment	Quantity	Usage	Reduction	SWL
Concrete Truck / Agitator - discharging	2	30%	3	94
Crawler crane 100 tonne	1	50%	3	93
Piling rig (Cassegrand C6xp2)	1	50%	0	105
Generator (400 kVA)	1	100%	3	91
Grout pump	1	100%	3	94

Activity Sound Power Level: 106

Stage 3a - Spoil Haulage

The transfer and haulage of generated spoil from the pile location to an on-site local stockpile area

Equipment	Quantity	Usage	Reduction	SWL
Truck, dump articulated	1	20%	3	98

Activity Sound Power Level: 98

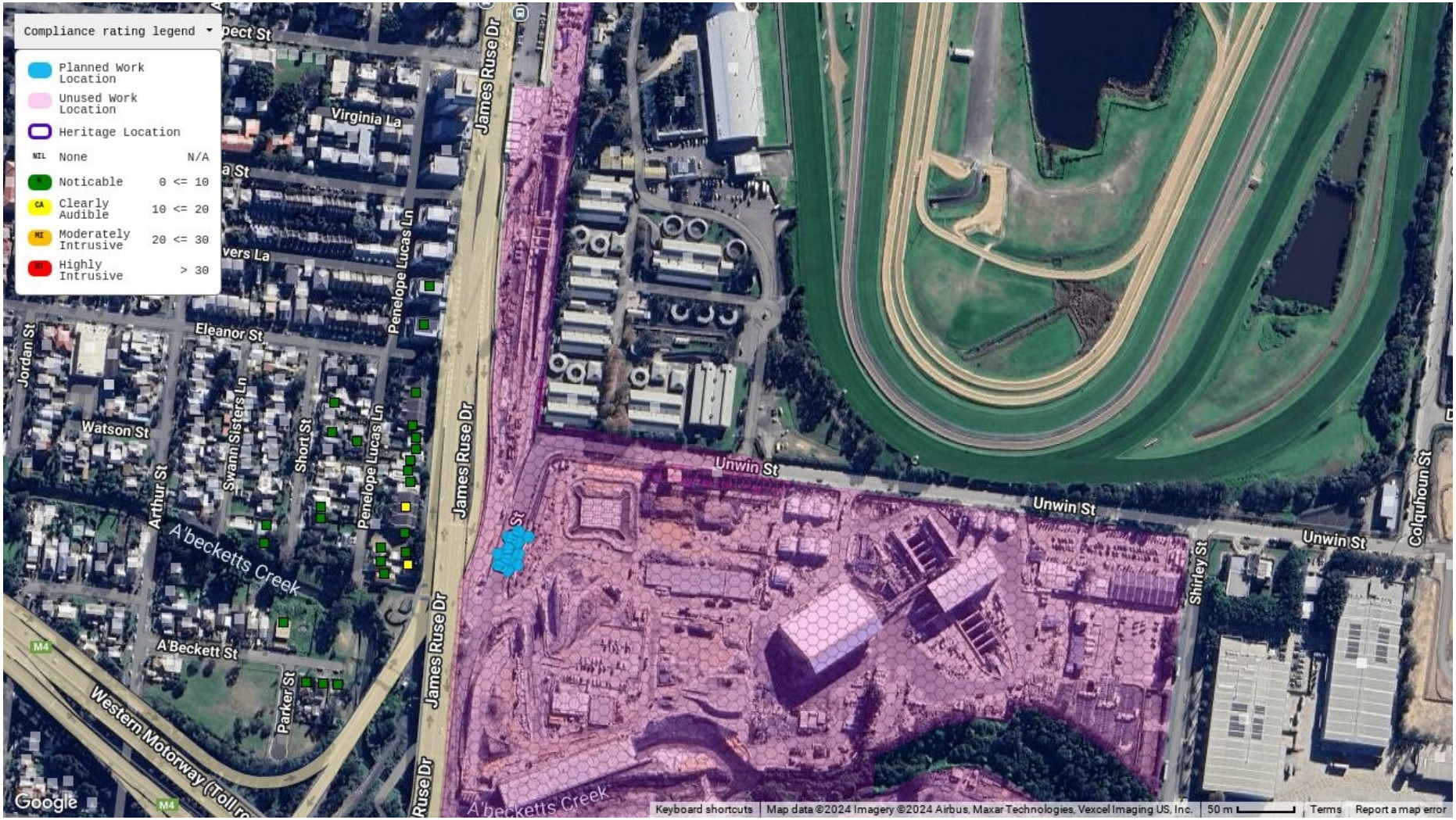
Stage 3b - Road Clean-up

At the end of the night prior to the reopening of the road way, the road will be cleaned

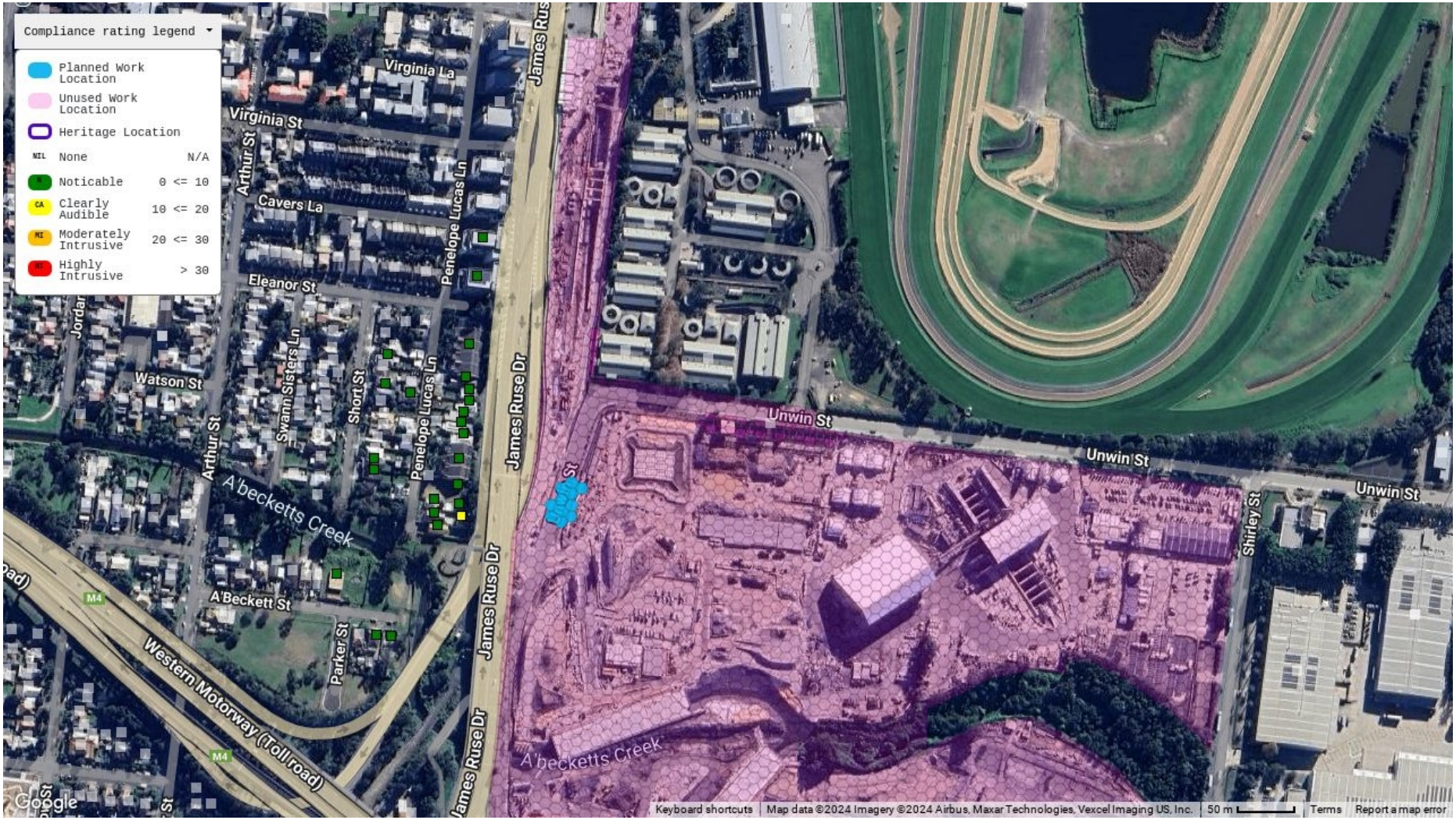
Equipment	Quantity	Usage	Reduction	SWL
Road Sweeper	1	40%	3	103
Water Tanker (8000 litre)	1	40%	3	96

