Construction Noise and Vibration Impact Statement

SMCSWSSJ-JHL-WSS-EM-REP-000002

Document and Revision History

Document Details	
Title	Construction Noise and Vibration Impact Statement
Client	Sydney Metro City & Southwest
Client reference no.	SMCSWSSJ-JHL-WSS-EM-REP-000002
JHLOR JV contract no.	K44

Revisions

Revision	Date	Description	Prepared by	Reviewed by
0	11/7/2018	Draft Issued for Review	Ashley Stevens (Wilkinson Murray)	Barry Murray (Wilkinson Murray)
1	16/8/2018	Updated to address comments from SM, AA, ER	Ashley Stevens (Wilkinson Murray)	Barry Murray (Wilkinson Murray)
2	21/8/2018	Updated following workshop to address minor comments.	Ashley Stevens (Wilkinson Murray)	Barry Murray (Wilkinson Murray)

ACOUSTICS AND AIR

SYDENHAM STATION & JUNCTION PROJECT

CONSTRUCTION NOISE & VIBRATION IMPACT STATEMENT

REPORT NO. 16134-J
VERSION C

AUGUST 2018

PREPARED FOR

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DOCUMENT CONTROL

Version	Status	Date	Prepared By	Reviewed By
A	Draft	11 July 2018	Ash Stevens	Barry Murray
B	Final	15 August 2018	Ash Stevens	Barry Murray
C	Final	20 August 2018	Ash Stevens	Barry Murray

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GLOSSARY OF ACOUSTIC TERMS

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph below, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

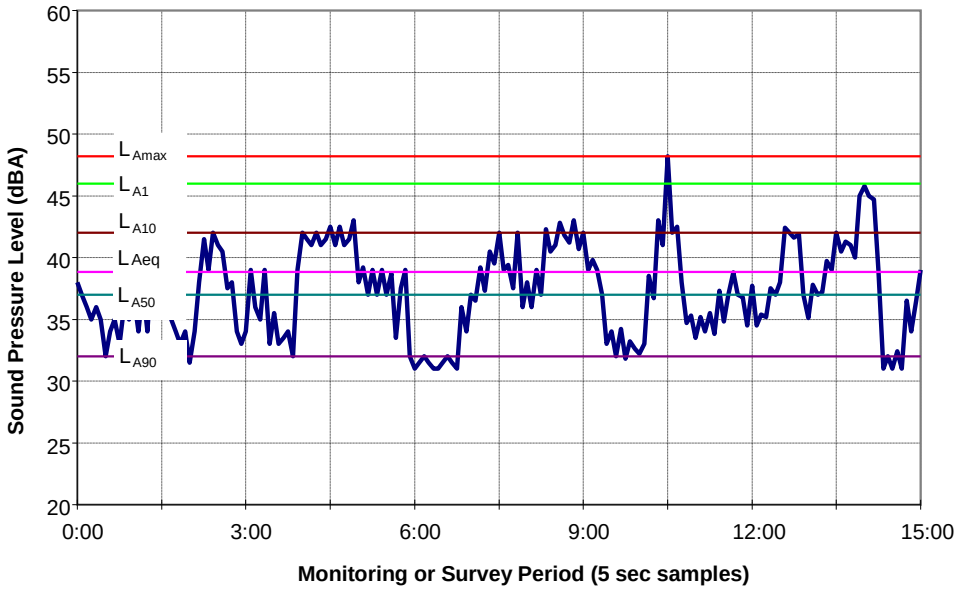
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10th percentile (lowest 10th percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.

Typical Graph of Sound Pressure Level vs Time



GLOSSARY OF VIBRATION TERMS

Displacement – A vector quantity that specifies the change of position of a body or particle with respect to a reference frame.

Velocity – A vector quantity that specifies the time derivative of displacement.

Acceleration – Acceleration is rate of change of velocity with time usually along a specified axis, usually expressed in m/s^2

Hertz (Hz) – Units in which frequency is expressed. Synonymous with cycles per second.

Decibel – Ratios of identical quantities are expressed in decibel or decibel or dB units. The number of dB is "ratiod" against some standard or reference value in terms of the base 10 logarithm of that ratio. In measuring acoustic or vibration power (as in PSD or ASD of random vibration), the number of dB = 10 log10 P/P_o. P_o, the reference level, equals 0 dB. In measuring the more common voltage-like quantities such as acceleration, the number of dB = 20 log10 E/E_o E_o, the reference level, equals 0 dB.-

Peak – Extreme value of a varying quantity, measured from the zero or mean value. Also, a maximum spectral value.

Peak-to-peak value – The algebraic difference between extreme values (as D = 2X).

Duration of a shock pulse is how long it lasts. Time is usually measured between instants when the amplitude is greater than 10% of the peak value.

Amplitude – The magnitude of variation (in a changing quantity) from its zero value. Always modify it with an adjective such as **peak, RMS, average**, etc. May refer to displacement, velocity, acceleration.

Crest factor – *Of an oscillating quantity.* The ratio of the peak value to the r.m.s. value.

VDV – The Vibration Dose Value is the accumulation of energy measured over a given time period, proportional to the root mean quad of acceleration. This is usually measured in each of the three axes of motion. In most cases, vibration tends to be higher in the Z (vertical) axis. This is measured with units of $m/s^{1.75}$.

PPV – Peak Particle Velocity is the instantaneous peak of the resultant vector sum of all three axes of motion. Results are expressed in terms of velocity normally mm/s.

Peak Acceleration – This is the peak acceleration level measured in each of the three axes of motion. In some cases, this can also be combined in a vector sum. This is measured in m/s^2.

Accelerometer – A sensor or transducer or pickup for converting acceleration to an electrical signal. Two common types are piezoresistive and piezoelectric.

Charge amplifier – An amplifier which converts a charge input signal (as from an accelerometer) into an output voltage; a charge-to-voltage converter.

Geophone – A sensor or transducer or pickup for converting velocity to an electrical signal.

1 INTRODUCTION

Wilkinson Murray (WM) has been commissioned by John Holland Laing O'Rourke Joint Venture (JHLORJV) to prepare a Construction Noise and Vibration Impact Statement (CNVIS) relating to the construction associated with the upgrade of Sydenham Station and Junction (SSJ). These construction works are part of the Sydney Metro City and Southwest Project.

This CNVIS has been prepared in compliance with Condition of Approval (CoA) E33 outlined in the Infrastructure Approval SSI-7400, which states:

Construction Noise and Vibration Impact Statements must be prepared for each construction site before construction noise and vibration impacts commence and include specific mitigation measures identified through consultation with affected sensitive receivers.

The assessment has been conducted in accordance with the Construction Noise and Vibration Management Plan (CNVMP) and the following noise and vibration guidelines.

- *Interim Construction Noise Guideline* (DECC, 2009) – *ICNG*
- *Sydney Metro City & Southwest Construction Noise and Vibration Strategy* (2017) – *CNVS*
- *NSW Industrial Noise Policy (NSW EPA, 2000) – INP*
- *Transport for NSW Construction Noise and Vibration Strategy – April 2018 (TfNSW 2018)*

This CNVIS supersedes the EIS noise and vibration assessment, which was not nearly as detailed. It is to be reviewed by the ER and the AA, as per CoA A24(d) and A27(d) respectively.

2 SITE DESCRIPTION

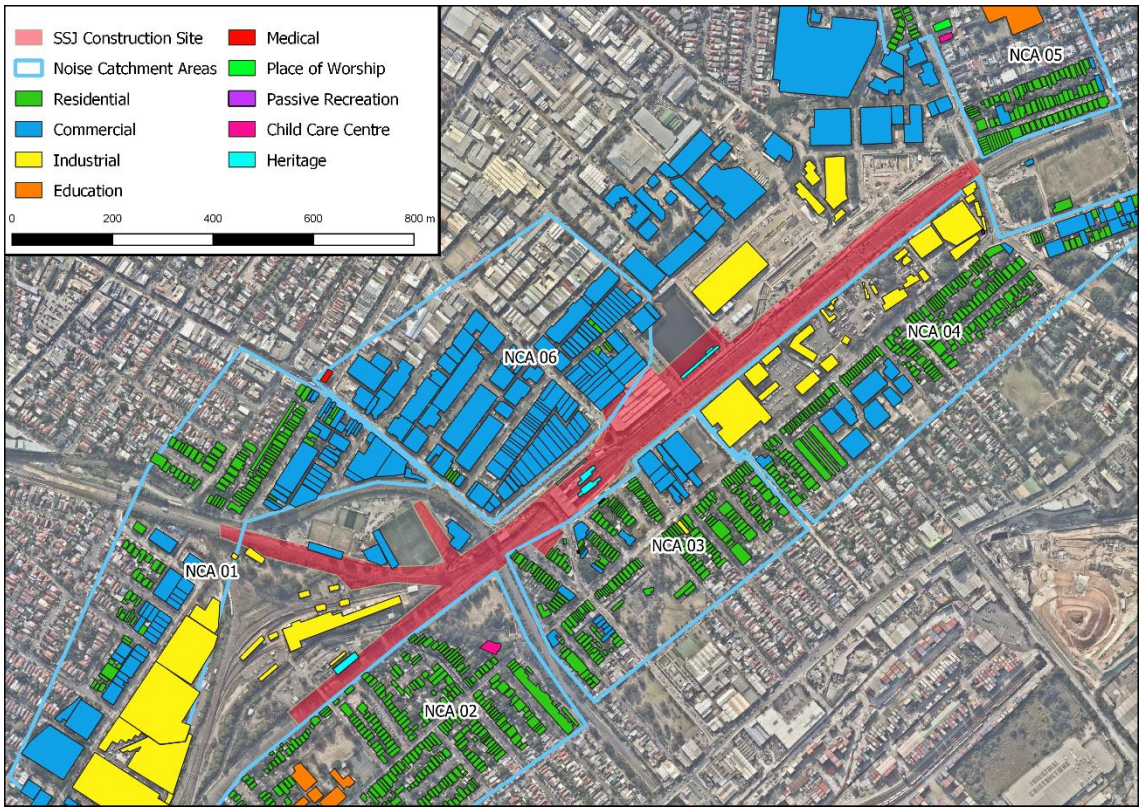
Construction activities will be focused around Sydenham Station and adjacent areas of track. Works will extend north east towards the city approximately 1km to the Bedwin Road Bridge, and south west approximately 550m on both tracks. Figure 2-1 presents the SSJ works site and surrounding area.

Surrounding the site is a mixture of residential, commercial and industrial premises. To the north of the site, adjacent to the rail corridor, is the part of the Tunnel and Station Excavation Works of the Sydney Metro City and Southwest Project. These works have been assessed under a separate CNVIS.

Nearby sensitive receivers have been divided into 6 different noise catchment areas (NCA) based on their acoustic environment. The NCA's are presented in Figure 2-1.

The defined noise catchment areas are consistent with those defined in the Environmental Impact Statement (EIS) for this project (*Sydney Metro City & Southwest Sydenham to Bankstown, Technical Paper 2 - Noise and Vibration Assessment, Report Number 610.15897-R02*) and the Sydney Metro City & Southwest Project Marrickville Construction Site CNVIS prepared by Renzo Tonin and Associates (*TH511-02 01.10.03 D01 MDS CNVIS*) where applicable.

Figure 2-1 Sydenham Station and surrounding area



2.1 Residential Receivers

Residential premises are located in all noise catchment areas. Noise catchment areas 02 and 05 consist of almost entirely residential receivers. NCA 03 has residences south of Burrows Ave and these are the closest to the Sydenham Station and Junction work site. More residences are located on the far side of Unwins Bridge Road, with an area of commercial/industrial land separating them form the site. Residences in NCA 04 are also located on the far side of Unwins Bridge Road and separated from the site by industrial land. NCA 01 and 06 have a small number of residential receivers, positioned back from the site behind commercial and industrial land

2.1.1 Sydney Airport Upgraded Glazing

As discussed in the CNVMP many residences in the vicinity of Sydenham Station have been fitted with heavy double glazing as part of the Sydney Airport Noise Management Plan. The area has been inspected and the double glazing has been determined as having an air space of at least 100mm. It is therefore conservatively estimated to reduce internal noise levels by at least 20dB more than that from the partially open window conditions, that is, by a total of 30dB.

All residential receivers in NCA 03 and NCA 04 that are potentially affected by construction noise have been fitted with the heavy double glazing. Some of the receivers, however not all, in NCA 01 and NCA 02 have also been fitted with the upgraded glazing.

2.2 Commercial and Industrial Receivers

Most commercial receivers in the SSJ vicinity are located to the north of the rail corridor, in NCAs 01 and 06. To the south of the rail corridor there are small areas of commercial premises, including some close to the station in Sydenham.

There is an area of industrial land adjacent to the rail corridor in NCA 04 that extends back as far as Unwins Bridge Road. At the south western end of the site is the Sydenham Maintenance Centre.

2.3 Other Sensitive Receivers

As detailed in the CNVS other types of sensitive receivers should be classified separately. The other sensitive receivers, as defined in the CNVS, that have been identified are presented in Table 2-1.

Table 2-1 Other sensitive receivers

ID	Receiver Type	Name	Address
NCA 02_OSR_1	Child Care Centre	Tillman Park Early Learning	81 Unwins Bridge Road, Tempe
NCA 02_OSR_2	Educational Institution	Tempe High School	Unwins Bridge Road, Tempe
NCA 03_OSR_1	Passive Recreation	The Boxcar Cafe	4 Burrows Ave, Sydenham
NCA 03_OSR_2	Passive Recreation	The Tinhorn Café	11 Gleeson Ave, Sydenham
NCA 04_OSR_1	Passive Recreation	Industrial Lunchbox	7/1 Unwins Bridge Road, St Peters
NCA 05_OSR_1	Child Care Centre	Only About Children	290 Edgeware Road, Enmore
NCA 05_OSR_2	Educational Institution	Camdenville Public School	Laura Street, Newtown
NCA 05_OSR_3	Place of Worship	St Pius Catholic Church	290 Edgeware Road, Enmore
NCA 06_OSR_1	Medical Facility	Comprehensive Medical Imaging	111 Marrickville Road, Marrickville

2.4 Heritage

There are a number of heritage structures in the vicinity of the Sydenham Station and Junction works that could potentially be impacted by construction activities. These structures have been identified in the Modification Report and are summarised below.

A structural assessment of the existing buildings on Sydenham Station has been conducted. Results of this assessment indicate that all buildings associated with the station are structurally sound, including the heritage platform buildings.

Table 2-2 Local heritage structures

Location	Heritage Element	Comment
Sydenham Station	Platform Building 1	Widening of the track will have potential impact.
	Platform Building 6	Widening of the track will have potential impact.
	Brick perimeter walls	Widening of the track will have impact. These walls will be rebuilt in a different location.
Sydenham Pit and Drainage Pumping Station	Pumping station	A new pumping station will be built to assist this aging infrastructure. No works will take place on the existing pumping station.
	Pit wall	The new pumping station has potential to impact the existing pit wall.

3 SUMMARY OF CONSTRUCTION WORKS

Construction works associated with this project are expected to run until April 2021. As almost all works will occur within an operational rail corridor and in order to allow for the continued operation of the Sydney rail network, they will often take place during possessions overnight and on weekends.

The construction periods as defined in the CNVS are presented in Table 5-1, below in section 5. Construction works for this project will occur throughout all of these periods.

For this assessment a number of scenarios have been assessed. These scenarios have been chosen to capture each of the stages of the construction and to predict the typical and worst-case noise impacts on surrounding receivers. The construction scenarios that have been assessed are presented in Table 3-1, along with the proposed equipment and noise levels. The selected scenarios will use relatively noisy equipment and will occur close to sensitive receivers. In addition, these works will often occur outside of normal construction hours, when the noise impact is greatest.

The worst-case activities during each relevant time period, considering both the *ICNG* and *CNVS,* have been identified and form the focus of this assessment. On this basis, it is critical to note that a worst case 15-minute noise level is predicted and that during the period of work noise levels are likely to be lower for most of the time.

Table 3-1 Summary of works and sound power levels

	Description	Location	Work Period	Main Equipment Used	Typical L_W	
					$L_{Aeq,15min}$	L_{Amax}
SC_01	Demolition of 11 Sydenham Road	11 Sydenham Road	Standard	24t excavator x2	106	116
				Jack hammer x2	**114 +5**	
				Crane truck	105	
				Hand tools	107	
				Truck and Dog	107	
				Watercart	109	
SC_02	Platform demolition	Station platforms	Standard and OOH	6.5t Excavator	103	116
				Concrete saw	**113 +5**	
				Jackhammer	**114 +5**	
				Hydrema	107	
SC_03	Platform civil works	Station platforms	Standard and OOH	CFA piling rig	108	111
				Concrete truck	107	
				Concrete pump	102	
				5t excavator	103	
				60t crane	99	
SC_04	Platform construction works	Station platforms	Standard and OOH	450t crane	106	110
				Cherry picker	100	
				Hand tools	107	

	Description	Location	Work Period	Main Equipment Used	Typical L_W	
					$L_{Aeq,15min}$	L_{Amax}
SC_05	Bridge works	Gleeson Ave Bridge ARTC Bridge Bedwin Road Bridge	Standard and OOH	EWP	100	110
				Hand tools	107	
				Multicrane	105	
				Telehandler	105	
SC_06	Track recon works	Rail corridor southwest of station	Standard and OOH	13t excavator	106	115
				Front end loader	112	
				Hydrema	107	
				Telehandler	105	
				Tamper	**115 +5**	
				Regulator	**110 +5**	
				Vibratory roller	**105 +5**	
SC_07	Track grinding	Rail corridor southwest of station	Standard and OOH	Rail grinder	**117 +5**	117
SC_08	Track civil works	Rail corridor northeast of station	Standard and OOH	13t excavator x2	106	112
				Concrete truck	107	
				Concrete pump	102	
				Crane truck x2	105	
				Hydrema	107	
				Vac truck	107	
				Trench roller	105	

Note: **BOLD** indicates that the activity is considered to be particularly annoying to nearby residents due to noise character and therefore the L_W receives a 5dB penalty as specified in the ICNG.

4 EXISTING NOISE ENVIRONMENT

To assess noise impacts at residential receivers from construction related activities, knowledge of the background noise levels is required.

Background noise levels have previously been measured as part of the Sydenham to Bankstown EIS prepared by SLR. Noise levels from this report have been adopted for NCA 01.

Due to difficulty obtaining consent to monitor background noise levels at a suitable location for NCA 05 and NCA 06, these levels have been adopted from the Sydney Metro City & Southwest Project Marrickville Construction Site CNVIS.

Measurements for the remaining noise catchment areas took place between Monday 18 June 2018 and Wednesday 27 June 2018. Monitoring took place at the following locations:

- NCA 02 25 Bridge Street, Tempe
- NCA 03 4 Burrows Road, Sydenham
- NCA 04 80 Unwins Bridge Road, St Peters

All measured rating background levels and ambient L_{Aeq} noise levels are presented in Table 4-1.

Table 4-1 Results of ambient unattended noise monitoring

Noise Monitoring Location	Day 7am-6pm		Evening 6pm-10pm		Night 10pm-7am	
	RBL	L_{Aeq}	RBL	L_{Aeq}	RBL	L_{Aeq}
NCA 01*	47	61	45	61	40	58
NCA 02	41	66	46	62	40	57
NCA 03	51	69	49	66	42	62
NCA 04	58	70	51	68	43	65
NCA 05**	58	69	52	66	38	62
NCA 06**	52	66	43	64	38	58

* Noise levels adopted from Sydenham to Bankstown EIS
** Noise levels adopted from Marrickville Construction Site CNVIS

To assist with the assessment of traffic noise, the 15-hour and 9-hour L_{Aeq} levels for NCA 03 and NCA 04 are presented in Table 4-2. The locations that monitoring took place are located on the designated heavy vehicle haulage routes, as detailed in the Sydenham Station and Junction Construction Traffic Management Plan.

