

TFNSW

TAP3 BEXLEY NORTH STATION NOISE AND VIBRATION IMPACT ASSESSMENT

BEXLEY NORTH STATION - TRANSPORT
ACCESS PROGRAM

JANUARY 2019



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TAP3 Bexley North Station Noise and Vibration Impact Assessment Bexley North Station - Transport Access Program




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REV	DATE	DETAILS
0	30/11/18	Draft issue
1	08/01/19	Final issue

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Bexley North Noise and Vibration
Rev1 (clean, no comments)



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EXECUTIVE SUMMARY

WSP Australia Pty Ltd (WSP) has been engaged to undertake a noise and vibration impact assessment for the proposed Bexley North Station Upgrade (the proposal).

The proposal is intended to improve accessibility and amenities for customers and include new lifts, walkways and upgrades to parking and vehicle access at Bexley North Station. The potential for construction noise and vibration impacts to occur was assessed in line with TfNSW's *Construction Noise and Vibration Strategy* (CNVS) (TfNSW, 2018) and the *Noise Policy for Industry* (NPfI) (EPA, 2017) was used to assess operational noise.

Sensitive receivers for both noise and vibration were identified in the area surrounding the proposal and were organised into Noise Catchment Areas (NCAs) based on a similar noise environment within these areas.

A site survey was carried out to establish the existing background noise levels in the areas surrounding Bexley North station using two unattended noise monitors. The background noise monitoring was supplemented using results from the *WestConnex New M5 Construction Noise and Vibration Management Plan* (Renzo Tonin & Associates, 2018). The supplemented noise monitoring is located close to sensitive receivers and occurred before WestConnex construction works, so is considered representative of long-term background noise levels as it excludes temporary construction works such as WestConnex. The results of the survey were used to set Noise Management Levels (NMLs) in accordance with the *Interim Construction Noise Guideline* (DECCW, 2009) and noise triggers for operational noise in accordance with the NPfI.

A total of six worst-case construction activities were assessed, with all works being undertaken during standard construction working hours and three also requiring works to be undertaken during up to five 48-hour rail possessions. The total duration of work is expected to be up to 12 months.

Three-dimensional computer noise modelling predicted that the NMLs have the potential to be exceeded during construction activities for a majority of representative residential receivers for all assessed activities when noise sources with special audible characteristics were in use. Predicted noise levels decreased considerably when equipment with special audible characteristics (concrete saw, chainsaw) are not in use, with almost no exceedances of standard hours NMLs in NCAs 5 to 8 during Activities 3, 4, and 6, and only exceedances of evening or night NMLs for Activities 1, 2, and 5. Exceedances of standard hours NMLs in NCAs 1 to 4 also decreased in magnitude. The closest non-residential receivers were predicted to be noise affected during most of the assessed construction activities.

Construction traffic noise impacts were assessed with reference to the *Road Noise Policy* (RNP) (EPA, 2011) and are expected to comply with the RNP criteria due to the proportionally minor increase in traffic generated by construction of the proposal, when compared to current traffic volumes along Bexley Road.

Minimum working distances for vibration intensive plant have been outlined to comply with human comfort and cosmetic damage vibration limits.

Mitigation measures, including the CNVS standard and additional noise and vibration mitigation measures have been provided to reduce impacts on nearby sensitive receivers.

Site specific noise mitigation measures have been recommended including:

- providing temporary barriers.
- using temporary screening or enclosures around works involving a concrete saw when used near the identified place of worship receiver (Olsens Funerals with Walters & Sons).
- further consultation with the identified place of worship receiver to minimise impacts during sensitive periods and on sensitive facilities within the receiver.

For operational noise, the mechanical plant selections have not yet been finalised. However, it is not expected that the mechanical plant would have a significant noise impact (when appropriately designed, sited and screened from the nearest noise sensitive receivers). Any mechanical plant, equipment or other operational noise source proposed is to be designed to meet the NPfI noise triggers identified in this report.