Activity Sound Power Level: 104

Appendix B.1a - Drill Pile FA-4 - Map showing predicted noise impacts by impact class



Appendix B.1b - Pour Pile FA-4 - Map showing predicted noise impacts by impact class



Appendix B.2a - Drill Pile FB-1 - Map showing predicted noise impacts by impact class

Appendix B2b - Pour Pile FB-1 - Map showing predicted noise impacts by impact class

Appendix B3 (a-b) - Spoil and road cleanup - Map showing predicted noise impacts by impact class

Appendix C.1a - Drill Pile FA-4 - Detailed predictions

C.1a Noise

Assessment: Piling Works St Unwins Street					NML LAeq 15min				Sleep LAax		Predicted noise level dBA		Exceedance summary										
														Exceedence NML (dB)				Exceed sleep disturbance by (dB):		Impact Classification			
NCA	REC	Address	Flr	Land use	Day	O/Day	Evening	Night	Screen	Awake	Cumulative LAeq, 15 minute	LMax	Highly Noise affected	Day	O/day	Eve	Night	Screen	Awake	Day	O/day	Eve	Night
NCA05	760631	8 A'BECKETT ST, GRANVILLE	1	RES	60	55	54	50			50.2	54.5		0	0	0	0.2	-	0.2	None	None	None	Noticable
NCA05	760636	63-65 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		60	64.3		0	5	6	10	-	10	None	Noticable	Noticable	Noticable
NCA05	760732	4 A'BECKETT ST, GRANVILLE	1	IND	60	55	54	50			51.3	55.6		0	0	0	1.3	-	1.3	None	None	None	Noticable
NCA05	760733	71 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		57.1	61.4		0	2.1	3.1	7.1	-	7.1	None	Noticable	Noticable	Noticable
NCA05	760810	35-43 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50			52.8	57.1		0	0	0	2.8	-	2.8	None	None	None	Noticable
NCA05	760811	35-43 PENELOPE LUCAS LANE, ROSEHILL	2	RES	60	55	54	50			53.3	57.6		0	0	0	3.3	-	3.3	None	None	None	Noticable
NCA05	760850	88 JAMES RUSE DR, ROSEHILL	5	RES	60	55	54	50			50.4	54.7		0	0	0	0.4	-	0.4	None	None	None	Noticable
NCA05	760855	19 SHORT ST, ROSEHILL	1	RES	60	55	54	50			50.9	55.2		0	0	0	0.9	-	0.9	None	None	None	Noticable
NCA05	760857	49 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		56.2	60.5		0	1.2	2.2	6.2	-	6.2	None	Noticable	Noticable	Noticable
NCA05	760859	55 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		58.2	62.5		0	3.2	4.2	8.2	-	8.2	None	Noticable	Noticable	Noticable
NCA05	760893	25 SHORT ST, ROSEHILL	1	RES	60	55	54	50			51.5	55.8		0	0	0	1.5	-	1.5	None	None	None	Noticable
NCA05	760903	19 SHORT ST, ROSEHILL	1	RES	60	55	54	50			52	56.3		0	0	0	2	-	2	None	None	None	Noticable
NCA05	760941	47 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50			55.5	59.8		0	0.5	1.5	5.5	-	5.5	None	Noticable	Noticable	Noticable
NCA05	760955	7 SHORT ST, ROSEHILL	1	RES	60	55	54	50			54.3	58.6		0	0	0.3	4.3	-	4.3	None	None	Noticable	Noticable