Table 4-2 Results of monitored traffic noise

Monitoring Location		$L_{Aeq(15\ hour)}$	$L_{Aeq(9\ hour)}$
NCA 03	4 Burrows Road, Sydenham	70	65
NCA 04	80 Unwins Bridge Road, St Peters	68	62

5 NOISE MANAGEMENT LEVELS

5.1 Construction Hours

As per CoA E36, construction is permitted between the hours of 7:00am and 6:00pm Monday to Friday, and 8:00am and 1:00pm Saturday. Construction is not permitted outside these hours unless an Out of Hours Work approval is obtained, as per CoA E44 and E47.

The CNVS presents a methodology for determining numerical limits – or Noise Management Levels (NMLs) – for the impacts of construction noise on residences and other land uses according to the time period during which the noise occurs.

5.2 Airborne Construction Noise

Noise Management Levels (NMLs) for residential land uses are presented in Table 5-1.

Table 5-1 Residential noise management levels

Time of Day	Management Level $L_{Aeq(15min)}$	How to Apply
Recommended Standard Hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or Public Holidays	Noise affected RBL + 10dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq(15min)}$ is greater than the noise affected level, the proponent would apply all feasible and reasonable work practices to minimise noise. 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 75dB	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 proponent would consider very carefully if there is any other feasible and reasonable way to reduce noise to below this level. If no quieter work method is feasible and reasonable, and the works proceed, the proponent would communicate with the impacted residents by clearly explaining the duration and noise level of the works, and by describing any respite periods that will be provided.
Outside Recommended Standard Hours	Noise affected RBL + 5dB	A strong justification would typically be required for works outside the recommended standard hours. The proponent would 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 5dBA above the noise affected level, the proponent would negotiate with the community. For guidance on negotiating agreements see section 7.2.2 of the ICNG.

The NMLs for other land uses as outlined in the CNVS, applicable to this project are presented in Table 5-2.

Table 5-2 Non-residential noise management levels

Land Use	Noise Management Level
Commercial premises	External noise level $L_{Aeq(15min)}$ 70dB
Industrial premises	External noise level $L_{Aeq(15min)}$ 75dB
Classrooms at schools and other educational institutions	Internal noise level $L_{Aeq(15min)}$ 45dB
Hospital wards and operating theatres	Internal noise level $L_{Aeq(15min)}$ 45dB
Places of worship	Internal noise level $L_{Aeq(15min)}$ 45dB
Active recreation areas (such as parks and sports grounds or playgrounds)	External noise level $L_{Aeq(15min)}$ 65dB
Passive recreation areas (such as outdoor grounds used for teaching, outdoor cafes or restaurants)	External noise level $L_{Aeq(15min)}$ 60dB
Child care centres	External noise level $L_{Aeq(1hr)}$ 55dB Internal noise level $L_{Aeq(1hr)}$ 40dB

The noise management levels for residential, commercial and industrial receivers are applicable to external areas of the premises. When assessing other sensitive non-residential receivers with internal noise criteria, such as education facility, place of worship or medical centre, a 10dB reduction through a partially open window can be assumed, as detailed in the ICNG and CNVMP. This allows for predictions to external areas of the premises.

Based on the collected background ambient noise levels, the Noise Management Levels presented in Table 5-3 have been established. In compliance with INP the NML for the evening period at NCA 02 has been reduced to the level during the day NML.

Table 5-3 Project noise management levels – $L_{Aeq,15min}$

Receiver Type	Standard Hours (RBL +10dB)	Outside Recommended Standard Hours (RBL +5dB)		
	Day	Day (Saturday & Sunday)	Evening	Night
Residential NCA 01	57	52	50	45
Residential NCA 02	51	46	46	45
Residential NCA 03	61	56	54	47
Residential NCA 04	68	63	56	48
Residential NCA 05	68	63	57	43
Residential NCA 06	62	57	48	43

5.3 Sleep Disturbance

In accordance with the CNVMP and Section 11.4 of the Sydenham Station and Sydney Metro Trains Facility South Modification Report, a sleep disturbance NML of L_{Amax} 55dBA (internal) has been adopted, which equates to an external noise level of 65 dBA (assuming open windows).

The CNVS provides further assessment of sleep disturbance, indicating that one or two events per night, with maximum internal noise levels of 65-70dBA, are not likely to affect health and wellbeing significantly.

5.4 Construction Traffic Noise

As described in the CNVMP and the CNVS there are no specific traffic noise criteria relating to construction work. Criteria are therefore adopted from Road Noise Policy (RNP) published by the EPA.

The CNVS states that construction traffic noise management levels are set 2dB above the existing road traffic noise levels during the day and night periods. Where the road traffic noise levels are predicted to increase by more than 2dB as a result of construction traffic, consideration is to be given to reasonable and feasible mitigation measures. In considering these mitigation measures, consideration would also be given to the actual noise levels associated with the construction traffic and whether or not these levels comply with the criteria in the RNP. These criteria are presented in Table 5-4.

Table 5-4 Road traffic noise criteria

Road Type	Period	Criteria
Freeway Arterial Sub Arterial	Day	$L_{Aeq(15\ hour)}$ 60dB
	Night	$L_{Aeq(9\ hour)}$ 55dB
Local	Day	$L_{Aeq(15\ hour)}$ 55dB
	Night	$L_{Aeq(9\ hour)}$ 50dB

6 PREDICTION & ASSESSMENT OF NOISE LEVELS

6.1 Methodology of Predictions

Site related noise emissions were modelled using the CadnaA noise prediction software. To complete this, a representative 3-D model within the software was constructed of the site and surrounding receivers.

Factors that are addressed in the modelling are:

- source sound level emissions and locations;
- screening effects from buildings
- receiver locations;
- ground topography;
- noise attenuation due to geometric spreading; and
- atmospheric absorption and ground effects.

Detailed topographic information has been sourced from NSW Government – Land & Property Information and used in our acoustic model.

The modelling software allows for ground effects (assigned as 50% on this project), air absorption, distance attenuation and shielding from the terrain as well as buildings. A 10m x 10m grid has been used to generate contours for predictions.

6.2 Standard Mitigation Measures

As identified in the Construction Noise and Vibration Management Plan, the most practical approach to minimise noise impact on surrounding receivers is to implement common sense noise management measures.

The following Standard Mitigation Measures (SMM) have been discussed in the CNVMP and should be implemented where practicable.

- Equipment Selection – All plant at the work sites should be appropriately selected, and where necessary, fitted with silencers or placed behind barriers. Further to this, orientation of equipment shall be considered to minimise the noise to receivers. The use of broadband style reversing alarms is also recommended, replacing the tonal alarms.
- Not Scheduling Work during the Night – It is understood that most of the works must be completed during a scheduled possession and therefore works will be undertaken for extended periods of time. All planning is to be undertaken to allocate the noisiest works during the less sensitive day period, followed by the evening period. For night works, the period before midnight is generally considered less sensitive than after midnight.
- Environmental Inductions – All personnel inducted onto the project should be trained in order to raise their awareness of potential noise problems. This includes identifying noise sensitive receivers. As a result of this, operators should increase their use of techniques to minimise noise emission.

- Temporary Noise Barriers – The use of temporary noise barriers should be considered where works are conducted by stationary plant or plant working in a confined location. This is particularly important for works occurring at the eastern and western ends of the site, near NCA 02 and NCA 05, as these receivers are closer to the site and potential do not have heavy double glazing. Appreciating the time to setup and remove at the beginning of each work period, a barrier such as the SilentUp noise barrier should be considered.

6.3 Predicted Construction Noise Levels

Predicted worst case noise levels at all nearby receivers for each construction scenario, as well as the applicable NML, are presented in the following tables. Noise contours are provided in Appendix A and a full list of predicted noise levels for each receiver is provided in Appendix B.

Demolition works at 11 Sydenham Road (Scenario 1) will only occur during standard construction hours. Works for all other scenario are expected to occur outside standard working hours. The OOH works are likely to occur during daytime, evening and night time. Accordingly, the NML for OOH works in the table is for night time, as this assesses the worst potential impact. Predicted L_{Amax} noise levels are also presented for these scenarios.

Table 6-1 Predicted worst-case residential noise levels for Scenario 1 – standard hours

Receiver	NML	Predicted Worst-Case $L_{Aeq,15min}$
NCA 01	**57**	36
NCA 02	**51**	42
NCA 03	**61**	65
NCA 04	**68**	48
NCA 05	**68**	44
NCA 06	**62**	50

Noise levels shaded light blue indicate exceedances above the applicable NML.

During Scenario 1 exceedances of the NML for residential receivers are predicted in NCA 03 only. Highly Noise Affected Management Level of $L_{Aeq(15min)}$ 75dBA is not predicted to be exceeded. It is noted that the predicted noise level at the worst affected receiver is below the measured ambient day period L_{Aeq} level.

As this construction activity is only proposed to occur during standard working hours, sleep disturbance has not been considered.

Table 6-2 Predicted worst-case residential noise levels for Scenario 2 - OOH

Receiver	NML	Predicted Worst-Case $L_{Aeq,15min}$	Predicted L_{Amax}
NCA 01	**45**	35	56
NCA 02	**45**	42	59
NCA 03	**47**	74	82
NCA 04	**48**	43	63
NCA 05	**43**	40	58
NCA 06	**43**	45	66

Noise levels shaded light blue indicate exceedances above the applicable NML. Noise levels shaded green exceed the sleep disturbance screening criteria.

During Scenario 2 exceedances of the NML for residential receivers are predicted in NCA 03 and NCA 06. The Highly Noise Affected Management Level of $L_{Aeq(15min)}$ 75dBA is not predicted to be exceeded.

The sleep disturbance level is predicted to be exceeded in NCA 03 and marginally in NCA 06.

Scenario 2 represents the demolition works to be undertaken on platform 1. These works are confined to a small area and therefore the use of temporary noise barriers should be considered. The barrier should extend a minimum 1m above the height of the platform and run parallel to the platform such that the residences along Burrows Avenue, between Hogan Avenue and Swain Street, do not have line of site to the works.

Demolition works are also proposed at other platforms and similar mitigation should be applied during these works.

Table 6-3 Predicted worst-case residential noise levels for Scenario 3 - OOH

Receiver	NML	Predicted Worst-Case $L_{Aeq,15min}$	Predicted L_{Amax}
NCA 01	**45**	33	38
NCA 02	**45**	38	42
NCA 03	**47**	68	68
NCA 04	**48**	41	47
NCA 05	**43**	35	41
NCA 06	**43**	43	50

Noise levels shaded light blue indicate exceedances above the applicable NML. Noise levels shaded green exceed the sleep disturbance screening criteria.

During Scenario 3 exceedances of the NML for residential receivers are predicted in NCA 03 only. The Highly Noise Affected Management Level of $L_{Aeq(15min)}$ 75dBA is not predicted to be exceeded.

The sleep disturbance level is predicted to be marginally exceeded in NCA 03.

Scenario 3 represents civil works being undertaken for the foundations of the platform extensions. The works are relatively confined to an area and the exceedances are predicted to occur at only a small number of residences in NCA 03. These works will require a concrete truck discharging to a concrete pump. This should occur as far to the north east as possible to utilise the shielding

provided by the large commercial buildings on Bolton Street. Temporary noise barriers should also be installed such that residences between Hogan Avenue and Swain Street do not have line of site to the works.

Table 6-4 Predicted worst-case residential noise levels for Scenario 4 - OOH

Receiver	NML	Predicted Worst-Case $L_{Aeq,15min}$	Predicted L_{Amax}
NCA 01	**45**	28	29
NCA 02	**45**	34	32
NCA 03	**47**	71	73
NCA 04	**48**	32	33
NCA 05	**43**	32	33
NCA 06	**43**	34	35

Noise levels shaded light blue indicate exceedances above the applicable NML. Noise levels shaded green exceed the sleep disturbance screening criteria.

During Scenario 4 exceedances of the NML for residential receivers are predicted in NCA 03 only. The Highly Noise Affected Management Level of $L_{Aeq(15min)}$ 75dBA is not predicted to be exceeded.

The sleep disturbance level is predicted to be exceeded in NCA 03.

Scenario 3 represent the construction of the new platforms. Noise during this scenario at residences in NCA 03 is dominated by the 450t mobile crane and to a lesser extent the hand tools. Consideration should be given to temporary noise barriers being used around the crane.

Table 6-5 Predicted worst-case residential noise levels for Scenario 5 - OOH

Receiver	NML	Predicted Worst-Case $L_{Aeq,15min}$	Predicted L_{Amax}
NCA 01	**45**	42	39
NCA 02	**45**	55	54
NCA 03	**47**	74	75
NCA 04	**48**	54	47
NCA 05	**43**	73	74
NCA 06	**43**	51	35

Noise levels shaded light blue indicate exceedances above the applicable NML. Noise levels shaded green exceed the sleep disturbance screening criteria.

During Scenario 5 exceedances of the NML for residential receivers are predicted in all NCAs except for NCA 01. The Highly Noise Affected Management Level of $L_{Aeq(15min)}$ 75dBA is not predicted to be exceeded.

The sleep disturbance level is predicted to be exceeded in NCA 03 and NCA 05.

Scenario 5 represents the works required on each of the bridges over the rail corridor. Due to the nature of the works being conducted on the bridges, at works mitigation such as temporary barriers can be difficult to implement. At receiver mitigation may be required for these works.

Table 6-6 Predicted worst-case residential noise levels for Scenario 6 - OOH

Receiver	NML	Predicted Worst-Case $L_{Aeq,15min}$	Predicted L_{Amax}
NCA 01	**45**	54	47
NCA 02	**45**	85	80
NCA 03	**47**	55	55
NCA 04	**48**	40	34
NCA 05	**43**	33	25
NCA 06	**43**	52	47

Noise levels shaded light blue indicate exceedances above the applicable NML. Noise levels shaded orange are above the Highly Noise Affected Management Level. Noise levels shaded green exceed the sleep disturbance screening criteria.

During Scenario 6 exceedances of the NML for residential receivers are predicted in NCA 01, NCA 02, NCA 03 and NCA 06. The Highly Noise Affected Management Level of $L_{Aeq(15min)}$ 75dBA is predicted to be exceeded at NCA 02.

The sleep disturbance level is predicted to be exceeded in NCA 02.

Scenario 6 represents the track modification works. Due to the mobile nature of these construction activities, mitigation such as temporary barriers are difficult to implement effectively.

Modelling of this scenario considered the works being conducted in one of the worst-case locations, however these works will be required along a significant portion of the rail corridor. Analysis of the modelling results indicates that noise levels in excess of $L_{Aeq,15min}$ 70dBA, which is close to triggering the highest level of additional mitigation (See Section 6.4), are possible at distances of up to 40m from the location of the works. Mitigation should be considered at similar distances in all areas where this work is to occur.

We understand that this work across all required areas of the site is likely to be undertaken during a single 16-day possession. Alternative accommodation is to be offered as a mitigation measure during these works.

Table 6-7 Predicted worst-case residential noise levels for Scenario 7 - OOH

Receiver	NML	Predicted Worst-Case $L_{Aeq,15min}$	Predicted L_{Amax}
NCA 01	**45**	50	43
NCA 02	**45**	85	80
NCA 03	**47**	52	54
NCA 04	**48**	35	29
NCA 05	**43**	31	22
NCA 06	**43**	47	42

Noise levels shaded light blue indicate exceedances above the applicable NML. Noise levels shaded orange are above the Highly Noise Affected Management Level. Noise levels shaded green exceed the sleep disturbance screening criteria.

During Scenario 7 exceedances of the NML for residential receivers are predicted in NCA 01, NCA 02, NCA 03 and NCA 06. The Highly Noise Affected Management Level of $L_{Aeq(15min)}$ 75dBA is predicted to be exceeded at NCA 02.

The sleep disturbance level is predicted to be exceeded in NCA 02.

Scenario 7 represents track grinding works. Similar to the works in scenario 6 these works are mobile in nature and mitigation such as temporary barriers are difficult to implement effectively.

Modelling of this scenario considered the works being conducted in one of the worst-case locations, however these works will be required along a significant portion of the rail corridor. Analysis of the modelling results indicates that noise levels in excess of $L_{Aeq,15min}$ 70dBA are possible at distances of up to 45m from the rail line where grinding is occurring. Mitigation should be considered at similar distances in all areas where this work is to occur.

We understand that this work is likely to take place concurrently with the track reconstruction works and will be undertaken during a single 16-day possession. Alternative accommodation is to be offered as a mitigation measure during these works.

Table 6-8 Predicted worst-case residential noise levels for Scenario 8 - OOH

Receiver	NML	Predicted Worst-Case $L_{Aeq,15min}$	Predicted L_{Amax}
NCA 01	**45**	31	24
NCA 02	**45**	32	27
NCA 03	**47**	38	36
NCA 04	**48**	52	52
NCA 05	**43**	63	60
NCA 06	**43**	38	33

Noise levels shaded light blue indicate exceedances above the applicable NML. Noise levels shaded green exceed the sleep disturbance screening criteria.

During Scenario 4 exceedances of the NML for residential receivers are predicted in NCA 04 and NCA 05 only. The Highly Noise Affected Management Level of $L_{Aeq(15min)}$ 75dBA is not predicted to be exceeded.

The sleep disturbance level is not predicted to be exceeded in any NCA.

Scenario 8 construction activities relate to the civil works required within the rail corridor. These works have been modelled at the north eastern end of the site, however will occur in other areas too. Similar mitigation should be applied where possible.

Table 6-9 Predicted worst-case noise levels for commercial receivers

	Predicted Worst-Case $L_{Aeq,15min}$			
	NCA 01	**NCA 03**	**NCA 04**	**NCA 06**
NML		**70**		
Scenario 01	40	71	66	71
Scenario 02	40	73	61	78
Scenario 03	37	70	54	63
Scenario 04	30	67	51	62
Scenario 05	50	67	68	65
Scenario 06	54	51	42	58
Scenario 07	50	48	39	57
Scenario 08	26	44	71	46

Note: There are no commercial receivers for NCA 05 considered in the assessment.
Noise levels shaded light blue indicate exceedances above the applicable NML.

Minor exceedances of 1-3dB are predicted at commercial receivers for some scenarios. Exceedances of up to 8dB above the NML are predicted in NCA 06 during Scenario 02. It should be noted that it is likely that many of these commercial premises will not be in use out of standard working hours.

Table 6-10 Predicted worst-case noise levels for industrial receivers

	Predicted Worst-Case $L_{Aeq,15min}$		
	NCA 01	**NCA 03**	**NCA 04**
NML		**75**	
Scenario 01	34	51	56
Scenario 02	32	51	51
Scenario 03	29	58	41
Scenario 04	23	45	35
Scenario 05	40	40	40
Scenario 06	59	41	37
Scenario 07	54	36	35
Scenario 08	25	33	66

Note: There are no industrial receivers for NCA 02, NCA 05 or NCA 06 considered in the assessment.

No exceedances of the NML are predicted at any industrial receivers.