ABBREVIATIONS

CNVS	TfNSW <i>Construction Noise and Vibration Strategy 2018</i>
dB	Decibel
dBA	A-Weighted Decibel
DEC	(NSW) Department of Environment Conservation
DECCW	(NSW) Department of Environment, Climate Change and Water
DEFRA	UK Department for Environment, Food and Rural Affairs
EPA	(NSW) Environment Protection Authority
ICNG	<i>Interim Construction Noise Guideline 2009</i>
NPfI	<i>Noise Policy for Industry 2017</i>
NATA	National Association Of Testing Authorities
NML	Noise Management Level
PPV	Peak Particle Velocity
RBL	Rating Background Level as defined in the NPfI
RNP	<i>Road Noise Policy 2011</i>
SWL	Sound power level
TAP3	Transport Access Program Stage 3
TfNSW	Transport for NSW
VDV	Vibration Dose Value

1 INTRODUCTION

1.1 PROPOSAL DESCRIPTION

Transport for New South Wales (TfNSW) proposes to provide accessibility upgrades at the Bexley North Station (the proposal). WSP has been engaged to undertake a noise and vibration assessment for the proposal to support the Review of Environment Factors (REF) for the Proposal. The Proposal is part of the Transport Access Program to improve accessibility and amenity for customers and is proposed to include the following key elements:

- provision of a new station entrance from the Bexley Road overbridge. The new station entrance would include:
 - demolition of the existing stairs and the eastern platform canopy in order to accommodate the new stairs, lift and entrance landing
 - construction of a new station entrance landing area
 - construction of a new lift between Bexley Road and the station platform
 - construction of new stairs between the landing and the station platform
 - construction of a replacement stair and platform canopy
- internal station building works including:
 - construction of a new family accessible toilet in the location of the existing male toilets
 - construction of a new unisex ambulant toilet at the location of the existing female toilets
 - other minor building modifications required to accommodate new electrical equipment including a main switchboard, and new or upgraded station communications equipment
- upgrade of existing platform surfaces (re-grading/re-surfacing) at locations across platforms to provide compliant accessible paths and ramps to station amenities
- upgrade of the existing commuter carpark on Kingsgrove Avenue including:
 - reconfiguration of the existing car park to allow for 22 parking spaces, including two accessible parking spaces. Note this would result in a net loss of 11 parking spaces from the existing configuration
 - an accessible ramp from the commuter carpark to the Bexley Road overbridge
 - increased car park aisle width and turning vehicle area
- landscaping and planting works within the station precinct
- upgrade of the existing footpaths to the north and south of the station entrance along the Bexley Road overbridge, including minor re-grading of footpaths and installation of landings
- power supply upgrades including modification to the existing station 11kV padmount transformer, construction of a new containment and submain cable including an underline crossing, and connection to the new main switchboard in the station building
- ancillary works including adjustments to fencing, retaining walls, crash barriers, lighting, electrical upgrades, electronic ticketing, new seating, relocation of rubbish bins, improvement to station communications and security systems (including CCTV cameras), public address system, hearing induction loops, station passenger information, wayfinding signage and installation of tactile ground surface indicators (TGSIs).

Figure 1.1 outlines the location of the proposal, which includes an outline of the Noise Catchment Areas (NCAs), noise monitoring locations and nearest representative noise sensitive receivers.



Figure 1.1 Proposal site layout

1.2 SENSITIVE RECEIVERS

The proposal has the potential to impact nearby properties that are considered sensitive to noise and vibration.

Receivers potentially sensitive to both noise and vibration in the following categories as defined in *Noise Policy for Industry* (NPfI) (EPA, 2017) and *Interim Construction Noise Guideline* (ICNG) (DECC, 2009) have been identified in the surrounding area:

- residential
- commercial
- library
- place of worship
- active recreation areas.

The receivers surrounding the proposal have been categorised into Noise Catchment Areas (NCAs) based on a similar noise environment within these areas. The area surrounding the proposal is generally made up of medium density residential areas with some limited commercial (retail) development. The M5 motorway and major roads – Bexley Road and Shaw Street – are located close to the residential areas.

Construction noise and vibration impacts have been assessed at representative receiver locations within each NCA. Table 1.1 presents the representative receivers for each NCA. The location of the NCAs is presented in Figure 1.1.