NCA05	760961	69 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y	Y	61.9	66.2		1.9	6.9	7.9	11.9	1	11.9	Noticable	Noticable	Noticable	Clearly Audible
NCA05	760962	9 SHORT ST, ROSEHILL	1	RES	60	55	54	50			52.8	57.1		0	0	0	2.8	-	2.8	None	None	None	Noticable
NCA05	760977	57-61 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		59.4	63.7		0	4.4	5.4	9.4	-	9.4	None	Noticable	Noticable	Noticable
NCA05	760978	57-61 PENELOPE LUCAS LANE, ROSEHILL	2	RES	60	55	54	50	Y		60.1	64.4		0.1	5.1	6.1	10.1	-	10.1	Noticable	Noticable	Noticable	Clearly Audible
NCA05	760990	6 A'BECKETT ST, GRANVILLE	1	RES	60	55	54	50			50.7	55		0	0	0	0.7	-	0.7	None	None	None	Noticable
NCA05	761020	88 JAMES RUSE DR, ROSEHILL	1	RES	60	55	54	50			50.9	55.2		0	0	0	0.9	-	0.9	None	None	None	Noticable
NCA05	761021	88 JAMES RUSE DR, ROSEHILL	2	RES	60	55	54	50			50.9	55.2		0	0	0	0.9	-	0.9	None	None	None	Noticable
NCA05	761022	88 JAMES RUSE DR, ROSEHILL	3	RES	60	55	54	50			51.2	55.5		0	0	0	1.2	-	1.2	None	None	None	Noticable
NCA05	761023	88 JAMES RUSE DR, ROSEHILL	4	RES	60	55	54	50			51.8	56.1		0	0	0	1.8	-	1.8	None	None	None	Noticable
NCA05	761024	88 JAMES RUSE DR, ROSEHILL	5	RES	60	55	54	50			52.2	56.5		0	0	0	2.2	-	2.2	None	None	None	Noticable
NCA05	761025	88 JAMES RUSE DR, ROSEHILL	6	RES	60	55	54	50			52.5	56.8		0	0	0	2.5	-	2.5	None	None	None	Noticable
NCA05	761041	51 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		57	61.3		0	2	3	7	-	7	None	Noticable	Noticable	Noticable
NCA05	761049	2-4 SHORT ST, ROSEHILL	1	RES	60	55	54	50			50.1	54.4		0	0	0	0.1	-	0.1	None	None	None	Noticable
NCA05	761055	53 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		57.6	61.9		0	2.6	3.6	7.6	-	7.6	None	Noticable	Noticable	Noticable
NCA05	761065	45 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50			54.9	59.2		0	0	0.9	4.9	-	4.9	None	None	Noticable	Noticable
NCA05	761100	67 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		57.2	61.5		0	2.2	3.2	7.2	-	7.2	None	Noticable	Noticable	Noticable
NCA05	761105	69 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50			56.1	60.4		0	1.1	2.1	6.1	-	6.1	None	Noticable	Noticable	Noticable
NCA05	761106	69 PENELOPE LUCAS LANE, ROSEHILL	2	RES	60	55	54	50	Y		57.7	62		0	2.7	3.7	7.7	-	7.7	None	Noticable	Noticable	Noticable
NCA05	761133	2-4 SHORT ST, ROSEHILL	1	RES	60	55	54	50			50.2	54.5		0	0	0	0.2	-	0.2	None	None	None	Noticable

NCA05	761207	3 A'BECKETT ST, GRANVILLE	1	RES	60	55	54	50			50.4	54.7		0	0	0	0.4	-	0.4	None	None	None	Noticable
NCA05	761215	67 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		59.6	63.9		0	4.6	5.6	9.6	-	9.6	None	Noticable	Noticable	Noticable