Table 6-11 Predicted worst-case noise levels for other sensitive land use receivers

ID	Receiver Type	NML	Scenario							
			1	2	3	4	5	6	7	8
NCA 02_OSR_1	Child Care Centre	**55**	33	40	31	28	53	53	51	25
NCA 02_OSR_2	Educational Institution	**55**	25	30	21	19	28	48	41	23
NCA 03_OSR_1	Passive Recreation	**65**	61	68	60	63	44	41	36	33
NCA 03_OSR_2	Passive Recreation	**65**	39	44	28	25	49	45	39	25
NCA 04_OSR_1	Passive Recreation	**65**	21	24	15	10	39	21	14	44
NCA 05_OSR_1	Child Care Centre	**55**	31	31	26	25	47	28	24	51
NCA 05_OSR_2	Educational Institution	**55**	34	32	29	26	30	27	24	44
NCA 05_OSR_3	Place of Worship	**55**	32	31	26	26	47	28	24	50
NCA 06_OSR_1	Medical Facility	**55**	29	36	27	23	28	39	32	27

Noise levels shaded light blue indicate exceedances above the applicable NML.

Exceedances of the NML are predicted at the passive recreation area associated with the café on Burrows Avenue. It should be noted that this receiver is unlikely to be in use outside of standard working hours. Furthermore, the predicted levels are below the measured ambient L_{Aeq} levels for this NCA.

6.4 Additional Mitigation Measures

Given the exceedances of the residential NML's, this section focuses on assessing the impact to the residential receivers in further detail.

The Sydney Metro City & Southwest Construction Noise and Vibration Strategy provides Additional Mitigation Measures (AMM) that are to be assessed when all Standard Mitigation Measures have been considered and there is still potential to exceed the NML.

As identified in the CNVMP all potentially affected residential premises in NCA 03 and NCA 04 have been fitted with heavy double glazing as part of the Sydney Airport Noise Management Plan. Although the NML for residences are based on external noise levels, this treatment is to be considered an AMM due to the ability to significantly reduce impacts on residents. The double glazing is estimated to reduce internal noise levels by at least 20dB more than that from the partially open window conditions assumed in the NMLs. The treatment is therefore equivalent to a 20dB construction noise mitigation measure for inside noise levels. For residential receivers in NCA 03 and NCA 04, the mitigation from the upgraded glazing has been accounted for before other AMM are considered.

The AMM from the CNVS are presented in Table 6-12. The period and corresponding exceedance of the NML that the CNVS applies each measure to is presented in Table 6-13.

Table 6-12 Additional mitigation measures

Measure	Abbreviation
Alternative accommodation	AA
Monitoring	M
Individual briefings	IB
Letterbox drops	LB
Project specific respite offer	RO
Phone calls	PC
Specific notifications	SN

Table 6-13 Additional noise mitigation measures matrix

Time Period		Mitigation Measures			
		Predicted $L_{Aeq,15min}$ Noise Level above Background (RBL)			
		0 to 10dB	10 to 20dB	20 to 30dB	>30dB
Standard	Mon-Fri (7am-6pm)	-	-	LB, M	LB, M
	Sat (8am-1pm)				
	Sun / Pub Hol (Nil)				
OOHW Period 1	Mon-Fri (6pm-10pm)	-	LB	LB, M	M, IB, LB, RO, PC, SN
	Sat (1pm-10pm)				
	Sun / Pub Hol (8am-6pm)				
OOHW Period 2	Mon-Fri (10pm-7am)		LB, M	M, IB, LB, PC, RO, SN	AA, M, IB, LB, PC, RO, SN
	Sat (10pm-8am)				
	Sun / Pub Hol (6pm-7am)				

Based on the predictions summarised in the tables above, additional mitigation will be required to be considered for works during all time periods. Table 6-14 summarises the AMM required for each scenario, noting the heavy double glazing referred to above.

It is to be noted that as these scenarios only give a range of typical impacts and do not encompass every construction activity at all locations on the site, particularly scenarios 6 and 7. The recommended additional mitigation is typical for each scenario only. This should be considered when construction activities occur in locations other than those used for this assessment.

Table 6-14 Recommended additional noise mitigation measures

Scenario	Period	NCA 01	NCA 02	NCA 03	NCA 04	NCA 05	NCA 06
SC_01	**Standard**						
SCA 02	**Standard**						
	OOHW 1						
	OOHW 2						
SCA 03	**Standard**						
	OOHW 1						
	OOHW 2						
SCA 04	**Standard**						
	OOHW 1						
	OOHW 2						
SCA 05	**Standard**						
	OOHW 1					LB	
	OOHW 2		LB, M			AA, M, IB, LB, PC, SN	
SCA 06	**Standard**		LB, M				
	OOHW 1		M, IB, LB, RO, PC, SN				
	OOHW 2		AA, M, IB, LB, PC, SN				
SCA 07	**Standard**		LB, M				
	OOHW 1		M, IB, LB, RO, PC, SN				
	OOHW 2		AA, M, IB, LB, PC, SN				
SCA 08	**Standard**						
	OOHW 1						
	OOHW 2					LB, M	

Note: AMM for NCA 03 and NCA 04 has considered the mitigation provided by the heavy double glazing found at these properties.

6.5 Construction Traffic Noise Assessment

At this stage detailed construction traffic volumes have not been determined and a detailed construction traffic noise assessment cannot be undertaken.

As detailed in the Sydenham Station and Junction Construction Traffic Management Plan, primary haulage routes will utilise Unwins Bridge Road, Railway Road and Gleeson Avenue for site access from south of the rail corridor and Sydenham Road and Marrickville Road for site access from north of the rail corridor. Additionally, site access at the far northern end of the site will be via Bedwin Road.

As per the road type definitions in the RNP, these primary haul routes are all on roads classified as either arterial or sub arterial. Further analysis indicates that no haul routes have been designated on local roads.

Analysis of the measured traffic noise levels on Unwins Bridge Road and Burrows road indicate that existing traffic noise in the area is well above the criteria levels specified in the RNP.

Based on the high existing traffic noise levels and the haul routes being restricted to arterial and sub arterial road, impact from additional construction traffic is expected to be minimal.

7 VIBRATION GOALS & ASSESSMENT

7.1 Vibration Goals

Vibration due to construction has the potential cause damage, both cosmetic and structural, to surrounding buildings. The CNVS provides screening criteria for construction activities that have the potential to cause building damage. These criteria, based on a conservative 50% of the British Standard BS 7385-2:1993, measured as Peak Component Particle Velocity (PCPV) are:

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

As per the CNVS, construction activities with the potential to cause vibration levels in excess of those above require a more detailed assessment of the structure and of the vibration source.

The CNVS suggests that heritage structures should not be assumed to be more sensitive to vibration sources and should be assessed by the same screening criteria, unless they are found to be structurally unsound after inspection. If a heritage structure is found to be structurally unsound, screening criteria of 2.5mm/s PCPV applies.

Other vibration sensitive structures and utilities, such as medical facilities, underground pipelines and fibre optic cables are to be assessed on a case by case basis using limits provided by manufactures. One medical facility with potentially vibration sensitive equipment has been identified, however it is located over 300m from the SSJ construction site. No vibration sensitive utilities have been identified in the vicinity of this project.

As required in the CNVS, attended vibration monitoring of each specific item of vibration intensive plant is to be conducted before beginning construction works to establish a more accurate minimum working distance. This is of particular importance when activities are in the close proximity to heritage structures, in compliance with CoA E30.

Continuous vibration monitoring with audible and visual alarms is required by the CNVS at the nearest sensitive receiver when activities are to occur inside the safe working distances. Additional mitigation requirements when vibration is expected to exceed the criteria are provided in the CNVS and summarised in Table 7-1.

Table 7-1 Additional mitigation measures matrix – vibration

Time Period		Mitigation Measures
Standard	Mon-Fri (7:00am-6:00pm)	M, LB, RO
	Sat (8:00am-1:00pm)	
	Sun/Pub Hol (Nil)	
OOHW 1	Mon-Fri (6:00pm-10:00pm)	M, IB, LB, PC, RO, SN
	Sat (1:00pm-10:00pm)	
	Sun/Pub Hol (8:00am-6:00pm)	
OOHW 2	Mon-Fri (10:00pm-7:00am)	AA, M, IB, LB, PC, RO, SN
	Sat (10:00pm-8:00am)	
	Sun/Pub Hol (6:00pm-7:00am)	

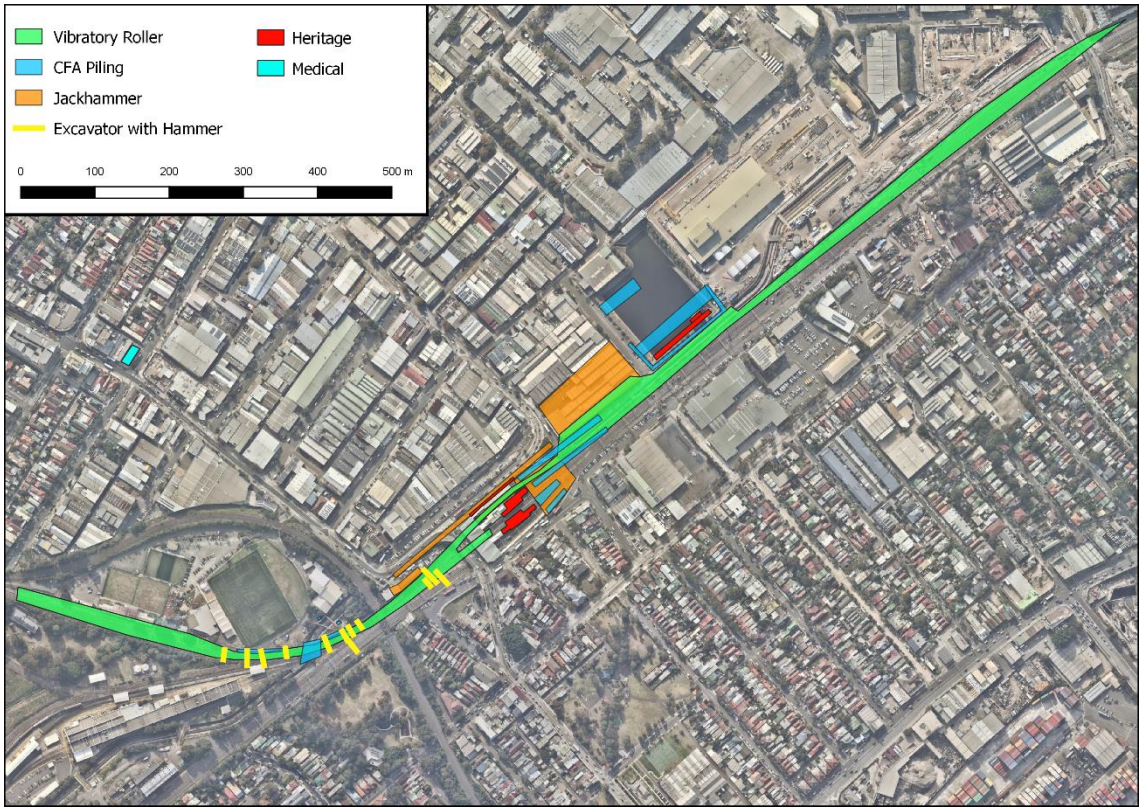
7.2 Summary of Vibration Intensive Works

Plant with the potential for vibration impacts that will be used during this project include:

- Jackhammer
- Vibratory roller
- Medium sized excavator with hammer
- CFA piling rig

Areas of the SSJ work site this plant will be operating are presented in Figure 7-1.

Figure 7-1 Work areas for vibration intensive plant



Wilkinson Murray has previously measured vibration levels from similar plant. Table 7-2 presents the measured vibration levels at various distances. The size of some of the plant proposed differs from plant previously measured by Wilkinson Murray. Where this occurs results for a larger item of plant are presented. Table 20 in Appendix D of the Transport for NSW Construction Noise and Vibration Strategy (2018) provides a list of recommended minimum working distances for vibration intensive plant. These distances are also presented.

Table 7-2 Typical vibration emission from construction plant.

Plant	PPV Vibration Level (mm/s) at Distance [1]					Recommended Minimum Working Distance[2]	
	5m	10m	20m	30m	40m	Building Damage	Human Comfort
Jack Hammer	0.2	0.1	<0.1	-	-	1m (nominal)	Avoid contact with structure
Large Vibratory Roller (20t)	7	4.5	3	2.3	2	25m	100m
Heavy Hydraulic Hammer (1500kg hammer on 30t exc)	4.5	2.5	0.5	0.2	0.12	22m	73m
Bored Piling	-	0.2	<0.1	-	-	2m (nominal)	N/A

Note 1: Vibration levels are typical based on measured data mostly in Sydney sandstone and should be used as a guide only. Short-term higher levels can be experienced at commencement of some operations.
Note 2: Minimum working distances from TfNSW Construction Noise and Vibration Strategy.

7.3 Vibration Assessment

As discussed above and required in the CNVS, attended vibration measurements are required before any vibration intensive construction activities. The recommendations made below are based on the typical emissions presented in Table 7-2. Potential mitigation should be reassessed following the attended measurements to determine safe working distances. Unless stated otherwise the assessment will be based on the screening criteria of 7.5mm/s for an unreinforced structure.

As mentioned in Section 2.4, the heritage structures at Sydenham Station have been assessed and found to be structurally sound. The general vibration screening criteria of 7.5mm/s applies.

7.3.1 Jackhammer

Typical vibration levels from previous WM measurements of a jackhammer indicate that vibration levels are well below the screening criteria at distances of 5m and greater. TfNSW Construction Noise and Vibration Strategy recommended minimum working distances for cosmetic building damage are lower than this at 1m. Contact with building structures should be avoided to limit impacts on human comfort.

Jackhammers are proposed to be used in a number of locations close to vibration sensitive receivers. The building adjacent to 11 Sydenham Road and the heritage structures of the station during demolition works could potentially be impacted.

Vibration monitoring should be undertaken at the heritage structures of the platform and of the building adjacent to 11 Sydenham Road during the demolition works, in compliance with CoA E30. Letter box drops and project specific respite offers may be required for the building adjacent to 11 Sydenham Road during demolition, pending the results of the attended measurements.

7.3.2 Vibratory Roller

Typical vibration levels from previous WM measurements of a large vibratory roller indicate that vibration levels are marginally below the screening criteria at distances of 5m. TfNSW Construction Noise and Vibration Strategy recommended minimum working distances for cosmetic building damage are higher than this at 25m. It is recommended that potential impacts on human comfort are possible within 100m of a large roller.

Vibratory rollers are proposed to be used across most of the SSJ site at various times. The roller will potentially work within 5m of residences on the corner of Lords Road and Edgeware Road, at the northern end of the site. There is potential to exceed the screening criteria at these residences. It is recommended to monitor vibration throughout the duration of the works close to these receivers, as well as notify them of the upcoming construction works. Pending results from the detailed assessment of the plant to be used in the works, additional mitigation measures may be triggered.

The vibratory rollers are proposed to operate at 45m from the receivers on Burrows Ave, Railway Parade and Meeks Road and 15m from the nearest receiver on Railway Road. The screening criterion is not exceeded at any of these receivers however monitoring should be conducted when works are occurring in the vicinity of the receivers in Railway Road.

The roller will potentially operate within 10m of the Sydenham Pit and Pumping Station, and within 5m of the heritage structures on the platforms. These works have the potential to exceed the screening criterion for these heritage structures. As per CoA E30 additional monitoring must be conducted before and during works. As there is potential exceedance of the preferred value for vibration, additional mitigation is required.

The size of the rollers to be used throughout this project have not yet been determined however due to the close proximity of the required works to vibration sensitive receiver, the size of the roller should be strongly considered. The smallest possible roller capable of meeting the operational requirements should be used. This is of particular importance for works near the heritage structures, and the residences at the northern end of the site. Alternative methods of compaction might need to be considered during these works.

Based on the recommendations of the TfNSW Construction Noise and Vibration Strategy human comfort impact can potentially occur within 100m of a large vibratory roller. A number of residences in the vicinity of Meeks Road at the western end of the site, Lords Road at the northern end and Burrows Ave near the station are within 100m of the proposed works. As human comfort limits are dependent on duration of works, potential exceedances should be investigated in more detail once the measurements of the specific plant have been conducted, and the duration of each construction activity known. Monitoring for human comfort exceedances should be conducted at the nearest receiver in each of those areas during nearby works.

7.3.3 Excavator with Hammer

Typical vibration levels from previous WM measurements of a large excavator with a hammer attachment indicate that vibration levels are below the screening criteria at distances of 5m and greater. TfNSW Construction Noise and Vibration Strategy recommended minimum working distances for cosmetic building damage are higher than this at 22m. It is recommended that potential impacts on human comfort are possible within 73m of a large excavator with a hammer attachment.

It is proposed to only use a smaller 13t excavator for the works, which will consist of removing existing footings for overhead wire structures. due to the size of the excavator and distance of closest works to a relevant receiver being over 40m, it is not expected that any cosmetic building damage impacts are likely. Works of this nature will not occur within 100m of heritage structures.

Residences in the vicinity of Burrows Ave/Railway Road are within the recommended 73m for human comfort. Due to the size of the excavator and hammer likely being over predicted and the short-term nature of the works, it is considered unlikely that any impacts to human comfort will occur.

7.3.4 CFA Piling

Typical vibration levels from previous WM measurements of bored piling indicate that vibration levels are insignificant at distances of 5m and greater. TfNSW Construction Noise and Vibration Strategy recommended minimum working distances for cosmetic building damage are lower than this at 2m. It is recommended that potential impacts on human comfort are not of concern at any distances.

Piling works will occur as part of the Sydenham Pit and Pumping Station upgrade and for the foundations of the extension to the platforms. These works are not considered likely to cause vibration levels in excess of the screening criterion of 7.5mm/s, however will occur within close proximity to the heritage pumping station and approximately 5m from the heritage structures of Sydenham Station. Works are also required at the southern end of the site for new structures for overhead wires. These works are not within the safe distances of any receiver.

No additional mitigation is predicted to be required for any piling works.

7.4 Ground-Borne Noise

Structure-borne or regenerated noise is noise generated by vibration transmitted through the ground into a structure that may lead to noise "regenerated" within a space in the building. The Construction Noise and Vibration Strategy provides criteria for both residential and commercial receivers, at various time periods. The ground-borne noise criteria are presented in Table 7-3.

Table 7-3 Ground-borne noise management levels

Period	Receiver	$L_{Aeq,15min}$ (Internal)
Day (7:00am-6:00pm)	Residential	45
	Commercial	50
Evening (6:00pm-10:00pm)	Residential	40
Day (10:00pm-7:00pm)	Residential	35

The CNVS states that these criteria are only applicable when ground-borne noise levels are higher than the airborne noise levels.

In addition to the above criteria CoA E37 states that all receivers likely to experience internal noise levels greater than $L_{Aeq,15min}$ 60dBA inclusive of a 5dB penalty, if rock breaking or any other annoying activity likely to result in ground-borne noise is planned (including works associated with utility adjustments), between the hours of 7:00am and 8:00pm must be identified.

If internal noise levels are predicted above these levels, consultation with affected receivers regarding periods of respite must be undertaken, in accordance with CoA E38.

All the works previously identified with the potential to cause vibration impacts are surface works. Additionally, hydraulic hammers will only be used to break up concrete and not be used on any rock. Levels within receiver buildings are predicted to be very low, and below the noise management levels. A detailed ground-borne noise assessment is not required.

8 CONCLUSION

This report outlines the assessment of the potential for noise and vibration impacts that may result to surrounding receivers from construction works for the Sydenham Station and Junction Project.

The impacts from the proposed works have been assessed against the Sydney Metro City & Southwest Construction Noise and Vibration Strategy requirements and the Conditions of Approval outlined in Infrastructure Approval SSI-7400.