Table 1.1 NCA and classification of representative receivers

NCA	RECEIVER TYPE	ADDRESS	RECEIVER ID
1	Residential	177 Slade Road, Bexley North	R1
2	Residential	1 Irwin Crescent, Bexley North	R2A
	Residential	236 Slade Road, Bexley North	R2B
	Commercial	238 Slade Road, Bexley North	C2
3	Residential	29 Shaw Street, Bexley North	R3
	Commercial	6 Shaw Street, Bexley North (Olsens Funerals with Walters & Sons)	C3
	Place of worship	6 Shaw Street, Bexley North (Olsens Funerals with Walters & Sons)	P3
	Library	Bexley North Library	L3
	Active Recreation	Shaw Street Reserve	AR3
4	Residential	26 Shaw Street, Bexley North	R4
5	Residential	1 Kingsgrove Avenue, Kingsgrove	R5
6	Residential	4 Jones Avenue, Kingsgrove	R6
7	Residential	264 Bexley Road, Earlwood	R7
8	Residential	9 Johnston Street, Earlwood	R8

1.3 LIST OF REFERENCED DOCUMENTS

This report has been written with reference to the following documents:

- TfNSW Construction Noise and Vibration Strategy 2018 (CNVS)
- NSW EPA Noise Policy for Industry 2017 (NPfi)
- NSW DECC Interim Construction Noise Guideline 2009 (ICNG)
- NSW EPA Road Noise Policy 2011 (RNP)
- NSW DEC Assessing Vibration: a technical guideline 2005 (AVTG)

The following report has been used to supplement characterisation of the existing noise environment:

- Westconnex The New M5 Construction Noise and Vibration Management Plan, dated 28 June 2018

Furthermore, the following Standards are referenced in this report:

- Australian Standard AS 1055-1997- *Acoustics-Description and Measurement of Environmental Noise*
- British Standard BS 7385-2: *Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration*
- Australian Standard AS 2436:2010 - *Guide to noise and vibration control on construction, demolition and maintenance sites*
- Department for Environment Food and Rural Affairs (United Kingdom), *Update of noise database for prediction of noise on construction and open sites – Phase 3: Noise measurement data for construction plant used on quarries*
- British Standard BS 7385 Part 2-1993 *Evaluation and measurement for vibration in buildings*
- German Standard DIN 4150: *Part 3 – 1999 Structural Vibration in Buildings: Effects on Structures.*

2 EXISTING ENVIRONMENT

The prevailing background and ambient noise levels surrounding the site were determined through a combination of unattended and operator attended noise surveys in accordance with the *Australian Standard 1055-1997- Acoustics- Description and Measurement of Environmental Noise* (AS 1055) and the NPfI.

Due to an equipment malfunction, noise monitoring data at monitoring location NM02 has been excluded. Representative background noise levels have been supplemented by unattended noise monitoring undertaken as part of the Westconnex – The New M5 construction works by Renzo Tonin & Associates and AECOM, detailed in the publicly available report *Westconnex The New M5 Construction Noise and Vibration Management Plan, dated 28 June 2018* (Westconnex New M5 CNVMP). These supplementary unattended noise surveys were conducted within the proposal NCAs before WestConnex construction works started, and can therefore be considered representative as it considers the long-term noise environment without temporary construction works such as WestConnex.

2.1 NOISE MONITORING LOCATIONS

Two noise monitoring locations were used to characterise the existing noise environment at representative residential receivers on either side of the station, presented in Table 2.1 and shown in Figure 1.1.

Table 2.1 also shows the noise monitoring locations from the Westconnex New M5 CNVMP used to supplement the assessment.

Table 2.1 Noise monitoring locations

NOISE MONITORING LOCATION	SURVEY METHOD	ADDRESS	DATE	COMPANY
NM01	Unattended measurement and Attended measurement	53 Shaw Street, Bexley North	November 2018	WSP
NM02	Unattended measurement and Attended measurement	39 Forrest Ave, Earlwood	November 2018	WSP
EIS NL23	Westconnex New M5 CNVMP measurement	92 Wolli Ave, Earlwood	June 2015	AECOM
DD NL03	Westconnex New M5 CNVMP measurement	8 Jones Ave, Kingsgrove	June 2016	Renzo Tonin & Associates
DD NL04	Westconnex New M5 CNVMP measurement	6 Kingsgrove Ave, Kingsgrove	June 2016	Renzo Tonin & Associates

2.2 INSTRUMENTATION

The monitoring equipment was fitted with windshields and were field calibrated before and after monitoring. No significant drifts in calibration (± 0.5 dB) were noted. The weather conditions at the time of monitoring were recorded at Sydney Airport (Bureau of Meteorology station number 066037), which is located approximately six kilometres east of the proposal.

Monitoring data was excluded during periods of weather where wind speeds were greater than five metres per second or during rainfall that may have adversely affected the collected data.