C.1b Vibration

NCA	Receiver	Address	Land use	Vibration Impact

Appendix C.1b - Pour Pile FA-4 - Detailed predictions

C.1b Noise

Assessment: Piling Works Unwin St					NML, LAeq, 15 minute				Sleep, LAmax		Predicted noise level, dBA		Exceedance summary										
														Exceed NML by (dB):				Exceed sleep disturbance by (dB):		Impact classification			
NCA	Rec	Address	Flr	Land use	Day	O/day	Eve	Night	Screen	Awake	Cumulative LAeq, 15 minute	LMax	Highly Affected?	Day	O/day	Eve	Night	Screen	Awake	Day	O/day	Eve	Night
NCA05	760636	63-65 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		59.8	64.3		0	4.8	5.8	9.8	-	9.8	None	Noticable	Noticable	Noticable
NCA05	760732	4 A'BECKETT ST, GRANVILLE	1	IND	60	55	54	50			51.1	55.6		0	0	0	1.1	-	1.1	None	None	None	Noticable
NCA05	760733	71 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		56.9	61.4		0	1.9	2.9	6.9	-	6.9	None	Noticable	Noticable	Noticable
NCA05	760810	35-43 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50			52.6	57.1		0	0	0	2.6	-	2.6	None	None	None	Noticable
NCA05	760811	35-43 PENELOPE LUCAS LANE, ROSEHILL	2	RES	60	55	54	50			53.1	57.6		0	0	0	3.1	-	3.1	None	None	None	Noticable
NCA05	760850	88 JAMES RUSE DR, ROSEHILL	5	RES	60	55	54	50			50.2	54.7		0	0	0	0.2	-	0.2	None	None	None	Noticable
NCA05	760855	19 SHORT ST, ROSEHILL	1	RES	60	55	54	50			50.7	55.2		0	0	0	0.7	-	0.7	None	None	None	Noticable
NCA05	760857	49 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		56	60.5		0	1	2	6	-	6	None	Noticable	Noticable	Noticable
NCA05	760859	55 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		58	62.5		0	3	4	8	-	8	None	Noticable	Noticable	Noticable
NCA05	760893	25 SHORT ST, ROSEHILL	1	RES	60	55	54	50			51.3	55.8		0	0	0	1.3	-	1.3	None	None	None	Noticable
NCA05	760903	19 SHORT ST, ROSEHILL	1	RES	60	55	54	50			51.8	56.3		0	0	0	1.8	-	1.8	None	None	None	Noticable
NCA05	760941	47 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50			55.3	59.8		0	0.3	1.3	5.3	-	5.3	None	Noticable	Noticable	Noticable
NCA05	760955	7 SHORT ST, ROSEHILL	1	RES	60	55	54	50			54.1	58.6		0	0	0.1	4.1	-	4.1	None	None	Noticable	Noticable
NCA05	760961	69 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y	Y	61.7	66.2		1.7	6.7	7.7	11.7	1	11.7	Noticable	Noticable	Noticable	Clearly Audible
NCA05	760962	9 SHORT ST, ROSEHILL	1	RES	60	55	54	50			52.6	57.1		0	0	0	2.6	-	2.6	None	None	None	Noticable
NCA05	760977	57-61 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		59.2	63.7		0	4.2	5.2	9.2	-	9.2	None	Noticable	Noticable	Noticable
NCA05	760978	57-61 PENELOPE LUCAS LANE, ROSEHILL	2	RES	60	55	54	50	Y		59.9	64.4		0	4.9	5.9	9.9	-	9.9	None	Noticable	Noticable	Noticable
NCA05	760990	6 A'BECKETT ST, GRANVILLE	1	RES	60	55	54	50			50.5	55		0	0	0	0.5	-	0.5	None	None	None	Noticable
NCA05	761020	88 JAMES RUSE DR, ROSEHILL	1	RES	60	55	54	50			50.7	55.2		0	0	0	0.7	-	0.7	None	None	None	Noticable
NCA05	761021	88 JAMES RUSE DR, ROSEHILL	2	RES	60	55	54	50			50.7	55.2		0	0	0	0.7	-	0.7	None	None	None	Noticable
NCA05	761022	88 JAMES RUSE DR, ROSEHILL	3	RES	60	55	54	50			51	55.5		0	0	0	1	-	1	None	None	None	Noticable
NCA05	761023	88 JAMES RUSE DR, ROSEHILL	4	RES	60	55	54	50			51.6	56.1		0	0	0	1.6	-	1.6	None	None	None	Noticable
NCA05	761024	88 JAMES RUSE DR, ROSEHILL	5	RES	60	55	54	50			52	56.5		0	0	0	2	-	2	None	None	None	Noticable
NCA05	761025	88 JAMES RUSE DR, ROSEHILL	6	RES	60	55	54	50			52.3	56.8		0	0	0	2.3	-	2.3	None	None	None	Noticable
NCA05	761041	51 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		56.8	61.3		0	1.8	2.8	6.8	-	6.8	None	Noticable	Noticable	Noticable
NCA05	761055	53 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		57.4	61.9		0	2.4	3.4	7.4	-	7.4	None	Noticable	Noticable	Noticable
NCA05	761065	45 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50			54.7	59.2		0	0	0.7	4.7	-	4.7	None	None	Noticable	Noticable
NCA05	761100	67 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		57	61.5		0	2	3	7	-	7	None	Noticable	Noticable	Noticable
NCA05	761105	69 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50			55.9	60.4		0	0.9	1.9	5.9	-	5.9	None	Noticable	Noticable	Noticable
NCA05	761106	69 PENELOPE LUCAS LANE, ROSEHILL	2	RES	60	55	54	50	Y		57.5	62		0	2.5	3.5	7.5	-	7.5	None	Noticable	Noticable	Noticable
NCA05	761207	3 A'BECKETT ST, GRANVILLE	1	RES	60	55	54	50			50.2	54.7		0	0	0	0.2	-	0.2	None	None	None	Noticable
NCA05	761215	67 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		59.4	63.9		0	4.4	5.4	9.4	-	9.4	None	Noticable	Noticable	Noticable