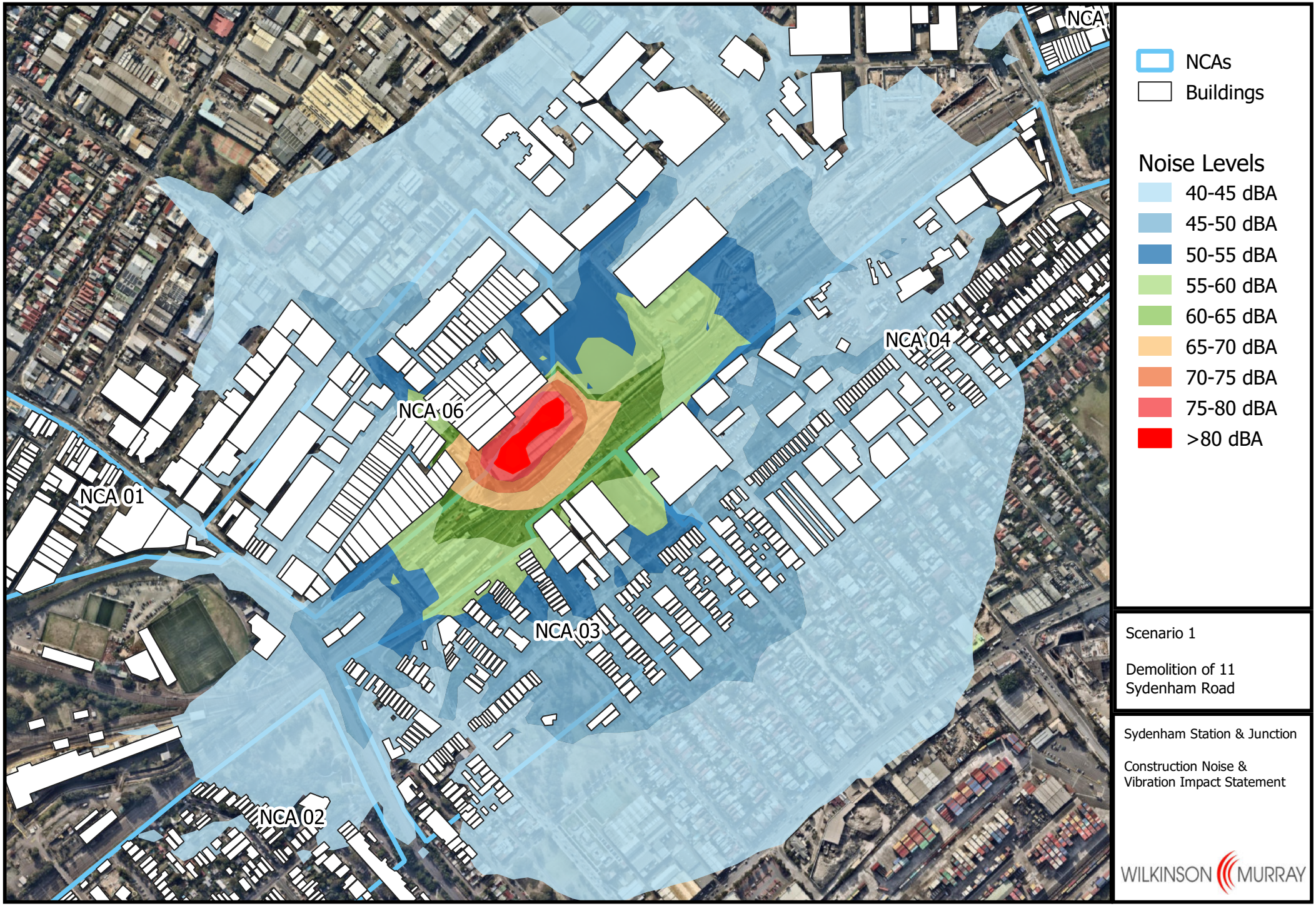
A number of noise scenarios representing a range of the works that will occur during the construction stage of this project have been assessed. These scenarios were chosen to capture potential worst-case noise emissions for different surrounding receivers throughout different stages of the construction.

Potential exceedances of the noise management level have been predicted during all of the assessed scenarios. Where an exceedance has been predicted, additional mitigation measures have been recommended in line with the recommendations in the Sydney Metro City & Southwest Construction Noise and Vibration Strategy and taking into account the double glazing installed in many residences as part of the Sydney Airport Management Plan.

A number of vibration intensive works have been identified. Initial predictions show that some of these works have the potential to exceed the screening criteria levels. As per the CNVS, monitoring and further assessment of plant before operation has been recommended.

APPENDIX A

SCENARIO NOISE CONTOURS


NCA
NCA 04
NCA 06
NCA 01
NCA 03
NCA 02
NCAs
Buildings
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45-50 dBA
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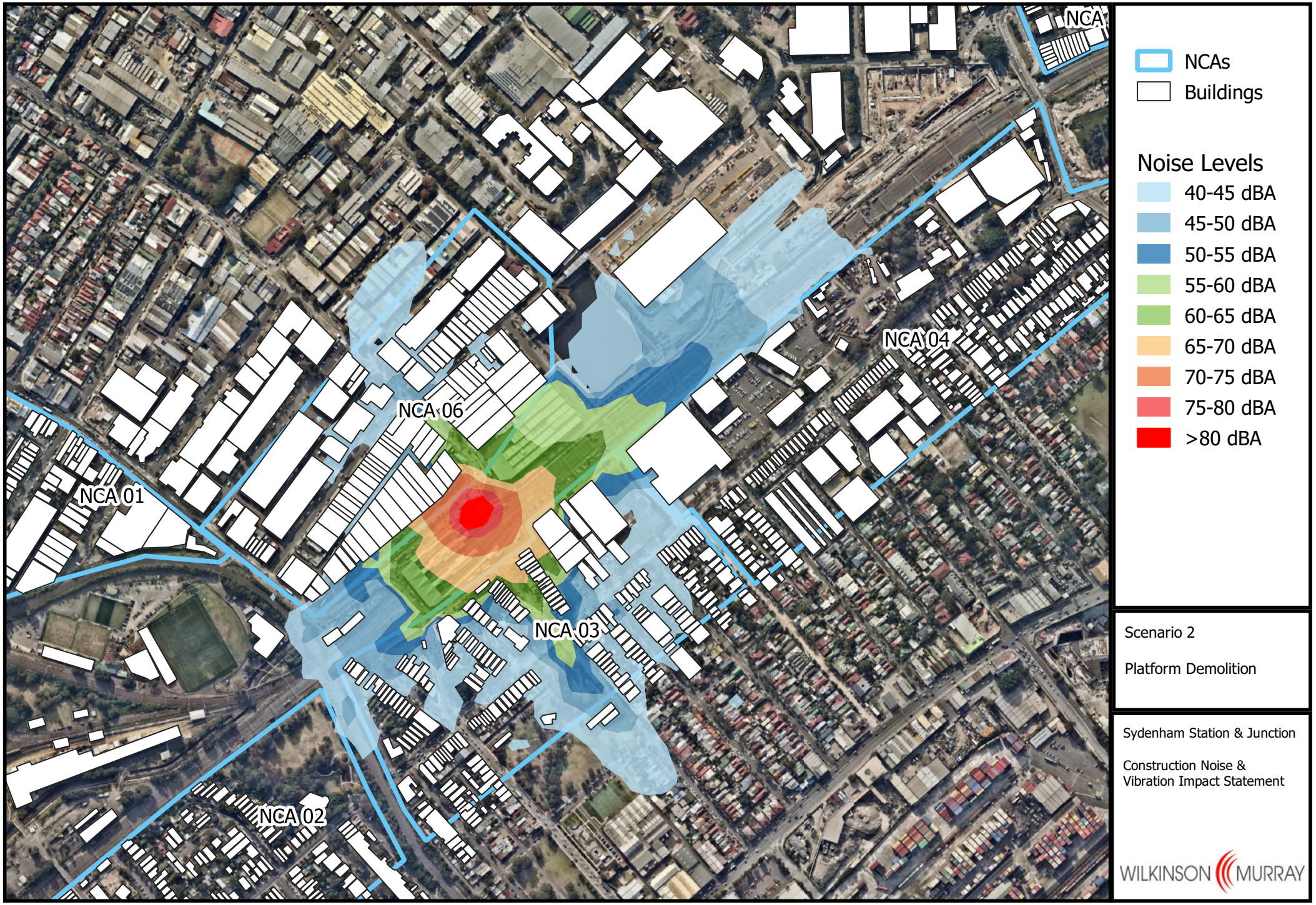
55-60 dBA
60-65 dBA
65-70 dBA
70-75 dBA
75-80 dBA
>80 dBA
Scenario 1
Demolition of 11 Sydenham Road
Sydenham Station & Junction
Construction Noise & Vibration Impact Statement
WILKINSON MURRAY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NCA 04
NCA 06
NCA 01
NCA 03
NCA 02
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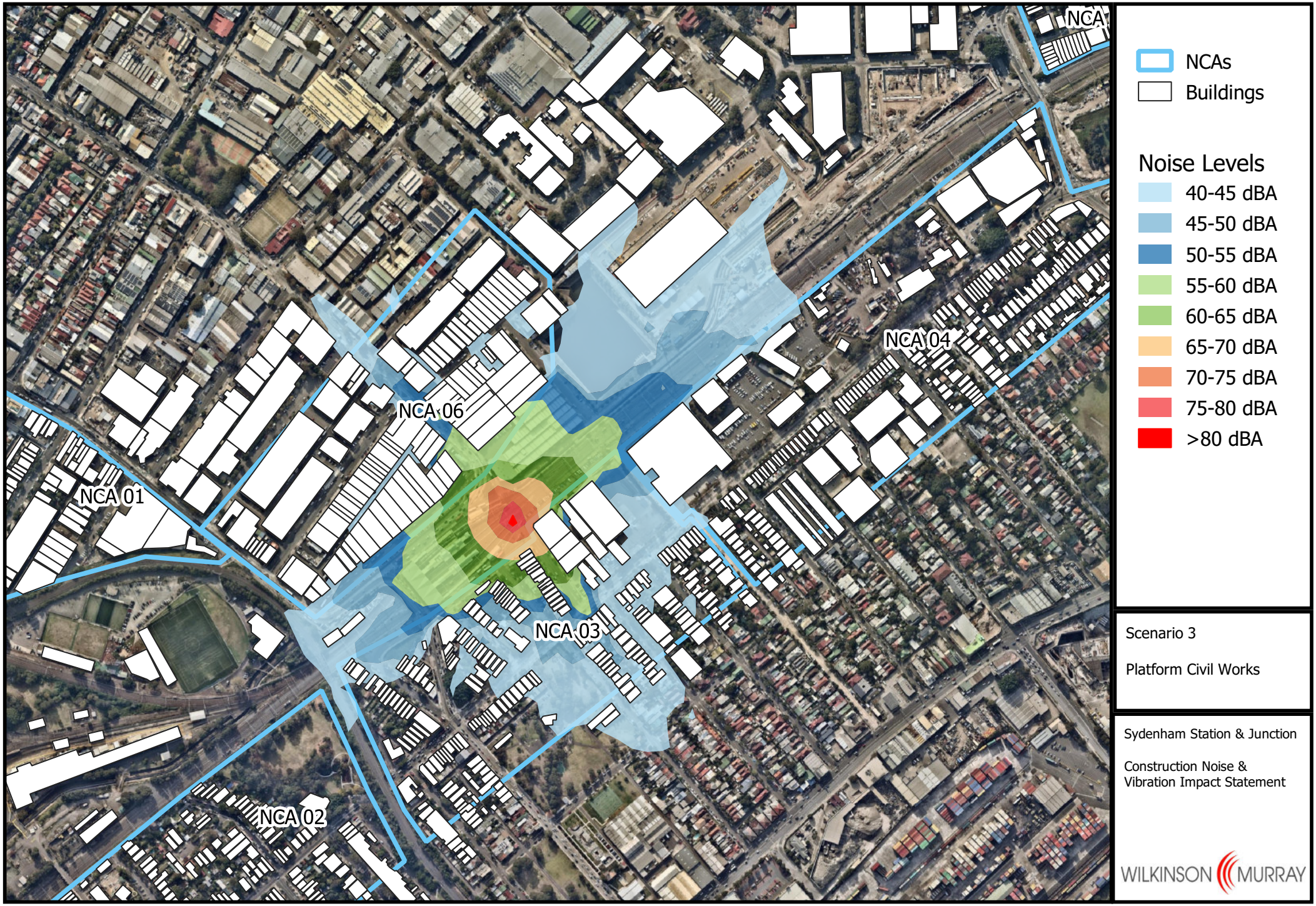
60-65 dBA
65-70 dBA
70-75 dBA
75-80 dBA
>80 dBA
Scenario 2
Platform Demolition
Sydenham Station & Junction
Construction Noise &
Vibration Impact Statement
WILKINSON MURRAY


NCA
NCA 04
NCA 06
NCA 01
NCA 03
NCA 02
NCAs
Buildings
Noise Levels
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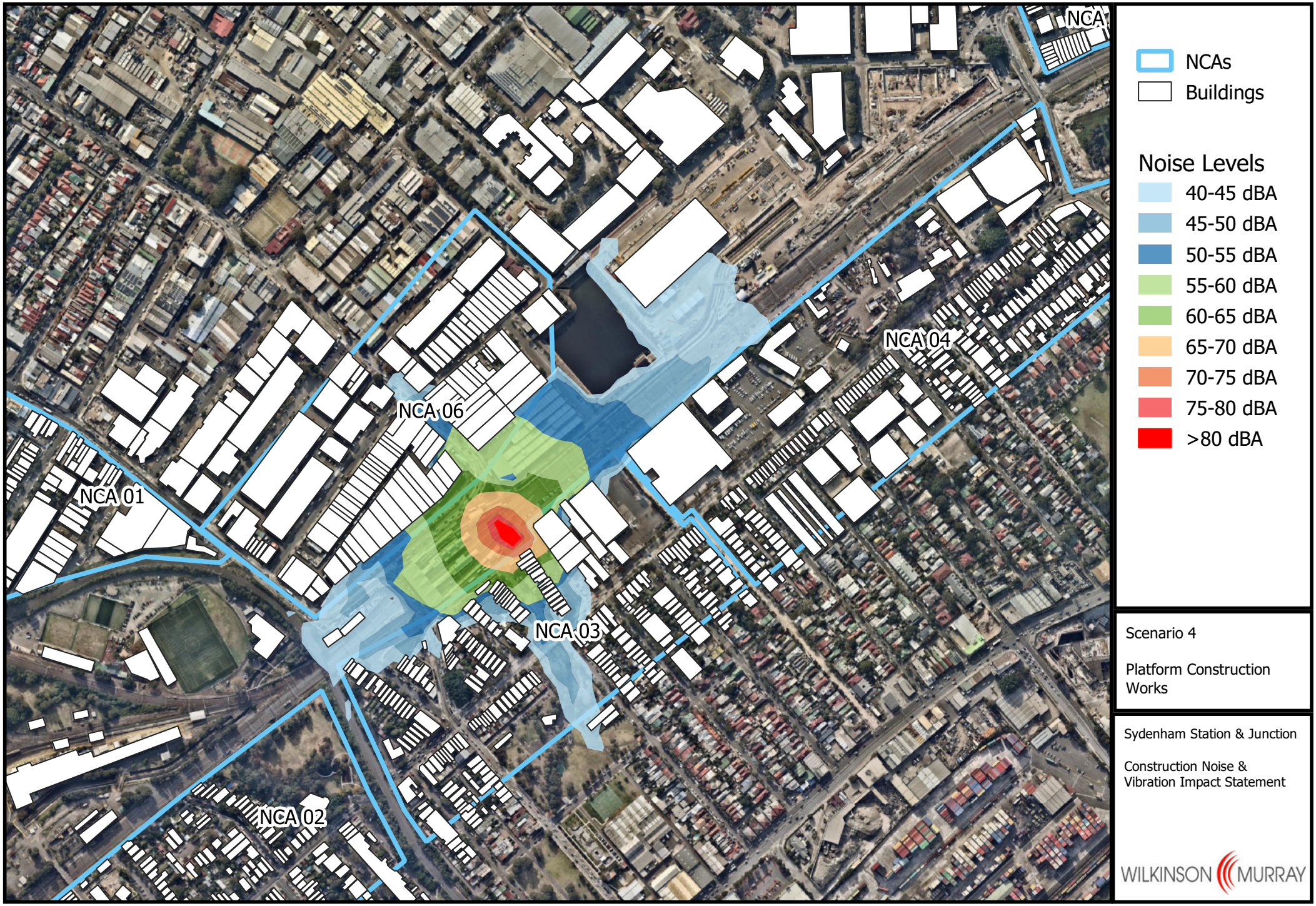
50-55 dBA
55-60 dBA
60-65 dBA
65-70 dBA
70-75 dBA
75-80 dBA
>80 dBA
Scenario 3
Platform Civil Works
Sydenham Station & Junction
Construction Noise &
Vibration Impact Statement
WILKINSON MURRAY