All of the WSP monitoring equipment has a current certified calibration certificate (National Association of Testing Authorities, NATA) at the time of use. Details of the WSP equipment used to conduct the noise survey are presented in Table 2.2. Copies of the calibration certificates can be provided upon request.

Table 2.2 Noise monitoring equipment

LOCATION	SURVEY METHOD	MANUFACTURER AND MODEL NO.	SERIAL NO.
NM01	Unattended measurement	Norsonic 140	1404791
NM02	Unattended measurement	Svan 958	36659
NM01and NM02	Attended measurement	Norsonic 140	1406502
NM01and NM02	Attended measurement & unattended measurement	NC 73 (calibrator)	11248294

2.3 UNATTENDED NOISE SURVEY

Unattended noise monitoring for background noise levels in the vicinity of Bexley North Station were carried out by WSP between 6 November 2018 and 15 November 2018 at NM01 and NM02.

Due to equipment malfunction, noise monitoring data at NM02 was considered to be contaminated and has been excluded from the assessment. Therefore, representative background noise levels have been supplemented by three unattended noise monitoring surveys undertaken as part of the WestConnex New M5 CNVMP. These supplementary unattended noise surveys were conducted within the proposal NCAs before WestConnex construction works started, and is considered representative of the long term existing noise environment in those areas as it excludes temporary noise sources such as construction works for WestConnex.

The results are summarised in Table 2.3 and detailed daily plots of data are presented for NM01 in Appendix A.

Table 2.3 Summary of unattended noise monitoring results

LOCATION	RATING BACKGROUND LEVEL (RBL) dBA ^{1,2}			AMBIENT NOISE LEVEL dBA L _{eq, 15 minute}		
	DAY	EVENING	NIGHT	DAY	EVENING	NIGHT
NM01	40	40	39	49	49	47
DD NL04	47	47	41	54	53	50
DD NL03	49	48	36	59	55	52
EIS L23	51	51	43	57	56	53

- (1) Rating Background Level (RBL) The overall single-figure background level representing each assessment period (daytime/evening/night-time) as defined in the NPfI.
- (2) Time periods defined as – Day: 7am to 6pm Monday to Saturday, 8am to 6pm Sunday; Evening: 6pm to 10pm; Night: 10pm to 7am Monday to Saturday, 10pm to 8am Sunday.

2.4 OPERATOR ATTENDED NOISE SURVEY

WSP carried out operator attended measurements to characterise the noise environment and identify the contributors to the acoustic environment. Attended measurements were carried out during the day period at NM01 and NM02 on Tuesday 6 November 2018. During the surveys, the weather was noted as being dry with light wind and suitable for noise monitoring.

At NM01, the background levels were characterised by consistent traffic along the M5. Ambient noise levels were controlled by vehicle pass-bys along Shaw Street, with contributions from trucks and loud vehicle pass-bys along the M5, birds and insect noise, train pass-bys and aircraft fly-overs.

At NM02, the background levels were characterised by consistent traffic along the M5 and Bexley Road. Ambient noise levels were controlled by trucks and loud vehicle pass-bys along the M5 and Bexley Road, birds and insect noise, train pass-bys and aircraft fly-overs.

The characteristic of the background noise environment observed during the attended noise survey is consistent with the observations provided in the Westconnex New M5 CNVMP. The results of the attended noise surveys and observations are detailed in Table 2.4.

Table 2.4 Summary of attended noise measurement results

LOCATION	TIME	dBA L _{eq} (15min)	dBA L ₉₀ (15min)	OBSERVATIONS
NM01	11:00am – 11:15am	50	46	<p>Ambient:</p> <p>Insects: 40 to 45 dBA for around 40% of the time Car pass-bys: up to 61 dBA Birds: ~48 dBA for 20% of the time Plane: up to 60 dBA</p> <p>Background:</p> <p>Urban hum Consistent traffic from the M5</p>
NM02	12:15pm – 12:30pm	47	37	<p>Ambient:</p> <p>Insects: 40 to 45 dBA for around 60% of the time Birds: ~48 dBA for 20% of the time</p> <p>Background:</p> <p>Consistent traffic from the M5</p>

3 ASSESSMENT CRITERIA

3.1 OPERATIONAL NOISE

Operational noise emissions from the proposal to surrounding noise sensitive areas are assessed according to the NPfI.

In assessing the impact of industrial noise sources, the NPfI requires consideration of intrusive, amenity and sleep disturbance noise impacts.