C.1b Vibration

NCA	Receiver	Address	Land use	Vibration Impact

Appendix C2.a Drill Pile FB-1 - Detailed predictions

C.2a Noise

Assessment: Piling Works Unwin St					NML, LAeq, 15 minute				Sleep, LAmax		Predicted noise level, dBA		Exceedance summary									
														Exceed NML by (dB):				Exceed sleep disturbance by (dB):		Impact classification			
NCA	Rec	Address	Flr	Land use	Day	O/day	Eve	Night	Screen	Awake	Cumulative LAeq, 15 minute	LMax	Highly Affected?	Day	O/day	Eve	Night	Screen	Awake	Day	O/day	Eve	Night
NCA05	76063	63-65 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		57.6	64.3		0	2.6	3.6	7.6	-	7.6	None	Noticable	Noticable	Noticable
NCA05	76073	71 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		55	61.7		0	0	1	5	-	5	None	None	Noticable	Noticable
NCA05	76081	35-43 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50			50.2	56.9		0	0	0	0.2	-	0.2	None	None	None	Noticable
NCA05	76081	35-43 PENELOPE LUCAS LANE, ROSEHILL	2	RES	60	55	54	50			50.5	57.2		0	0	0	0.5	-	0.5	None	None	None	Noticable
NCA05	76085	49 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		53.8	60.5		0	0	0	3.8	-	3.8	None	None	None	Noticable
NCA05	76085	55 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		55.8	62.5		0	0.8	1.8	5.8	-	5.8	None	Noticable	Noticable	Noticable
NCA05	76094	47 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50			53.1	59.8		0	0	0	3.1	-	3.1	None	None	None	Noticable
NCA05	76095	7 SHORT ST, ROSEHILL	1	RES	60	55	54	50			52.5	59.2		0	0	0	2.5	-	2.5	None	None	None	Noticable
NCA05	76096	69 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y	Y	59.5	66.2		0	4.5	5.5	9.5	1	9.5	None	Noticable	Noticable	Noticable
NCA05	76096	9 SHORT ST, ROSEHILL	1	RES	60	55	54	50			50.4	57.1		0	0	0	0.4	-	0.4	None	None	None	Noticable
NCA05	76097	57-61 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		57	63.7		0	2	3	7	-	7	None	Noticable	Noticable	Noticable
NCA05	76097	57-61 PENELOPE LUCAS LANE, ROSEHILL	2	RES	60	55	54	50	Y		57.7	64.4		0	2.7	3.7	7.7	-	7.7	None	Noticable	Noticable	Noticable
NCA05	76104	51 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		54.6	61.3		0	0	0.6	4.6	-	4.6	None	None	Noticable	Noticable
NCA05	76105	53 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		55.2	61.9		0	0.2	1.2	5.2	-	5.2	None	Noticable	Noticable	Noticable
NCA05	76106	45 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50			52.4	59.1		0	0	0	2.4	-	2.4	None	None	None	Noticable
NCA05	76110	67 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		54.8	61.5		0	0	0.8	4.8	-	4.8	None	None	Noticable	Noticable
NCA05	76110	69 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50			53.7	60.4		0	0	0	3.7	-	3.7	None	None	None	Noticable
NCA05	76110	69 PENELOPE LUCAS LANE, ROSEHILL	2	RES	60	55	54	50	Y		55.3	62		0	0.3	1.3	5.3	-	5.3	None	Noticable	Noticable	Noticable
NCA05	76121	67 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		57.2	63.9		0	2.2	3.2	7.2	-	7.2	None	Noticable	Noticable	Noticable