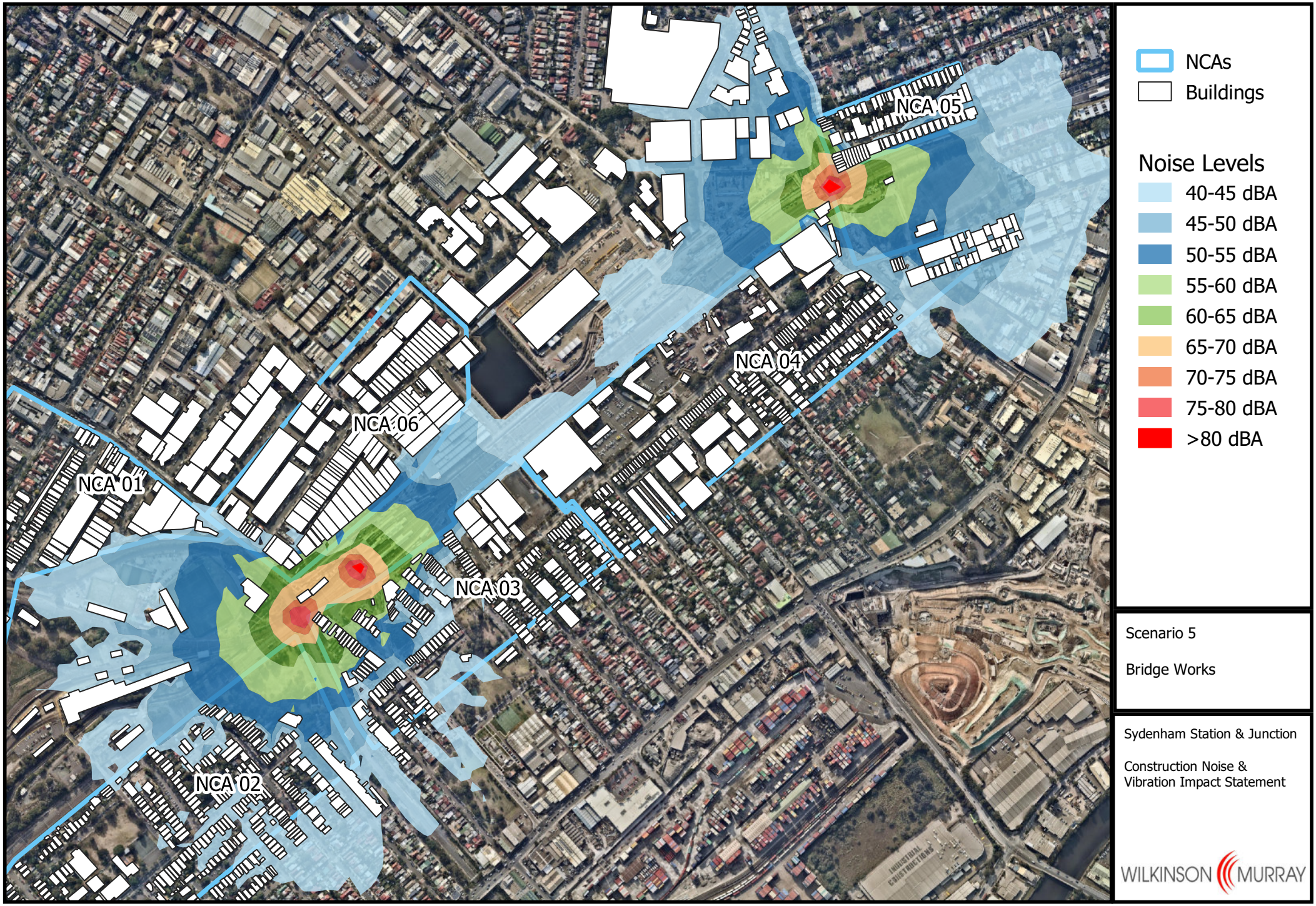
Scenario 4

Platform Construction Works

Sydenham Station & Junction

Construction Noise & Vibration Impact Statement

WILKINSON MURRAY


NCAs
Buildings
Noise Levels
40-45 dBA
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50-55 dBA
55-60 dBA
60-65 dBA
65-70 dBA
70-75 dBA
75-80 dBA
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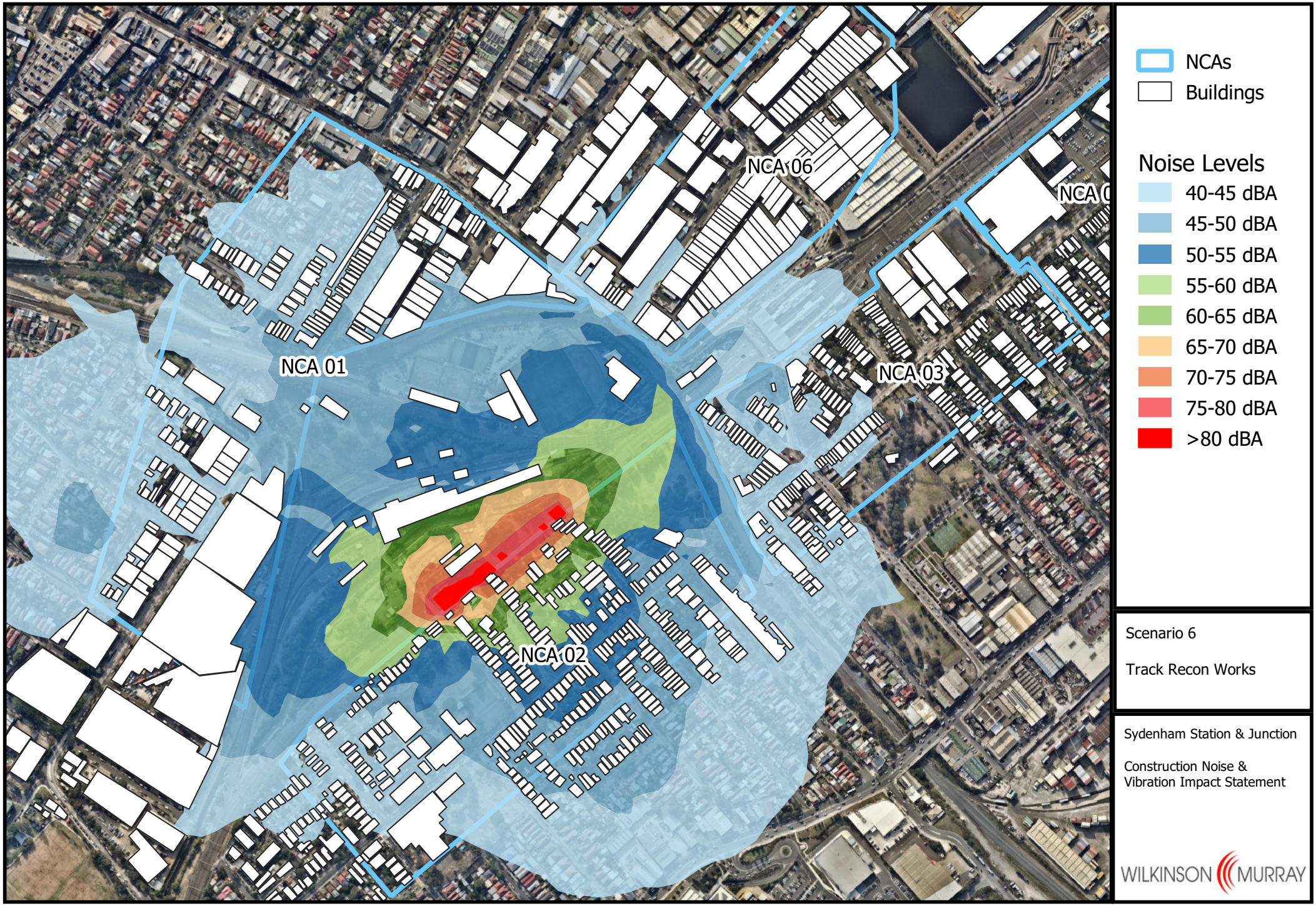
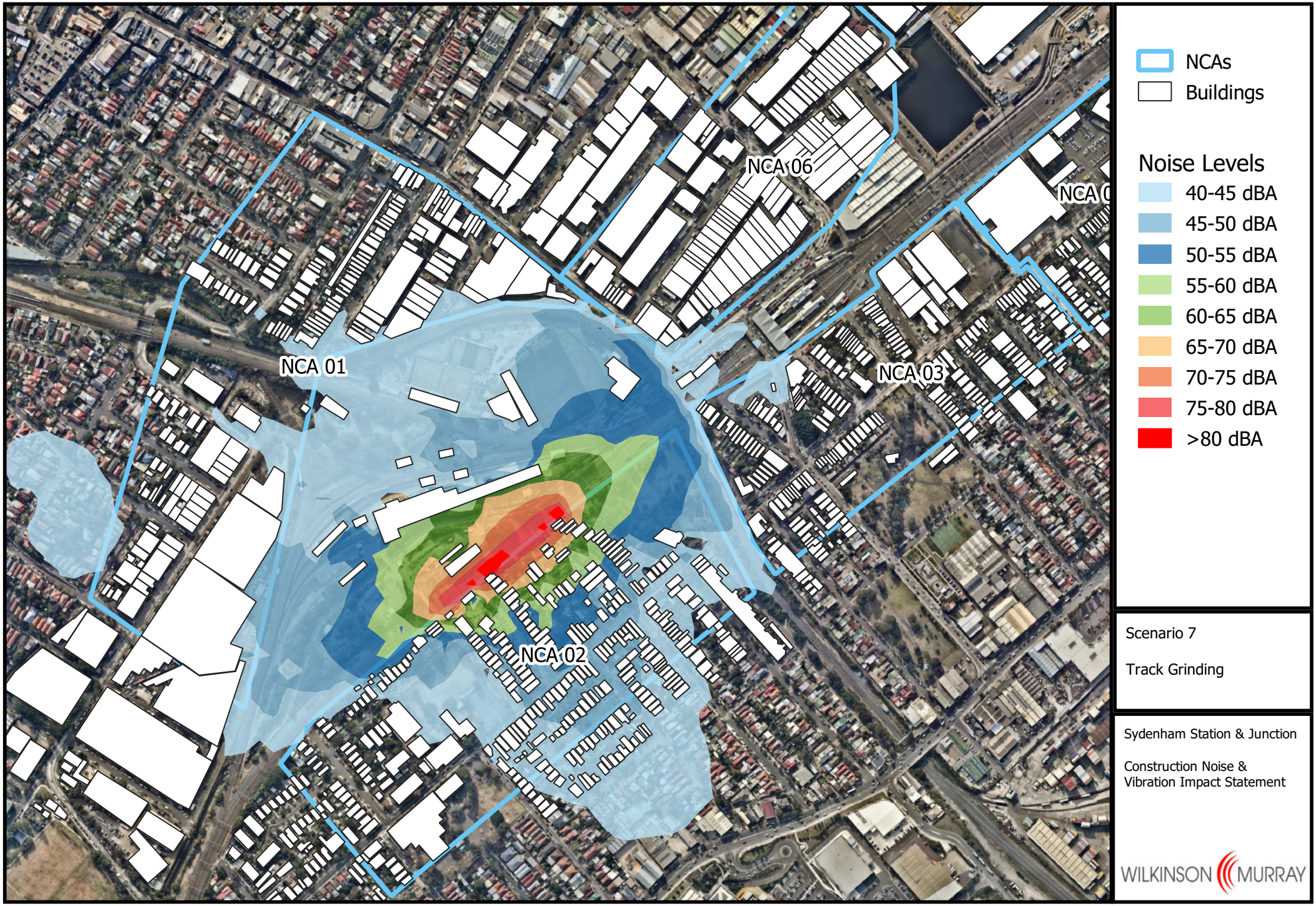
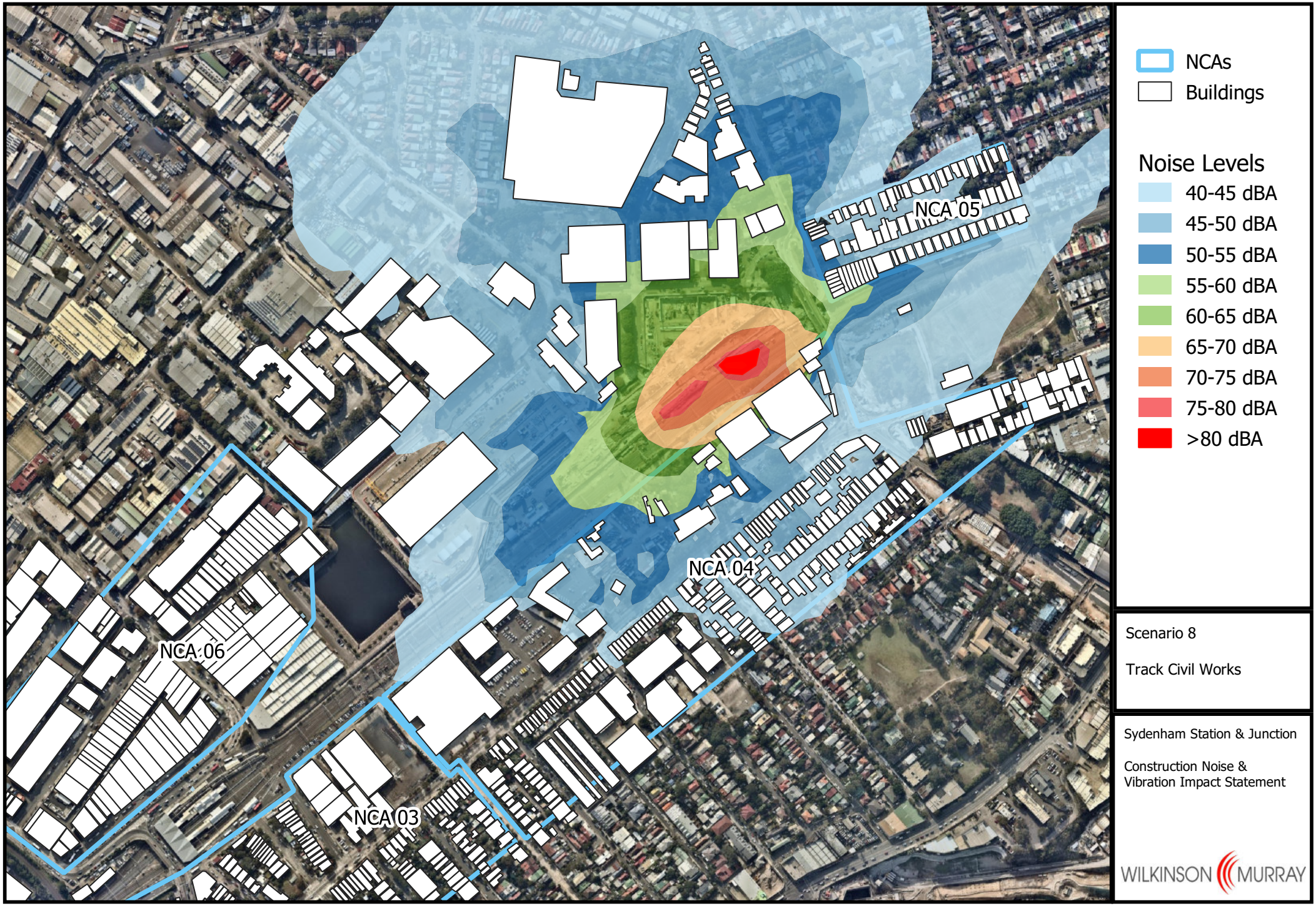
NCA 01
NCA 02
NCA 03
NCA 04
NCA 05
NCA 06
Scenario 5
Bridge Works
Sydenham Station & Junction
Construction Noise &
Vibration Impact Statement
WILKINSON MURRAY


NCAs
Buildings
Noise Levels
40-45 dBA
45-50 dBA
50-55 dBA
55-60 dBA
60-65 dBA
65-70 dBA
70-75 dBA
75-80 dBA
>80 dBA
NCA 01
NCA 02
NCA 03
NCA 06
Scenario 6
Track Recon Works
Sydenham Station & Junction
Construction Noise &
Vibration Impact Statement
WILKINSON MURRAY


NCAs
Buildings
Noise Levels
40-45 dBA
45-50 dBA
50-55 dBA
55-60 dBA
60-65 dBA
65-70 dBA
70-75 dBA
75-80 dBA
>80 dBA
NCA 01
NCA 02
NCA 03
NCA 06
Scenario 7
Track Grinding
Sydenham Station & Junction
Construction Noise &
Vibration Impact Statement
WILKINSON MURRAY


NCAs
Buildings
Noise Levels
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45-50 dBA
50-55 dBA
55-60 dBA
60-65 dBA
65-70 dBA
70-75 dBA
75-80 dBA
>80 dBA
NCA 05
NCA 04
NCA 06
NCA 03
Scenario 8
Track Civil Works
Sydenham Station & Junction
Construction Noise & Vibration Impact Statement
WILKINSON MURRAY

APPENDIX B

TABLE OF PREDICTED NOISE LEVELS

Receiver ID	Address	Scenario 01	Scenario 02	Scenario 03	Scenario 04	Scenario 05	Scenario 06	Scenario 07	Scenario 08
NCA 01_1001	133_MEEKS_ROAD_MARRICKVILLE	35	35	33	28	42	53	50	26
NCA 01_1002	135_MEEKS_ROAD_MARRICKVILLE	25	23	20	8	18	51	46	15
NCA 01_1003	137_MEEKS_ROAD_MARRICKVILLE	26	23	20	9	19	50	46	16
NCA 01_1004	139_MEEKS_ROAD_MARRICKVILLE	26	23	20	9	19	50	45	16
NCA 01_1005	141_MEEKS_ROAD_MARRICKVILLE	28	25	23	12	21	50	45	16
NCA 01_1006	143_MEEKS_ROAD_MARRICKVILLE	26	23	21	10	19	50	45	16
NCA 01_1007	129_MEEKS_ROAD_MARRICKVILLE	34	33	31	23	40	54	50	24
NCA 01_1008	127_MEEKS_ROAD_MARRICKVILLE	34	34	31	23	38	54	50	24
NCA 01_1009	125_MEEKS_ROAD_MARRICKVILLE	35	34	31	23	38	53	49	25
NCA 01_1010	123_MEEKS_ROAD_MARRICKVILLE	35	34	32	24	39	54	50	25
NCA 01_1011	121_MEEKS_ROAD_MARRICKVILLE	35	34	32	24	35	54	50	25
NCA 01_1012	353_VICTORIA_ROAD_MARRICKVILLE	24	22	19	8	16	48	45	15
NCA 01_1013	2_QUEEN_STREET_MARRICKVILLE	24	21	18	7	15	43	39	14
NCA 01_1014	2A_QUEEN_STREET_MARRICKVILLE	23	21	18	7	15	47	42	14
NCA 01_1015	4_QUEEN_STREET_MARRICKVILLE	24	22	19	7	15	47	42	14
NCA 01_1016	6_QUEEN_STREET_MARRICKVILLE	24	22	19	8	15	47	42	15
NCA 01_1017	20_MYRTLE_STREET_MARRICKVILLE	30	29	26	16	24	47	41	22
NCA 01_1018	18_MYRTLE_STREET_MARRICKVILLE	31	30	28	17	25	47	42	22
NCA 01_1019	16_MYRTLE_STREET_MARRICKVILLE	29	28	25	15	25	47	42	18
NCA 01_1020	23_HARRIETT_STREET_MARRICKVILLE	28	28	25	14	22	41	35	19
NCA 01_1024	90_MEEKS_ROAD_MARRICKVILLE	27	25	22	11	24	47	42	16
NCA 01_1027	119_MEEKS_ROAD_MARRICKVILLE	33	32	30	22	31	52	48	27
NCA 01_1028	117_MEEKS_ROAD_MARRICKVILLE	35	35	32	25	32	53	49	27
NCA 01_1029	115_MEEKS_ROAD_MARRICKVILLE	36	35	32	25	32	53	49	31

Receiver ID	Address	Scenario 01	Scenario 02	Scenario 03	Scenario 04	Scenario 05	Scenario 06	Scenario 07	Scenario 08
NCA 01_1493	2_JUNCTION_STREET_MARRICKVILLE	27	24	22	11	19	46	40	19
NCA 01_1494	4_JUNCTION_STREET_MARRICKVILLE	27	25	22	12	19	42	36	20
NCA 01_1495	25A_SCHWEBEL_STREET_MARRICKVILLE	24	23	19	8	20	48	43	16
NCA 01_1496	23_SCHWEBEL_STREET_MARRICKVILLE	26	24	21	11	21	47	42	19
NCA 01_1497	25_SCHWEBEL_STREET_MARRICKVILLE	27	26	22	12	21	48	42	20
NCA 01_1499	29_SCHWEBEL_STREET_MARRICKVILLE	23	25	17	6	22	44	39	14
NCA 01_NR_115	88_MEEKS_ROAD_MARRICKVILLE	36	36	34	28	43	54	49	25
NCA 01_NR_290	94_MEEKS_ROAD_MARRICKVILLE	33	33	31	23	43	53	48	24
NCA 01_NR_37	86_MEEKS_ROAD_MARRICKVILLE	36	35	33	27	43	54	50	25
NCA 01_NR_444	27_GERALD_STREET_MARRICKVILLE	36	36	34	26	45	53	48	23
NCA 01_NR_462	3_MYRTLE_STREET_MARRICKVILLE	34	33	30	23	39	49	44	23
NCA 01_NR_463	5_CARRINGTON_ROAD_MARRICKVILLE	35	34	31	23	40	54	49	25
NCA 01_NR_464	11A_CARRINGTON_ROAD_MARRICKVILLE	32	32	29	20	32	52	47	25
NCA 01_NR_465	22_MYRTLE_STREET_MARRICKVILLE	31	31	28	19	28	48	44	22
NCA 01_NR_466	7_CARRINGTON_ROAD_MARRICKVILLE	34	33	30	21	39	52	47	25
NCA 01_NR_467	15_CARRINGTON_ROAD_MARRICKVILLE	32	32	29	19	30	52	47	25
NCA 01_NR_468	11_CARRINGTON_ROAD_MARRICKVILLE	31	31	28	20	37	51	46	25
NCA 01_NR_470	10_GERALD_STREET_MARRICKVILLE	37	39	36	30	48	54	50	24
NCA 01_NR_471	21_GERALD_STREET_MARRICKVILLE	35	36	33	28	45	53	48	26
NCA 01_NR_473	25_GERALD_STREET_MARRICKVILLE	37	38	35	30	46	54	50	26
NCA 01_NR_474	104_MARRICKVILLE_ROAD_MARRICKVILLE	37	39	36	29	50	54	50	24
NCA 01_NR_475	17_GERALD_STREET_MARRICKVILLE	37	37	34	26	46	54	49	26
NCA 01_NR_476	15_GERALD_STREET_MARRICKVILLE	37	36	33	25	46	53	49	26
NCA 01_NR_477	12_GERALD_STREET_MARRICKVILLE	37	39	36	30	47	53	49	22