3.1.1 PROPOSAL INTRUSIVENESS NOISE LEVEL

Table 3.1 presents the proposal intrusiveness level based on the measured RBL.

Table 3.1 Established Proposal Intrusiveness Noise Level, residential receivers only

MONITORING LOCATION	NCA	TIME PERIOD	RBL dBA	PROPOSAL INTRUSIVENESS NOISE LEVEL (RBL + 5dB) dBA L _{eq, 15 minute}
NM01	NCA 1 - 4	Day	40	45
		Evening	40	45
		Night	39	44
DD NL04	NCA 5	Day	47	52
		Evening	47	52
		Night	41	46
DD NL03	NCA 6	Day	49	54
		Evening	48	53
		Night	36	41
EIS L23	NCA 7 - 8	Day	51	56
		Evening	51	56
		Night	43	48

3.1.2 PROPOSAL AMENITY NOISE LEVELS

To limit continuing increases in noise levels, the amenity noise level within an area from industrial noise sources should not normally exceed the amenity noise levels prescribed in the NPfI.

The recommended amenity noise levels represent the objective for **total** industrial noise at a receiver location, whereas the **proposal amenity noise level** represents the objective for noise from a **single** industrial development at a receiver location as follows:

$$\text{Proposal amenity noise level} = \text{recommended amenity noise level (Table 2.2 of NPfI)} \text{ minus } 5 \text{ dB(A)}$$

The amenity criteria have been established at the identified receivers based on the results of the attended and unattended noise survey. The established amenity criteria applicable to the proposal are presented in Table 3.2.

Residential receivers with a similar noise environment to observed across the proposal site have been classified as an urban noise environment in accordance with the NPfI as the background noise environment is defined by road traffic noise from the M5 and urban hum as part of the noise environment and is near commercial districts.

Table 3.2 Established Proposal Amenity Noise Level

TYPE OF RECEIVER ¹	RECOMMENDED AMENITY NOISE LEVEL (ANL) dBA L _{eq, period}	PROPOSAL AMENITY NOISE LEVEL (ANL - 5dB) dBA L _{eq, period}	PROPOSAL ADJUSTED ANL ²		
			dBA L _{eq period}		
			DAY	EVENING	NIGHT
Library (as per AS2107:2016)	45 ³	40	40	40	40
Active recreation	55	50	50	50	50
Commercial	65	60	60	60	60
Place of worship	50 ³	45	45	45	45
Residential (Urban) (NML01, DD NL03, DD NL04, EIS L23)	Day: 60 Evening: 50 Night: 45	Day: 55 Evening: 45 Night: 40	55	45	40

- (1) Amenity levels only apply during times of use for all receivers except residential.
- (2) Day: the period from 7:00 am to 6:00 pm Monday to Saturday; or 8:00 am to 6:00 pm on Sundays and public holidays; evening: the period from 6:00 pm to 10:00pm; night: the remaining periods.
- (3) A 10dB internal to external correction has been applied, in accordance with Section 2.6 of the NPfI.

3.1.3 PROPOSAL NOISE TRIGGER LEVELS

In assessing the noise impact of the proposal on surrounding residential receivers, both the intrusiveness and amenity criterion must be considered. The most stringent trigger level forms the proposal noise trigger levels (PNTL) for the development under assessment.

In order to standardise the time periods for the intrusiveness and amenity noise levels, the following conversion between L_{eq, period} and L_{eq, 15 minute} has been applied (as per Section 2.2 of the NPfI):

$$\text{dBA } L_{\text{eq, 15 minute}} = \text{dBA } L_{\text{eq, period}} + 3 \text{ dB}$$

As required in Section 2.2 of the NPfI, all proposal noise trigger levels and limits are expressed as L_{eq, 15 minute}, unless otherwise expressed. A summary of the PTNL applicable to this proposal is presented in Table 3.3.