C.2a Vibration

NCA	Receiver	Address	Land use	Vibration Impact

Appendix C.2.b - Pour Pile FB-1 - Detailed predictions

C.2b Noise

Assessment: Piling Works Unwin St					NML, LAeq, 15 minute				Sleep, LAmax		Predicted noise level, dBA		Exceedance summary									
														Exceed NML by (dB):				Exceed sleep disturbance by (dB):		Impact classification			
NCA	Rec	Address	Flr	Land use	Day	O/day	Eve	Night	Screen	Awake	Cumulative LAeq, 15 minute	LMax	Highly Affected?	Day	O/day	Eve	Night	Screen	Awake	Day	O/day	Eve	Night
NCA05	760636	63-65 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		57.3	64.3		0	2.3	3.3	7.3	-	7.3	None	Noticable	Noticable	Noticable
NCA05	760733	71 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		54.7	61.7		0	0	0.7	4.7	-	4.7	None	None	Noticable	Noticable
NCA05	760811	35-43 PENELOPE LUCAS LANE, ROSEHILL	2	RES	60	55	54	50			50.2	57.2		0	0	0	0.2	-	0.2	None	None	None	Noticable
NCA05	760857	49 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		53.5	60.5		0	0	0	3.5	-	3.5	None	None	None	Noticable
NCA05	760859	55 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		55.5	62.5		0	0.5	1.5	5.5	-	5.5	None	Noticable	Noticable	Noticable
NCA05	760941	47 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50			52.8	59.8		0	0	0	2.8	-	2.8	None	None	None	Noticable
NCA05	760955	7 SHORT ST, ROSEHILL	1	RES	60	55	54	50			52.2	59.2		0	0	0	2.2	-	2.2	None	None	None	Noticable
NCA05	760961	69 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y	Y	59.2	66.2		0	4.2	5.2	9.2	1	9.2	None	Noticable	Noticable	Noticable
NCA05	760962	9 SHORT ST, ROSEHILL	1	RES	60	55	54	50			50.1	57.1		0	0	0	0.1	-	0.1	None	None	None	Noticable
NCA05	760977	57-61 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		56.7	63.7		0	1.7	2.7	6.7	-	6.7	None	Noticable	Noticable	Noticable
NCA05	760978	57-61 PENELOPE LUCAS LANE, ROSEHILL	2	RES	60	55	54	50	Y		57.4	64.4		0	2.4	3.4	7.4	-	7.4	None	Noticable	Noticable	Noticable
NCA05	761041	51 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		54.3	61.3		0	0	0.3	4.3	-	4.3	None	None	Noticable	Noticable
NCA05	761055	53 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		54.9	61.9		0	0	0.9	4.9	-	4.9	None	None	Noticable	Noticable
NCA05	761065	45 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50			52.1	59.1		0	0	0	2.1	-	2.1	None	None	None	Noticable
NCA05	761100	67 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		54.5	61.5		0	0	0.5	4.5	-	4.5	None	None	Noticable	Noticable
NCA05	761105	69 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50			53.4	60.4		0	0	0	3.4	-	3.4	None	None	None	Noticable
NCA05	761106	69 PENELOPE LUCAS LANE, ROSEHILL	2	RES	60	55	54	50	Y		55	62		0	0	1	5	-	5	None	None	Noticable	Noticable
NCA05	761215	67 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		56.9	63.9		0	1.9	2.9	6.9	-	6.9	None	Noticable	Noticable	Noticable