Receiver ID	Address	Scenario 01	Scenario 02	Scenario 03	Scenario 04	Scenario 05	Scenario 06	Scenario 07	Scenario 08
NCA 01_NR_479	100_MARRICKVILLE_ROAD_MARRICKVILLE	40	40	37	28	41	50	45	26
NCA 01_NR_480	4_CARRINGTON_ROAD_MARRICKVILLE	34	32	29	23	40	59	54	25
NCA 01_NR_481	21_CARRINGTON_ROAD_MARRICKVILLE	30	30	27	19	27	50	44	23
NCA 01_NR_482	29_CARRINGTON_ROAD_MARRICKVILLE	29	29	25	17	28	50	44	22
NCA 01_NR_483	10_CARRINGTON_ROAD_MARRICKVILLE	30	31	27	20	36	55	52	22
NCA 01_NR_484	24A_HARRIETT_STREET_MARRICKVILLE	30	30	27	18	27	50	46	22
NCA 01_NR_485	24_HARRIETT_STREET_MARRICKVILLE	30	30	27	17	28	50	46	22
NCA 01_NR_486	27_CARRINGTON_ROAD_MARRICKVILLE	29	29	25	17	27	50	44	22
NCA 01_NR_487	26_HARRIETT_STREET_MARRICKVILLE	31	31	28	18	28	51	46	22
NCA 01_NR_488	25_CARRINGTON_ROAD_MARRICKVILLE	30	31	26	22	34	53	50	25
NCA 01_NR_489	17_CARRINGTON_ROAD_MARRICKVILLE	31	31	28	19	27	50	44	24
NCA 01_NR_490	8_CARRINGTON_ROAD_MARRICKVILLE	33	31	29	23	31	58	54	24
NCA 01_NR_491	23_CARRINGTON_ROAD_MARRICKVILLE	30	30	27	19	28	50	44	23
NCA 01_NR_492	19_CARRINGTON_ROAD_MARRICKVILLE	30	30	27	18	27	50	44	23
NCA 01_NR_498	29_SCHWEBEL_STREET_MARRICKVILLE	28	26	23	14	27	49	46	20
NCA 01_NR_54	92_MEEKS_ROAD_MARRICKVILLE	35	34	32	23	44	54	49	23
NCA 02_1030	15_COLLINS_STREET_TEMPE	26	25	23	12	20	49	44	17
NCA 02_1031	17_COLLINS_STREET_TEMPE	26	25	23	12	20	50	44	17
NCA 02_1032	19_COLLINS_STREET_TEMPE	29	29	25	13	23	52	47	18
NCA 02_1033	28_TOYER_STREET_TEMPE	25	22	19	9	17	48	43	15
NCA 02_1034	26_TOYER_STREET_TEMPE	26	23	20	11	18	50	45	16
NCA 02_1035	24_TOYER_STREET_TEMPE	25	23	20	11	17	50	46	16
NCA 02_1036	22_TOYER_STREET_TEMPE	24	21	19	9	15	49	45	15
NCA 02_1037	20_TOYER_STREET_TEMPE	33	31	27	18	27	59	56	22

Receiver ID	Address	Scenario 01	Scenario 02	Scenario 03	Scenario 04	Scenario 05	Scenario 06	Scenario 07	Scenario 08
NCA 02_1038	16_TOYER_STREET_TEMPE	31	29	27	17	26	54	48	19
NCA 02_1039	14_TOYER_STREET_TEMPE	34	33	30	22	32	61	58	25
NCA 02_1040	12_TOYER_STREET_TEMPE	35	34	30	23	33	62	59	25
NCA 02_1041	10_TOYER_STREET_TEMPE	36	35	31	23	32	61	56	24
NCA 02_1042	8_TOYER_STREET_TEMPE	35	33	29	18	29	60	56	22
NCA 02_1043	6_TOYER_STREET_TEMPE	35	33	30	20	30	60	56	23
NCA 02_1044	4_TOYER_STREET_TEMPE	34	33	29	18	30	59	56	21
NCA 02_1045	2A_TOYER_STREET_TEMPE	32	29	26	17	26	57	53	22
NCA 02_1046	2_TOYER_STREET_TEMPE	37	35	32	24	40	69	67	31
NCA 02_1047	23_WAY_STREET_TEMPE	37	36	31	20	31	75	72	23
NCA 02_1048	21_WAY_STREET_TEMPE	35	33	30	21	31	70	67	23
NCA 02_1049	19_WAY_STREET_TEMPE	38	37	34	31	43	70	66	29
NCA 02_1050	24_COLLINS_STREET_TEMPE	29	26	21	11	21	51	46	18
NCA 02_1051	22_COLLINS_STREET_TEMPE	27	26	21	11	21	48	42	18
NCA 02_1052	20_COLLINS_STREET_TEMPE	27	27	22	13	22	48	42	20
NCA 02_1053	18_COLLINS_STREET_TEMPE	28	27	23	13	23	48	42	20
NCA 02_1054	16_COLLINS_STREET_TEMPE	28	27	22	11	22	48	43	18
NCA 02_1055	13_COLLINS_STREET_TEMPE	29	28	26	14	24	49	42	19
NCA 02_1056	11_COLLINS_STREET_TEMPE	24	24	21	10	18	48	41	15
NCA 02_1057	9_COLLINS_STREET_TEMPE	25	25	22	11	19	46	40	16
NCA 02_1058	7_COLLINS_STREET_TEMPE	26	25	23	12	20	47	40	17
NCA 02_1059	31_TOYER_STREET_TEMPE	29	26	22	10	21	48	42	17
NCA 02_1060	29_TOYER_STREET_TEMPE	29	25	23	13	21	49	43	19
NCA 02_1061	27_TOYER_STREET_TEMPE	26	23	20	10	18	49	42	16

Receiver ID	Address	Scenario 01	Scenario 02	Scenario 03	Scenario 04	Scenario 05	Scenario 06	Scenario 07	Scenario 08
NCA 02_1062	25_TOYER_STREET_TEMPE	26	23	21	10	18	49	42	16
NCA 02_1064	24_HILLCREST_STREET_TEMPE	38	38	35	30	45	85	84	32
NCA 02_1065	24_WAY_STREET_TEMPE	36	35	32	26	41	81	79	27
NCA 02_1066	22A_HILLCREST_STREET_TEMPE	38	39	34	32	44	75	73	29
NCA 02_1067	22B_WAY_STREET_TEMPE	37	35	32	25	34	66	63	25
NCA 02_1068	22A_WAY_STREET_TEMPE	38	37	33	27	36	65	62	26
NCA 02_1069	22_WAY_STREET_TEMPE	37	35	32	24	34	63	60	24
NCA 02_1070	20_HILLCREST_STREET_TEMPE	39	39	36	33	44	62	59	27
NCA 02_1071	18_WAY_STREET_TEMPE	40	40	36	33	44	63	59	27
NCA 02_1072	16_WAY_STREET_TEMPE	39	38	35	31	40	62	58	27
NCA 02_1073	16_HILLCREST_STREET_TEMPE	39	38	34	27	38	63	59	26
NCA 02_1074	18_HILLCREST_STREET_TEMPE	38	37	35	29	37	64	60	26
NCA 02_1075	20_HILLCREST_STREET_TEMPE	38	37	33	26	36	64	61	25
NCA 02_1076	22_HILLCREST_STREET_TEMPE	39	40	35	33	44	68	65	28
NCA 02_1077	22_HILLCREST_STREET_TEMPE	39	39	35	31	45	72	70	30
NCA 02_1078	33_HILLCREST_STREET_TEMPE	38	37	34	26	46	85	84	27
NCA 02_1079	31_HILLCREST_STREET_TEMPE	36	35	33	26	39	76	77	26
NCA 02_1080	29_HILLCREST_STREET_TEMPE	38	38	34	29	42	76	76	27
NCA 02_1081	27_HILLCREST_STREET_TEMPE	38	37	33	26	38	74	74	26
NCA 02_1082	25_HILLCREST_STREET_TEMPE	38	37	35	28	39	73	73	26
NCA 02_1084	21_HILLCREST_STREET_TEMPE	38	36	32	23	35	68	68	24
NCA 02_1085	19_HILLCREST_STREET_TEMPE	38	37	34	28	37	64	60	25
NCA 02_1086	17_HILLCREST_STREET_TEMPE	36	35	32	27	36	63	59	26
NCA 02_1087	15_HILLCREST_STREET_TEMPE	38	39	35	30	41	61	59	26

Receiver ID	Address	Scenario 01	Scenario 02	Scenario 03	Scenario 04	Scenario 05	Scenario 06	Scenario 07	Scenario 08
NCA 02_1088	13_HILLCREST_STREET_TEMPE	39	39	35	30	41	61	59	26
NCA 02_1089	3_LESLIE_STREET_TEMPE	31	29	26	19	37	77	77	20
NCA 02_1090	1_LESLIE_STREET_TEMPE	38	35	32	24	42	78	78	25
NCA 02_1091	5_LESLIE_STREET_TEMPE	37	35	32	24	35	73	73	23
NCA 02_1092	7_LESLIE_STREET_TEMPE	40	38	36	31	46	67	66	27
NCA 02_1093	8_LESLIE_STREET_TEMPE	41	40	37	32	47	67	66	27
NCA 02_1094	6_LESLIE_STREET_TEMPE	39	38	36	32	46	68	67	26
NCA 02_1095	4_LESLIE_STREET_TEMPE	40	39	37	32	47	68	68	27
NCA 02_1096	2_LESLIE_STREET_TEMPE	39	38	35	30	47	68	68	26
NCA 02_1097	14_BRIDGE_STREET_TEMPE	39	39	36	28	47	68	68	26
NCA 02_1098	16_BRIDGE_STREET_TEMPE	37	35	35	30	39	70	70	27
NCA 02_1099	18_BRIDGE_STREET_TEMPE	39	38	34	28	41	75	75	27
NCA 02_1100	20_BRIDGE_STREET_TEMPE	40	38	35	29	47	80	80	26
NCA 02_1101	29_BRIDGE_STREET_TEMPE	40	40	37	31	53	85	85	28
NCA 02_1102	27_BRIDGE_STREET_TEMPE	40	40	37	31	53	80	80	28
NCA 02_1103	25_BRIDGE_STREET_TEMPE	40	39	35	27	53	73	73	26
NCA 02_1104	23_BRIDGE_STREET_TEMPE	40	39	36	29	53	72	72	26
NCA 02_1105	21_BRIDGE_STREET_TEMPE	41	41	37	31	54	71	71	28
NCA 02_1106	2A_LESLIE_STREET_TEMPE	40	39	35	29	45	66	66	26
NCA 02_1107	10_BRIDGE_STREET_TEMPE	40	40	35	28	41	63	62	26
NCA 02_1108	19_BRIDGE_STREET_TEMPE	40	40	36	30	54	66	65	27
NCA 02_1109	17A_BRIDGE_STREET_TEMPE	40	39	36	30	55	62	59	27
NCA 02_1110	17_BRIDGE_STREET_TEMPE	40	40	36	31	55	66	65	26
NCA 02_1111	1_BRIDGE_STREET_TEMPE	40	40	36	27	53	60	58	25

Receiver ID	Address	Scenario 01	Scenario 02	Scenario 03	Scenario 04	Scenario 05	Scenario 06	Scenario 07	Scenario 08
NCA 02_1112	3_BRIDGE_STREET_TEMPE	41	41	36	27	52	60	59	23
NCA 02_1113	5_BRIDGE_STREET_TEMPE	41	41	36	28	53	60	59	25
NCA 02_1114	7_BRIDGE_STREET_TEMPE	42	42	38	29	53	62	62	25
NCA 02_1115	9_BRIDGE_STREET_TEMPE	41	41	36	30	48	63	63	25
NCA 02_1116	11_BRIDGE_STREET_TEMPE	41	41	37	30	55	64	63	25
NCA 02_1117	13_BRIDGE_STREET_TEMPE	40	40	37	30	54	63	63	26
NCA 02_1118	15_BRIDGE_STREET_TEMPE	40	40	36	31	55	66	65	26
NCA 02_1119	8_BRIDGE_STREET_TEMPE	41	42	38	34	50	64	63	26
NCA 02_1120	6_BRIDGE_STREET_TEMPE	41	42	37	32	51	63	61	26
NCA 02_1122	81_UNWINS BRIDGE_ROAD_TEMPE	37	36	32	22	37	59	55	19
NCA 02_1123	83_UNWINS BRIDGE_ROAD_TEMPE	37	37	31	20	37	57	52	21
NCA 02_1124	85_UNWINS BRIDGE_ROAD_TEMPE	38	38	34	24	47	55	50	22
NCA 02_1125	87_UNWINS BRIDGE_ROAD_TEMPE	38	38	33	22	38	54	49	23
NCA 02_1126	89_UNWINS BRIDGE_ROAD_TEMPE	36	36	31	22	37	52	46	24
NCA 02_1127	91_UNWINS BRIDGE_ROAD_TEMPE	39	38	34	25	51	53	47	24
NCA 02_1129	95_UNWINS BRIDGE_ROAD_TEMPE	37	36	33	25	46	57	56	25
NCA 02_NR_359	23_TOYER_STREET_TEMPE	33	31	28	21	29	52	47	24
NCA 02_NR_388	81_UNWINS BRIDGE_ROAD_TEMPE	44	45	40	33	56	61	59	26
NCA 03_1131	110_RAILWAY_ROAD_SYDENHAM	47	53	47	47	74	55	52	36
NCA 03_1132	108_RAILWAY_ROAD_SYDENHAM	47	53	47	46	73	52	48	36
NCA 03_1133	106_RAILWAY_ROAD_SYDENHAM	48	51	45	44	70	47	42	31
NCA 03_1134	104_RAILWAY_ROAD_SYDENHAM	48	52	44	40	67	48	42	30
NCA 03_1135	100_RAILWAY_ROAD_SYDENHAM	47	50	44	40	64	48	42	30
NCA 03_1136	98_RAILWAY_ROAD_SYDENHAM	47	50	44	40	59	46	41	26

Receiver ID	Address	Scenario 01	Scenario 02	Scenario 03	Scenario 04	Scenario 05	Scenario 06	Scenario 07	Scenario 08
NCA 03_1137	96_RAILWAY_ROAD_SYDENHAM	45	47	43	32	60	49	43	25
NCA 03_1138	94_RAILWAY_ROAD_SYDENHAM	43	46	40	33	61	49	43	25
NCA 03_1139	92_RAILWAY_ROAD_SYDENHAM	43	44	39	31	61	49	43	25
NCA 03_1140	90_RAILWAY_ROAD_SYDENHAM	43	44	39	32	50	48	43	25
NCA 03_1141	88_RAILWAY_ROAD_SYDENHAM	43	44	38	31	55	49	43	25
NCA 03_1142	86_RAILWAY_ROAD_SYDENHAM	43	44	39	31	58	46	41	25
NCA 03_1143	84_RAILWAY_ROAD_SYDENHAM	43	44	38	31	59	49	43	26
NCA 03_1144	82_RAILWAY_ROAD_SYDENHAM	42	43	38	30	58	49	44	26
NCA 03_1146	103_RAILWAY_ROAD_SYDENHAM	43	48	39	36	52	50	46	28
NCA 03_1147	105_RAILWAY_ROAD_SYDENHAM	43	44	39	33	52	50	46	25
NCA 03_1148	107_RAILWAY_ROAD_SYDENHAM	45	51	38	37	60	51	46	25
NCA 03_1149	109_RAILWAY_ROAD_SYDENHAM	43	50	39	32	57	50	46	25
NCA 03_1150	111_RAILWAY_ROAD_SYDENHAM	47	53	39	32	61	51	46	25
NCA 03_1151	113_RAILWAY_ROAD_SYDENHAM	48	54	45	43	62	51	46	25
NCA 03_1152	115_RAILWAY_ROAD_SYDENHAM	51	57	48	47	63	49	45	26
NCA 03_1153	53_UNWINS BRIDGE_ROAD_SYDENHAM	34	35	29	22	40	50	45	19
NCA 03_1154	55_UNWINS BRIDGE_ROAD_SYDENHAM	39	38	34	25	59	47	41	21
NCA 03_1155	57_UNWINS BRIDGE_ROAD_SYDENHAM	38	38	34	26	58	48	43	22
NCA 03_1156	59_UNWINS BRIDGE_ROAD_SYDENHAM	41	41	37	28	59	47	41	22
NCA 03_1157	61_UNWINS BRIDGE_ROAD_SYDENHAM	39	41	34	26	59	42	35	23
NCA 03_1158	63_UNWINS BRIDGE_ROAD_SYDENHAM	45	47	40	32	61	52	49	29
NCA 03_1159	286_UNWINS BRIDGE_ROAD_SYDENHAM	42	41	37	30	56	51	48	28
NCA 03_1160	284_UNWINS BRIDGE_ROAD_SYDENHAM	38	38	33	27	46	48	42	26
NCA 03_1161	282_UNWINS BRIDGE_ROAD_SYDENHAM	44	42	39	33	55	50	46	27

Receiver ID	Address	Scenario 01	Scenario 02	Scenario 03	Scenario 04	Scenario 05	Scenario 06	Scenario 07	Scenario 08
NCA 03_1162	278_UNWINS BRIDGE_ROAD_SYDENHAM	43	41	39	33	55	49	44	27
NCA 03_1163	276_UNWINS BRIDGE_ROAD_SYDENHAM	42	42	37	32	55	50	45	28
NCA 03_1164	274_UNWINS BRIDGE_ROAD_SYDENHAM	42	41	38	31	50	45	40	27
NCA 03_1165	272_UNWINS BRIDGE_ROAD_SYDENHAM	41	39	36	29	49	46	41	27
NCA 03_1166	268_UNWINS BRIDGE_ROAD_SYDENHAM	45	44	40	38	54	50	46	29
NCA 03_1167	266_UNWINS BRIDGE_ROAD_SYDENHAM	45	45	40	34	55	49	45	30
NCA 03_1168	264_UNWINS BRIDGE_ROAD_SYDENHAM	45	46	41	35	56	50	46	29
NCA 03_1169	262_UNWINS BRIDGE_ROAD_SYDENHAM	43	45	39	33	48	50	45	29
NCA 03_1170	260_UNWINS BRIDGE_ROAD_SYDENHAM	42	43	38	32	56	48	44	30
NCA 03_1171	258_UNWINS BRIDGE_ROAD_SYDENHAM	43	43	40	34	56	49	45	30
NCA 03_1172	256_UNWINS BRIDGE_ROAD_SYDENHAM	44	43	40	34	56	48	44	30
NCA 03_1173	254_UNWINS BRIDGE_ROAD_SYDENHAM	42	41	37	32	53	39	34	29
NCA 03_1174	252_UNWINS BRIDGE_ROAD_SYDENHAM	43	41	40	34	52	45	39	29
NCA 03_1175	250_UNWINS BRIDGE_ROAD_SYDENHAM	44	41	41	35	52	46	41	30
NCA 03_1176	248_UNWINS BRIDGE_ROAD_SYDENHAM	44	43	41	35	51	47	42	30
NCA 03_1177	246_UNWINS BRIDGE_ROAD_SYDENHAM	45	44	41	35	48	48	43	32
NCA 03_1178	244A_UNWINS BRIDGE_ROAD_SYDENHAM	45	44	42	36	48	47	43	32
NCA 03_1179	242_UNWINS BRIDGE_ROAD_SYDENHAM	45	44	42	36	42	48	43	31
NCA 03_1180	240_UNWINS BRIDGE_ROAD_SYDENHAM	45	45	42	36	41	48	43	32
NCA 03_1181	238_UNWINS BRIDGE_ROAD_SYDENHAM	45	46	42	36	41	48	43	30
NCA 03_1182	236_UNWINS BRIDGE_ROAD_SYDENHAM	45	46	42	36	42	46	41	32
NCA 03_1183	234_UNWINS BRIDGE_ROAD_SYDENHAM	45	46	42	36	43	46	41	31
NCA 03_1184	232_UNWINS BRIDGE_ROAD_SYDENHAM	45	46	42	37	42	44	39	33
NCA 03_1185	230_UNWINS BRIDGE_ROAD_SYDENHAM	46	46	43	38	43	45	40	31

Receiver ID	Address	Scenario 01	Scenario 02	Scenario 03	Scenario 04	Scenario 05	Scenario 06	Scenario 07	Scenario 08
NCA 03_1186	5_WRIGHT_STREET_SYDENHAM	54	62	50	51	66	50	47	25
NCA 03_1189	18_SWAIN_STREET_SYDENHAM	48	50	45	41	55	41	35	31
NCA 03_1191	11_SWAIN_STREET_SYDENHAM	56	65	57	55	63	42	37	33
NCA 03_1192	9_SWAIN_STREET_SYDENHAM	54	58	53	48	62	43	37	34
NCA 03_1193	7_SWAIN_STREET_SYDENHAM	52	53	54	47	58	40	35	33
NCA 03_1194	5_SWAIN_STREET_SYDENHAM	52	48	50	47	57	43	38	32
NCA 03_1195	3_SWAIN_STREET_SYDENHAM	49	48	47	44	37	42	37	30
NCA 03_1196	1_SWAIN_STREET_SYDENHAM	49	49	46	42	43	44	39	30
NCA 03_1197	16_SWAIN_STREET_SYDENHAM	48	50	45	40	57	45	41	31
NCA 03_1198	14_SWAIN_STREET_SYDENHAM	48	48	46	41	53	47	42	31
NCA 03_1199	12_SWAIN_STREET_SYDENHAM	48	48	46	41	53	48	44	31
NCA 03_1200	10_SWAIN_STREET_SYDENHAM	48	47	45	40	52	50	46	30
NCA 03_1201	8_SWAIN_STREET_SYDENHAM	47	47	45	40	52	44	39	29
NCA 03_1202	6_SWAIN_STREET_SYDENHAM	47	46	44	39	42	42	36	29
NCA 03_1203	4_SWAIN_STREET_SYDENHAM	46	47	44	39	41	42	37	29
NCA 03_1204	2_SWAIN_STREET_SYDENHAM	45	47	43	37	39	42	38	29
NCA 03_1206	43_UNWINS BRIDGE_ROAD_SYDENHAM	45	47	42	36	52	48	44	29
NCA 03_1207	41_UNWINS BRIDGE_ROAD_SYDENHAM	45	46	42	36	45	48	44	29
NCA 03_1210	7_GLEESON_AVENUE_SYDENHAM	47	59	38	29	60	49	47	21
NCA 03_1211	9_GLEESON_AVENUE_SYDENHAM	49	53	40	31	62	51	49	24
NCA 03_1212	11_GLEESON_AVENUE_SYDENHAM	42	42	39	46	63	52	50	22
NCA 03_1213	136_GEORGE_STREET_SYDENHAM	62	72	62	64	61	48	46	35
NCA 03_1214	134_GEORGE_STREET_SYDENHAM	60	72	63	66	49	43	38	33
NCA 03_1215	132_GEORGE_STREET_SYDENHAM	57	69	61	63	56	43	37	32

Receiver ID	Address	Scenario 01	Scenario 02	Scenario 03	Scenario 04	Scenario 05	Scenario 06	Scenario 07	Scenario 08
NCA 03_1216	130_GEORGE_STREET_SYDENHAM	58	69	60	62	49	43	38	31
NCA 03_1217	128_GEORGE_STREET_SYDENHAM	60	69	62	64	44	43	37	33
NCA 03_1218	126_GEORGE_STREET_SYDENHAM	59	68	62	62	42	44	39	33
NCA 03_1219	124_GEORGE_STREET_SYDENHAM	58	70	59	61	51	46	41	33
NCA 03_1220	122_GEORGE_STREET_SYDENHAM	59	70	61	62	49	44	39	34
NCA 03_1221	120_GEORGE_STREET_SYDENHAM	55	67	57	60	44	45	40	29
NCA 03_1222	118_GEORGE_STREET_SYDENHAM	58	67	57	60	50	47	42	34
NCA 03_1223	116_GEORGE_STREET_SYDENHAM	54	67	52	58	44	43	38	33
NCA 03_1224	30_HOGAN_AVENUE_SYDENHAM	65	74	68	71	56	47	44	33
NCA 03_1225	28_HOGAN_AVENUE_SYDENHAM	59	71	66	66	55	40	35	30
NCA 03_1226	26_HOGAN_AVENUE_SYDENHAM	59	71	65	60	55	42	37	33
NCA 03_1227	24_HOGAN_AVENUE_SYDENHAM	60	67	63	62	53	44	39	34
NCA 03_1228	22_HOGAN_AVENUE_SYDENHAM	61	67	64	62	47	44	39	34
NCA 03_1229	20_HOGAN_AVENUE_SYDENHAM	57	65	61	58	45	42	37	32
NCA 03_1230	18_HOGAN_AVENUE_SYDENHAM	59	65	62	57	43	45	40	34
NCA 03_1231	16_HOGAN_AVENUE_SYDENHAM	57	65	62	57	45	43	38	34
NCA 03_1232	14_HOGAN_AVENUE_SYDENHAM	57	65	60	56	42	44	39	34
NCA 03_1233	12_HOGAN_AVENUE_SYDENHAM	54	64	59	56	43	39	34	30
NCA 03_1234	10_HOGAN_AVENUE_SYDENHAM	54	63	59	55	39	40	34	32
NCA 03_1235	8_HOGAN_AVENUE_SYDENHAM	54	62	58	55	38	40	35	31
NCA 03_1236	6_HOGAN_AVENUE_SYDENHAM	53	66	59	54	36	40	35	31
NCA 03_1237	4_HOGAN_AVENUE_SYDENHAM	53	64	59	51	36	40	34	31
NCA 03_1238	2_HOGAN_AVENUE_SYDENHAM	52	60	57	50	38	41	36	32
NCA 03_1239	216_UNWINS BRIDGE_ROAD_SYDENHAM	48	63	48	39	41	42	37	32

Receiver ID	Address	Scenario 01	Scenario 02	Scenario 03	Scenario 04	Scenario 05	Scenario 06	Scenario 07	Scenario 08
NCA 03_1240	214_UNWINS BRIDGE_ROAD_SYDENHAM	49	57	46	48	40	42	37	32
NCA 03_1241	212_UNWINS BRIDGE_ROAD_SYDENHAM	49	59	47	51	38	42	36	34
NCA 03_1242	210_UNWINS BRIDGE_ROAD_SYDENHAM	51	58	55	39	38	41	36	36
NCA 03_1243	208_UNWINS BRIDGE_ROAD_SYDENHAM	51	49	57	40	38	41	36	36
NCA 03_1244	206_UNWINS BRIDGE_ROAD_SYDENHAM	52	49	57	39	38	41	36	34
NCA 03_1246	202_UNWINS BRIDGE_ROAD_SYDENHAM	49	49	57	41	36	41	35	33
NCA 03_1247	200_UNWINS BRIDGE_ROAD_SYDENHAM	49	57	49	40	37	41	36	32
NCA 03_1248	198_UNWINS BRIDGE_ROAD_SYDENHAM	47	46	43	37	36	38	33	33
NCA 03_1249	196_UNWINS BRIDGE_ROAD_SYDENHAM	49	46	43	37	36	38	33	32
NCA 03_1250	194_UNWINS BRIDGE_ROAD_SYDENHAM	49	44	44	35	34	39	34	34
NCA 03_1251	192_UNWINS BRIDGE_ROAD_SYDENHAM	49	44	43	35	33	39	34	32
NCA 03_1252	190_UNWINS BRIDGE_ROAD_SYDENHAM	48	45	43	36	32	41	36	34
NCA 03_1253	188_UNWINS BRIDGE_ROAD_SYDENHAM	49	44	42	36	31	41	35	32
NCA 03_1254	168_UNWINS BRIDGE_ROAD_ST PETERS	54	43	42	33	30	38	33	33
NCA 03_1255	170_UNWINS BRIDGE_ROAD_ST PETERS	53	43	42	34	29	36	31	33
NCA 03_1256	172_UNWINS BRIDGE_ROAD_ST PETERS	53	43	42	33	30	38	33	33
NCA 03_1257	174_UNWINS BRIDGE_ROAD_ST PETERS	54	43	42	34	32	39	33	35
NCA 03_1258	176_UNWINS BRIDGE_ROAD_ST PETERS	56	45	43	36	34	38	33	34
NCA 03_1259	176A_UNWINS BRIDGE_ROAD_ST PETERS	56	45	43	37	32	38	33	36
NCA 03_1260	178_UNWINS BRIDGE_ROAD_ST PETERS	56	45	43	36	31	33	27	38
NCA 03_1261	180_UNWINS BRIDGE_ROAD_ST PETERS	57	46	44	37	33	40	35	35
NCA 03_1262	182_UNWINS BRIDGE_ROAD_ST PETERS	57	46	44	37	33	38	33	35
NCA 03_1263	184_UNWINS BRIDGE_ROAD_ST PETERS	57	47	44	37	34	38	33	36
NCA 03_NR_151	6_BOLTON_STREET_SYDENHAM	71	71	65	60	49	42	39	42

Receiver ID	Address	Scenario 01	Scenario 02	Scenario 03	Scenario 04	Scenario 05	Scenario 06	Scenario 07	Scenario 08
NCA 03_NR_175	3_GLEESON_AVENUE_SYDENHAM	40	43	36	30	58	49	45	27
NCA 03_NR_205	204_UNWINS BRIDGE_ROAD_SYDENHAM	51	51	58	45	40	41	36	33
NCA 03_NR_212	45_UNWINS BRIDGE_ROAD_SYDENHAM	47	50	44	38	53	50	47	30
NCA 03_NR_250	9_HOGAN_AVENUE_SYDENHAM	51	68	62	62	43	40	35	35
NCA 03_NR_288	5_GLEESON_AVENUE_SYDENHAM	43	51	36	28	60	49	45	26
NCA 03_NR_311	27_UNWINS BRIDGE_ROAD_SYDENHAM	47	43	41	35	31	39	33	34
NCA 03_NR_32	21_UNWINS BRIDGE_ROAD_ST PETERS	70	68	62	57	47	41	36	44
NCA 03_NR_356	29_UNWINS BRIDGE_ROAD_SYDENHAM	45	41	39	32	32	37	32	34
NCA 03_NR_375	31_UNWINS BRIDGE_ROAD_SYDENHAM	48	51	48	44	38	42	37	31
NCA 03_NR_381	3_HOGAN_AVENUE_SYDENHAM	54	68	62	60	39	42	37	31
NCA 03_NR_385	39_UNWINS BRIDGE_ROAD_SYDENHAM	49	50	47	42	44	48	45	34
NCA 03_NR_447	2_BOLTON_STREET_SYDENHAM	70	73	70	67	53	43	39	42
NCA 03_NR_6	20_SWAIN_STREET_SYDENHAM	59	68	58	58	67	51	48	33
NCA 03_NR_66	25_UNWINS BRIDGE_ROAD_SYDENHAM	50	43	42	34	32	37	32	35
NCA 03_NR_7	20_SWAIN_STREET_SYDENHAM	49	54	46	44	48	40	34	31
NCA 04_1265	160_UNWINS BRIDGE_ROAD_ST PETERS	48	43	41	32	33	37	33	37
NCA 04_1266	158_UNWINS BRIDGE_ROAD_ST PETERS	48	43	41	32	35	40	35	36
NCA 04_1267	156_UNWINS BRIDGE_ROAD_ST PETERS	47	43	41	31	34	38	33	35
NCA 04_1268	154_UNWINS BRIDGE_ROAD_ST PETERS	45	41	39	28	31	36	32	34
NCA 04_1269	116_UNWINS BRIDGE_ROAD_ST PETERS	45	41	37	28	33	36	33	40
NCA 04_1270	114_UNWINS BRIDGE_ROAD_ST PETERS	42	37	35	27	31	36	32	41
NCA 04_1271	112_UNWINS BRIDGE_ROAD_ST PETERS	44	39	37	29	33	36	32	42
NCA 04_1272	120_UNWINS BRIDGE_ROAD_ST PETERS	44	39	36	27	30	36	32	38
NCA 04_1273	122_UNWINS BRIDGE_ROAD_ST PETERS	45	41	38	27	32	36	32	36

Receiver ID	Address	Scenario 01	Scenario 02	Scenario 03	Scenario 04	Scenario 05	Scenario 06	Scenario 07	Scenario 08
NCA 04_1274	124_UNWINS BRIDGE_ROAD_ST PETERS	45	41	38	27	31	36	31	37
NCA 04_1275	126_UNWINS BRIDGE_ROAD_ST PETERS	45	41	38	27	29	36	31	36
NCA 04_1276	128_UNWINS BRIDGE_ROAD_ST PETERS	45	41	38	28	29	37	32	36
NCA 04_1277	130_UNWINS BRIDGE_ROAD_ST PETERS	45	40	38	27	29	36	32	36
NCA 04_1278	132_UNWINS BRIDGE_ROAD_ST PETERS	45	40	38	29	32	36	31	36
NCA 04_1279	134_UNWINS BRIDGE_ROAD_ST PETERS	45	38	37	25	28	37	32	37
NCA 04_1280	136_UNWINS BRIDGE_ROAD_ST PETERS	46	40	38	27	30	37	33	34
NCA 04_1281	138_UNWINS BRIDGE_ROAD_ST PETERS	45	39	37	25	28	37	33	36
NCA 04_1282	140_UNWINS BRIDGE_ROAD_ST PETERS	44	40	38	27	30	37	33	34
NCA 04_1283	142_UNWINS BRIDGE_ROAD_ST PETERS	44	40	38	26	29	37	33	36
NCA 04_1284	144_UNWINS BRIDGE_ROAD_ST PETERS	44	40	38	28	31	37	33	34
NCA 04_1285	146_UNWINS BRIDGE_ROAD_ST PETERS	44	41	38	27	29	38	33	36
NCA 04_1286	148_UNWINS BRIDGE_ROAD_ST PETERS	43	39	38	27	31	37	33	34
NCA 04_1287	150_UNWINS BRIDGE_ROAD_ST PETERS	44	41	39	27	30	36	32	34
NCA 04_1288	152_UNWINS BRIDGE_ROAD_ST PETERS	45	41	39	29	32	37	32	36
NCA 04_1289	110_UNWINS BRIDGE_ROAD_ST PETERS	44	40	37	27	31	36	32	45
NCA 04_1290	108_UNWINS BRIDGE_ROAD_ST PETERS	44	41	38	29	34	36	32	46
NCA 04_1291	106_UNWINS BRIDGE_ROAD_ST PETERS	44	40	37	28	32	36	32	46
NCA 04_1292	104_UNWINS BRIDGE_ROAD_ST PETERS	45	41	38	29	33	36	32	45
NCA 04_1293	102_UNWINS BRIDGE_ROAD_ST PETERS	43	40	37	26	30	36	32	44
NCA 04_1294	100_UNWINS BRIDGE_ROAD_ST PETERS	44	39	36	27	33	36	32	46
NCA 04_1295	98_UNWINS BRIDGE_ROAD_ST PETERS	43	39	36	27	31	36	32	45
NCA 04_1296	96_UNWINS BRIDGE_ROAD_ST PETERS	42	39	36	27	32	36	32	45
NCA 04_1297	94_UNWINS BRIDGE_ROAD_ST PETERS	44	40	37	28	33	36	32	47

Receiver ID	Address	Scenario 01	Scenario 02	Scenario 03	Scenario 04	Scenario 05	Scenario 06	Scenario 07	Scenario 08
NCA 04_1298	92_UNWINS BRIDGE_ROAD_ST PETERS	44	40	37	28	33	36	32	47
NCA 04_1299	90_UNWINS BRIDGE_ROAD_ST PETERS	44	40	37	28	34	36	32	48
NCA 04_1300	88_UNWINS BRIDGE_ROAD_ST PETERS	42	39	36	28	34	36	32	48
NCA 04_1301	86_UNWINS BRIDGE_ROAD_ST PETERS	44	41	37	28	32	36	32	48
NCA 04_1302	84_UNWINS BRIDGE_ROAD_ST PETERS	44	41	37	29	35	35	32	49
NCA 04_1303	82_UNWINS BRIDGE_ROAD_ST PETERS	43	41	36	28	35	35	32	48
NCA 04_1304	80_UNWINS BRIDGE_ROAD_ST PETERS	43	41	37	28	34	35	32	49
NCA 04_1305	78_UNWINS BRIDGE_ROAD_ST PETERS	44	40	36	27	33	35	32	47
NCA 04_1306	76_UNWINS BRIDGE_ROAD_ST PETERS	44	41	37	30	36	36	33	50
NCA 04_1307	74_UNWINS BRIDGE_ROAD_ST PETERS	44	41	36	28	35	35	33	50
NCA 04_1308	72_UNWINS BRIDGE_ROAD_ST PETERS	42	40	36	28	34	35	32	49
NCA 04_1309	70_UNWINS BRIDGE_ROAD_ST PETERS	42	39	35	24	33	35	32	50
NCA 04_1310	68_UNWINS BRIDGE_ROAD_ST PETERS	42	37	34	24	34	35	31	49
NCA 04_1311	66_UNWINS BRIDGE_ROAD_ST PETERS	42	38	35	25	34	34	31	50
NCA 04_1312	64_UNWINS BRIDGE_ROAD_ST PETERS	42	37	34	22	33	34	31	52
NCA 04_1313	62_UNWINS BRIDGE_ROAD_ST PETERS	41	37	34	22	33	34	31	50
NCA 04_1316	60_UNWINS BRIDGE_ROAD_ST PETERS	39	35	32	21	32	33	30	49
NCA 04_1317	58_UNWINS BRIDGE_ROAD_ST PETERS	39	35	32	21	33	33	30	50
NCA 04_1318	56_UNWINS BRIDGE_ROAD_ST PETERS	39	35	32	20	32	33	29	49
NCA 04_1319	54_UNWINS BRIDGE_ROAD_ST PETERS	39	34	32	22	33	33	29	49
NCA 04_1320	52_UNWINS BRIDGE_ROAD_ST PETERS	38	34	31	20	32	33	28	51
NCA 04_1321	50_UNWINS BRIDGE_ROAD_ST PETERS	40	34	32	19	35	33	28	49
NCA 04_1322	48_UNWINS BRIDGE_ROAD_ST PETERS	39	34	32	22	34	33	28	52
NCA 04_1323	46_UNWINS BRIDGE_ROAD_ST PETERS	38	33	31	19	34	32	28	52