C.2 Vibration

NCA	Receiver	Address	Land use	Vibration Impact

Appendix C.3(a-b) Spoil Haulage and cleanup - Detailed predictions

C.3 Noise

Assessment: Piling Works Unwin St					NML, LAeq, 15 minute				Sleep, LAmax		Predicted noise level, dBA		Exceedance summary										
														Exceed NML by (dB):				Exceed sleep disturbance by (dB):		Impact classification			
NCA	Rec	Address	Flr	Land use	Day	O/day	Eve	Night	Screen	Awake	Cumulative LAeq, 15 minute	LMax	Highly Affected?	Day	O/day	Eve	Night	Screen	Awake	Day	O/day	Eve	Night
NCA05	760636	63-65 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		55.9	63.3		0	0.9	1.9	5.9	-	5.9	None	Noticable	Noticable	Noticable
NCA05	760733	71 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		54.1	61.4		0	0	0.1	4.1	-	4.1	None	None	Noticable	Noticable
NCA05	760857	49 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		53	60.7		0	0	0	3	-	3	None	None	None	Noticable
NCA05	760859	55 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		54.5	62.1		0	0	0.5	4.5	-	4.5	None	None	Noticable	Noticable
NCA05	760941	47 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50			52.3	59.9		0	0	0	2.3	-	2.3	None	None	None	Noticable
NCA05	760955	7 SHORT ST, ROSEHILL	1	RES	60	55	54	50			51.5	58.8		0	0	0	1.5	-	1.5	None	None	None	Noticable
NCA05	760961	69 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		57.6	65.2		0	2.6	3.6	7.6	-	7.6	None	Noticable	Noticable	Noticable
NCA05	760977	57-61 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		55.2	62.7		0	0.2	1.2	5.2	-	5.2	None	Noticable	Noticable	Noticable
NCA05	760978	57-61 PENELOPE LUCAS LANE, ROSEHILL	2	RES	60	55	54	50	Y		55.9	63.4		0	0.9	1.9	5.9	-	5.9	None	Noticable	Noticable	Noticable
NCA05	761041	51 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		53.7	61.3		0	0	0	3.7	-	3.7	None	None	None	Noticable
NCA05	761055	53 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		54.1	61.7		0	0	0.1	4.1	-	4.1	None	None	Noticable	Noticable
NCA05	761065	45 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50			51.3	58.9		0	0	0	1.3	-	1.3	None	None	None	Noticable
NCA05	761070	63-65 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50			51.6	58.9		0	0	0	1.6	-	1.6	None	None	None	Noticable
NCA05	761100	67 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		52.9	60.5		0	0	0	2.9	-	2.9	None	None	None	Noticable
NCA05	761105	69 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50			52.6	59.9		0	0	0	2.6	-	2.6	None	None	None	Noticable
NCA05	761106	69 PENELOPE LUCAS LANE, ROSEHILL	2	RES	60	55	54	50	Y		53.9	61.3		0	0	0	3.9	-	3.9	None	None	None	Noticable
NCA05	761215	67 PENELOPE LUCAS LANE, ROSEHILL	1	RES	60	55	54	50	Y		56.2	63.7		0	1.2	2.2	6.2	-	6.2	None	Noticable	Noticable	Noticable

C.3 Vibration

NCA	Receiver	Address	Land use	Vibration Impact