Receiver ID	Address	Scenario 01	Scenario 02	Scenario 03	Scenario 04	Scenario 05	Scenario 06	Scenario 07	Scenario 08
NCA 04_1324	44_UNWINS BRIDGE_ROAD_ST PETERS	39	34	33	21	35	32	28	50
NCA 04_1325	42_UNWINS BRIDGE_ROAD_ST PETERS	39	34	31	20	34	32	27	49
NCA 04_1326	40_UNWINS BRIDGE_ROAD_ST PETERS	38	33	31	19	35	32	27	47
NCA 04_1327	38_UNWINS BRIDGE_ROAD_ST PETERS	39	33	31	19	34	32	27	47
NCA 04_1328	36_UNWINS BRIDGE_ROAD_ST PETERS	38	34	32	20	35	31	27	47
NCA 04_1329	34_UNWINS BRIDGE_ROAD_ST PETERS	36	31	29	17	35	31	27	46
NCA 04_1330	28_UNWINS BRIDGE_ROAD_ST PETERS	37	30	29	17	35	31	27	45
NCA 04_1331	26_UNWINS BRIDGE_ROAD_ST PETERS	36	33	31	19	35	31	27	45
NCA 04_1332	24_UNWINS BRIDGE_ROAD_ST PETERS	35	29	28	19	34	31	26	44
NCA 04_1333	22_UNWINS BRIDGE_ROAD_ST PETERS	35	29	28	16	36	31	26	45
NCA 04_1334	20A_UNWINS BRIDGE_ROAD_ST PETERS	35	29	27	15	36	31	26	44
NCA 04_1335	130_MAY_STREET_ST PETERS	30	23	22	8	50	22	16	41
NCA 04_1336	128_MAY_STREET_ST PETERS	30	23	22	8	54	23	17	43
NCA 04_1337	126_MAY_STREET_ST PETERS	30	23	22	9	54	23	17	43
NCA 04_1338	124_MAY_STREET_ST PETERS	30	23	22	9	54	24	19	42
NCA 04_1406	6_UNWINS BRIDGE_ROAD_ST PETERS	35	27	25	12	50	26	21	45
NCA 04_1407	8_UNWINS BRIDGE_ROAD_ST PETERS	36	27	26	12	50	26	20	45
NCA 04_1408	10_UNWINS BRIDGE_ROAD_ST PETERS	36	30	28	16	50	26	21	45
NCA 04_1409	12_UNWINS BRIDGE_ROAD_ST PETERS	36	30	28	16	50	32	28	45
NCA 04_1410	14_UNWINS BRIDGE_ROAD_ST PETERS	38	32	30	16	42	32	28	45
NCA 04_1411	16_UNWINS BRIDGE_ROAD_ST PETERS	36	30	28	16	41	32	28	45
NCA 04_1412	18_UNWINS BRIDGE_ROAD_ST PETERS	36	30	28	16	40	32	28	45
NCA 04_1415	4_UNWINS BRIDGE_ROAD_ST PETERS	35	27	26	12	50	26	21	45
NCA 04_NR_13	2_UNWINS BRIDGE_ROAD_ST PETERS	36	31	28	17	54	32	29	46

Receiver ID	Address	Scenario 01	Scenario 02	Scenario 03	Scenario 04	Scenario 05	Scenario 06	Scenario 07	Scenario 08
NCA 04_NR_148	17_UNWINS BRIDGE_ROAD_ST PETERS	66	61	54	51	45	42	39	47
NCA 04_NR_209	15_UNWINS BRIDGE_ROAD_ST PETERS	62	57	49	45	41	39	36	49
NCA 04_NR_210	15_UNWINS BRIDGE_ROAD_ST PETERS	59	55	48	44	41	39	37	50
NCA 04_NR_211	15_UNWINS BRIDGE_ROAD_ST PETERS	48	43	40	31	35	38	35	44
NCA 04_NR_349	1_UNWINS BRIDGE_ROAD_ST PETERS	45	43	37	31	54	35	33	69
NCA 04_NR_350	1_UNWINS BRIDGE_ROAD_ST PETERS	41	41	36	30	68	34	32	68
NCA 04_NR_354	1_UNWINS BRIDGE_ROAD_ST PETERS	45	42	35	29	57	34	32	71
NCA 04_NR_369	162_UNWINS BRIDGE_ROAD_ST PETERS	47	43	41	32	33	39	34	32
NCA 04_NR_417	9_UNWINS BRIDGE_ROAD_ST PETERS	56	51	41	31	34	34	29	51
NCA 04_NR_418	9_UNWINS BRIDGE_ROAD_ST PETERS	47	47	40	35	40	37	35	52
NCA 04_NR_420	9_UNWINS BRIDGE_ROAD_ST PETERS	43	34	33	21	32	33	29	55
NCA 04_NR_421	9_UNWINS BRIDGE_ROAD_ST PETERS	44	33	32	20	34	34	31	51
NCA 04_NR_424	9_UNWINS BRIDGE_ROAD_ST PETERS	44	44	36	30	35	34	31	66
NCA 05_1339	186_LORD_STREET_NEWTOWN	38	39	35	31	67	33	31	61
NCA 05_1340	190_LORD_STREET_NEWTOWN	39	40	35	31	69	33	31	61
NCA 05_1341	358_EDGEWARE_ROAD_NEWTOWN	44	40	35	31	73	33	31	63
NCA 05_1342	358_EDGEWARE_ROAD_NEWTOWN	40	40	35	31	72	33	31	62
NCA 05_1343	180_LORD_STREET_NEWTOWN	38	37	35	30	65	32	31	60
NCA 05_1344	178_LORD_STREET_NEWTOWN	38	37	35	28	64	32	31	59
NCA 05_1345	352_EDGEWARE_ROAD_NEWTOWN	37	33	30	26	67	33	31	55
NCA 05_1346	354_EDGEWARE_ROAD_NEWTOWN	39	38	35	32	70	33	31	62
NCA 05_1347	184_LORD_STREET_NEWTOWN	38	38	35	31	67	33	31	60
NCA 05_1348	182_LORD_STREET_NEWTOWN	38	37	35	30	66	33	31	60
NCA 05_1349	350_EDGEWARE_ROAD_NEWTOWN	38	38	30	27	66	33	31	55

Receiver ID	Address	Scenario 01	Scenario 02	Scenario 03	Scenario 04	Scenario 05	Scenario 06	Scenario 07	Scenario 08
NCA 05_1350	188_LORD_STREET_NEWTOWN	39	39	35	31	68	33	31	61
NCA 05_1351	356_EDGEWARE_ROAD_NEWTOWN	40	40	35	31	71	33	31	62
NCA 05_1352	176_LORD_STREET_NEWTOWN	38	37	35	28	64	32	30	59
NCA 05_1353	344_EDGEWARE_ROAD_NEWTOWN	43	39	35	32	63	33	31	61
NCA 05_1354	338_EDGEWARE_ROAD_NEWTOWN	41	38	33	29	60	33	31	57
NCA 05_1355	336_EDGEWARE_ROAD_NEWTOWN	41	38	33	29	60	33	31	57
NCA 05_1356	334_EDGEWARE_ROAD_NEWTOWN	41	38	33	29	60	33	31	58
NCA 05_1357	332_EDGEWARE_ROAD_NEWTOWN	41	38	33	29	58	33	31	58
NCA 05_1358	330_EDGEWARE_ROAD_NEWTOWN	41	38	33	29	58	33	31	58
NCA 06_1364	37_MARRICKVILLE_ROAD_MARRICKVILLE	40	39	35	27	51	50	44	22
NCA 06_1365	39_MARRICKVILLE_ROAD_MARRICKVILLE	39	38	34	27	48	49	43	22
NCA 06_1366	41_MARRICKVILLE_ROAD_MARRICKVILLE	36	35	32	27	49	52	47	22
NCA 06_1367	43_MARRICKVILLE_ROAD_MARRICKVILLE	35	35	31	27	50	51	46	21
NCA 06_1402	18_SHIRLOW_STREET_MARRICKVILLE	50	45	43	33	31	38	32	33
NCA 06_1403	20_SHIRLOW_STREET_MARRICKVILLE	49	44	42	32	30	38	32	29
NCA 06_1404	17_SHIRLOW_STREET_MARRICKVILLE	48	45	43	34	34	39	33	38
NCA 06_NR_1	30_BUCKLEY_STREET_MARRICKVILLE	42	40	36	27	34	42	37	26
NCA 06_NR_106	42_BUCKLEY_STREET_MARRICKVILLE	42	42	37	28	37	43	38	25
NCA 06_NR_116	35_SHIRLOW_STREET_MARRICKVILLE	53	45	44	36	39	40	35	46
NCA 06_NR_126	20_BUCKLEY_STREET_MARRICKVILLE	42	41	38	29	33	42	37	26
NCA 06_NR_133	39_SYDENHAM_ROAD_MARRICKVILLE	54	63	57	55	39	42	36	31
NCA 06_NR_141	91_RAILWAY_PARADE_MARRICKVILLE	48	53	48	51	63	52	50	31
NCA 06_NR_143	10_SHIRLOW_STREET_MARRICKVILLE	45	41	39	29	33	39	34	33
NCA 06_NR_144	47_SYDENHAM_ROAD_MARRICKVILLE	54	58	56	54	38	42	37	31

Receiver ID	Address	Scenario 01	Scenario 02	Scenario 03	Scenario 04	Scenario 05	Scenario 06	Scenario 07	Scenario 08
NCA 06_NR_152	40_BUCKLEY_STREET_MARRICKVILLE	42	42	37	28	36	43	38	27
NCA 06_NR_160	57_RAILWAY_PARADE_MARRICKVILLE	68	76	61	61	53	40	35	41
NCA 06_NR_161	25_SHIRLOW_STREET_MARRICKVILLE	50	44	43	33	37	41	36	44
NCA 06_NR_17	8_BUCKLEY_STREET_MARRICKVILLE	42	42	38	30	32	41	36	25
NCA 06_NR_170	33B_SHIRLOW_STREET_MARRICKVILLE	53	45	44	36	38	40	35	46
NCA 06_NR_176	19_SHIRLOW_STREET_MARRICKVILLE	50	45	43	33	38	40	36	44
NCA 06_NR_179	4_BUCKLEY_STREET_MARRICKVILLE	43	44	39	31	31	41	36	26
NCA 06_NR_189	79_RAILWAY_PARADE_MARRICKVILLE	61	70	57	57	61	49	47	41
NCA 06_NR_190	65_RAILWAY_PARADE_MARRICKVILLE	66	77	62	61	57	48	44	36
NCA 06_NR_193	31_SHIRLOW_STREET_MARRICKVILLE	52	45	44	36	38	40	35	46
NCA 06_NR_217	14_BUCKLEY_STREET_MARRICKVILLE	42	41	38	29	32	42	36	25
NCA 06_NR_218	33_MARRICKVILLE_ROAD_MARRICKVILLE	36	36	33	24	55	53	49	22
NCA 06_NR_224	6_SYDENHAM_ROAD_MARRICKVILLE	58	65	50	52	36	39	34	32
NCA 06_NR_238	23_SHIRLOW_STREET_MARRICKVILLE	48	42	41	31	35	40	35	42
NCA 06_NR_24	8_SHIRLOW_STREET_MARRICKVILLE	45	41	39	29	27	37	31	29
NCA 06_NR_25	2_SHIRLOW_STREET_MARRICKVILLE	45	41	39	29	27	36	30	28
NCA 06_NR_281	21_SHIRLOW_STREET_MARRICKVILLE	48	43	41	32	35	40	35	42
NCA 06_NR_284	22_BUCKLEY_STREET_MARRICKVILLE	41	41	37	27	33	42	36	26
NCA 06_NR_292	93_RAILWAY_PARADE_MARRICKVILLE	55	61	52	52	65	53	51	37
NCA 06_NR_296	103_RAILWAY_PARADE_MARRICKVILLE	53	55	44	45	65	58	57	37
NCA 06_NR_297	101_RAILWAY_PARADE_MARRICKVILLE	53	56	46	46	65	54	52	38
NCA 06_NR_302	41_SYDENHAM_ROAD_MARRICKVILLE	53	62	56	55	38	42	37	31
NCA 06_NR_310	52_BUCKLEY_STREET_MARRICKVILLE	39	39	35	26	35	45	40	23
NCA 06_NR_316	44_BUCKLEY_STREET_MARRICKVILLE	39	39	34	24	37	44	39	24

Receiver ID	Address	Scenario 01	Scenario 02	Scenario 03	Scenario 04	Scenario 05	Scenario 06	Scenario 07	Scenario 08
NCA 06_NR_338	71_RAILWAY_PARADE_MARRICKVILLE	64	74	60	60	59	48	45	40
NCA 06_NR_339	55_RAILWAY_PARADE_MARRICKVILLE	71	77	63	62	54	40	35	44
NCA 06_NR_341	27_SHIRLOW_STREET_MARRICKVILLE	51	45	44	35	37	41	36	44
NCA 06_NR_342	20_SYDENHAM_ROAD_MARRICKVILLE	54	57	53	49	36	35	29	33
NCA 06_NR_35	6_BUCKLEY_STREET_MARRICKVILLE	43	43	39	30	32	41	36	26
NCA 06_NR_357	75_RAILWAY_PARADE_MARRICKVILLE	62	72	59	58	60	49	46	40
NCA 06_NR_358	10_SYDENHAM_ROAD_MARRICKVILLE	54	64	52	51	36	39	34	31
NCA 06_NR_361	67_RAILWAY_PARADE_MARRICKVILLE	65	76	61	61	57	48	45	40
NCA 06_NR_362	4_SHIRLOW_STREET_MARRICKVILLE	45	41	39	29	27	36	30	28
NCA 06_NR_365	38_BUCKLEY_STREET_MARRICKVILLE	42	42	37	28	35	42	37	27
NCA 06_NR_366	99_RAILWAY_PARADE_MARRICKVILLE	54	60	51	50	65	53	51	37
NCA 06_NR_367	16_GARDEN_STREET_MARRICKVILLE	49	40	39	29	35	32	26	42
NCA 06_NR_371	37_SYDENHAM_ROAD_MARRICKVILLE	54	65	57	56	39	42	37	33
NCA 06_NR_373	12_GARDEN_STREET_MARRICKVILLE	52	40	40	30	35	32	26	42
NCA 06_NR_374	59_RAILWAY_PARADE_MARRICKVILLE	69	78	63	62	55	45	42	40
NCA 06_NR_376	89_RAILWAY_PARADE_MARRICKVILLE	58	62	55	54	63	51	49	39
NCA 06_NR_377	61_RAILWAY_PARADE_MARRICKVILLE	66	78	62	62	56	47	44	38
NCA 06_NR_379	25_SYDENHAM_ROAD_MARRICKVILLE	63	71	59	58	45	42	37	29
NCA 06_NR_383	85_RAILWAY_PARADE_MARRICKVILLE	58	63	54	55	59	51	48	40
NCA 06_NR_384	81_RAILWAY_PARADE_MARRICKVILLE	60	65	56	56	62	50	47	40
NCA 06_NR_386	35_SYDENHAM_ROAD_MARRICKVILLE	57	68	58	56	39	42	37	33
NCA 06_NR_4	29_SHIRLOW_STREET_MARRICKVILLE	52	45	44	36	38	40	35	46
NCA 06_NR_40	2_SYDENHAM_ROAD_MARRICKVILLE	59	65	54	51	36	39	34	31
NCA 06_NR_41	26_BUCKLEY_STREET_MARRICKVILLE	41	40	37	27	34	42	37	27

Receiver ID	Address	Scenario 01	Scenario 02	Scenario 03	Scenario 04	Scenario 05	Scenario 06	Scenario 07	Scenario 08
NCA 06_NR_42	18_BUCKLEY_STREET_MARRICKVILLE	42	41	38	29	33	42	36	25
NCA 06_NR_455	22_GARDEN_STREET_MARRICKVILLE	48	39	39	29	35	32	26	42
NCA 06_NR_456	19_SYDENHAM_ROAD_MARRICKVILLE	65	72	61	59	39	42	37	31
NCA 06_NR_469	21_MARRICKVILLE_ROAD_MARRICKVILLE	37	38	34	27	60	57	57	23
NCA 06_NR_472	45_MARRICKVILLE_ROAD_MARRICKVILLE	35	38	33	27	48	53	48	21
NCA 06_NR_478	31A_MARRICKVILLE_ROAD_MARRICKVILLE	37	40	35	28	57	54	51	23
NCA 06_NR_57	37_SHIRLOW_STREET_MARRICKVILLE	53	45	43	36	39	40	35	46
NCA 06_NR_58	30_SHIRLOW_STREET_MARRICKVILLE	48	43	41	31	36	35	29	44
NCA 06_NR_74	34_BUCKLEY_STREET_MARRICKVILLE	41	41	37	26	34	41	35	25
NCA 06_NR_75	16_BUCKLEY_STREET_MARRICKVILLE	42	41	38	29	33	42	37	25
NCA 06_NR_78	31_SYDENHAM_ROAD_MARRICKVILLE	62	69	58	57	39	42	37	31
NCA 06_NR_95	22_SHIRLOW_STREET_MARRICKVILLE	48	38	40	30	31	34	28	41
NCA 06_NR_97	12_SYDENHAM_ROAD_MARRICKVILLE	53	61	52	53	36	39	34	31

ENDORSEMENT

CITY & SOUTHWEST ACOUSTIC ADVISOR

Review of	**Construction Noise and Vibration Impact Statement: Sydenham Station Junction Site**	**Document reference:**	**SYDNEY METRO CITY & SOUTHWEST-JOHN HOLLAND LAING O-ROURKE JOINT VENTURE Construction Noise and Vibration Impact Statement: Sydenham Station Junction Site** *6134-J (revC), Dated 20 August 2018*
Prepared by:	Dave Anderson		
Date of issue:	23 August 2018		

As approved Acoustic Advisor for the Sydney Metro City & Southwest project, I have reviewed the Construction Noise and Vibration Impact Statement (CNVIS) for the Sydenham Station Junction Site, as required under A27 (d) of the project approval conditions.

The CNVIS covers demolition, civil and trackworks at Sydenham Station and nearby bridges and track corridors.

Potential vibration impacts on structures, including heritage station infrastructure, have been assessed in conjunction with an assessment of structural soundness. Potential noise impacts on noise sensitive receivers have been assessed in conjunction with observations of façade acoustic performances or residential receivers, as well as operational functions of non-residential receivers.

I am satisfied that the CNVIS is technically valid and that it includes appropriate noise and vibration mitigation and management. On this basis I endorse revision C of the impact statement in relation to the works documented at the Sydenham Station Junction site.

Dave Anderson, City & Southwest Acoustic Advisor

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Stuart Hodgson
Director
Program Sustainability Environment & Planning
Sydney Metro
Transport for NSW
PO Box K659
HAYMARKET NSW 1240

23 August 2018

Ref: SSJ CNVIS

Dear Stuart

RE: Endorsement Of Sydney Metro City & Southwest-John Holland Laing O-Rourke Joint Venture Construction Noise And Vibration Impact Statement: Sydenham Station Junction Site

Thank you for providing the following documents for Environmental Representative (ER) review and endorsement as required by the Condition of Approval A24 (d) of the Sydney Metro City & Southwest project (SSI – 15_7400 January 9 2017).

- Sydney Metro City & Southwest-John Holland Laing O'Rourke Joint Venture Construction Noise And Vibration Impact Statement: Sydenham Station Junction Site 6134-J (Revision C, 20 August 2018).

As an approved ER for the Sydney Metro City & Southwest project with reference to the Acoustic Advisor endorsement letter dated 23 August 2018, I have reviewed and provided comments on this document and now consider it appropriate for implementation.

Yours sincerely

Annabelle Tungol Reyes
Environmental Representative – Sydney Metro – City and South West