Table 3.3 Summary of NSW Noise Policy for Industry Proposal Noise Trigger Levels (PNTL)

RECEIVER TYPE	NCA	TIME PERIOD ¹	NOISE LEVEL dBA $L_{eq, 15 \text{ minute}}$		
			INTRUSIVENESS	AMENITY	PTNL
Education	All	When in use	-	43	43
Active recreation	All	When in use	-	53	53
Place of worship	All	When in use	-	48	48
Commercial	All	When in use	-	63	63
Residential (Urban) (NM01)	NCA 1 – 4	Day	45	58	45
		Evening	45	48	45
		Night	44	43	43
Residential (Urban) (DD NL03)	NCA 5	Day	52	58	52
		Evening	52	48	48
		Night	46	43	43
Residential (Urban) (DD NL04)	NCA 6	Day	54	58	54
		Evening	53	48	48
		Night	41	43	41
Residential (Urban) (EIS L23)	NCA 7	Day	56	58	56
		Evening	56	48	48
		Night	48	43	43

(1) Non-residential receivers trigger levels apply when the premises are in use. Time periods defined as Day: the period from 7:00 am to 6:00 pm Monday to Saturday; or 8:00 am to 6:00 pm on Sundays and public holidays; evening: the period from 6:00 pm to 10:00 pm; night: the remaining periods.

3.1.4 SLEEP DISTURBANCE

The potential for sleep disturbance from noise events from the premises during the night period needs to be considered. Sleep disturbance is considered to be both awakenings and disturbance to sleep stages.

As outlined in the NPfI, where the development night time noise levels at a residential location exceed the following, a detailed maximum noise level event assessment should be undertaken:

- “ $L_{Aeq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or
- L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater.”

Table 3.4 summarises the operational noise sleep disturbance screening criteria for this proposal.

Table 3.4 Sleep disturbance proposal screening criteria

NCA	PROVIDED SCREENING CRITERIA	RBL BASED SCREENING CRITERIA	PROPOSAL SCREENING CRITERIA
NCA 1 - 4	40 L _{Aeq} , 15 minute dBA	$(39 + 5)^1$ 44	44 L_{eq}, 15 minute dBA
	52 L _{AFmax} dBA	$(39 + 15)^2$ 54	54 L_{Fmax} dBA
NCA 5	40 L _{Aeq} , 15 minute dBA	$(47 + 5)^1$ 52	52 L_{eq}, 15 minute dBA
	52 L _{AFmax} dBA	$(47 + 15)^2$ 62	62 L_{Fmax} dBA
NCA 6	40 L _{Aeq} , 15 minute dBA	$(49 + 5)^1$ 54	54 L_{eq}, 15 minute dBA
	52 L _{AFmax} dBA	$(49 + 15)^2$ 64	64 L_{Fmax} dBA
NCA 7 - 8	40 L _{Aeq} , 15 minute dBA	$(51 + 5)^1$ 56	56 L_{eq}, 15 minute dBA
	52 L _{AFmax} dBA	$(51 + 15)^2$ 66	66 L_{Fmax} dBA

- (1) RBL + 5 as outlined in the NPfl
(2) RBL + 15 as outlined in the NPfl

3.2 CONSTRUCTION NOISE

The *TfNSW Construction Noise and Vibration Strategy* (CNVS) (TfNSW, 2018) establishes assessment methods for construction noise impacts at sensitive receivers from TfNSW Infrastructure and Services Division proposals. The strategy includes reference to objectives in the *Interim Construction Noise Guideline* (ICNG) (DECC, 2009).

3.2.1 CONSTRUCTION NOISE ASSESSMENT PERIODS

The CNVS assessment time periods applicable to the proposal are presented in Table 3.5.

Table 3.5 CNVS assessment periods

NAME	RBL PERIOD	TIME PERIODS
Standard Hours (SH)	Day	Monday to Friday - 7am to 6pm Saturday - 8am to 1pm Sunday/Public Holiday - Nil
Out of Hours Works (OOHW) Period 1	Day	Saturday - 7am to 8am and 1pm to 6pm Sunday and public holidays - 8am to 6pm
	Evening	Monday to Saturday - 6pm to 10pm
Out of Hours Works (OOHW) Period 2	Day	Sunday and public holidays - 7am to 8am
	Evening	Sunday and public holidays - 6pm to 10pm
	Night	All days 10pm to 7am

3.2.2 CONSTRUCTION NOISE MANAGEMENT LEVELS

A quantitative assessment requires the development of noise management levels (NML) based on existing RBLs and a comparison of predicted construction noise levels with the NML.

Recommended standard hours represent the times of the day when receivers are likely to be less sensitive to noise impacts. Where work is proposed outside of standard hours, justification is required and more stringent NMLs apply. For all other receiver types, the NMLs only apply when the receiver is being used. Table 3.6 sets out the application of the management levels for noise at residences.

Table 3.6 Application of the ICNG noise management levels for residential receivers

TIME OF DAY	NML, dBA L _{eq} , 15 minute	HOW TO APPLY
<p>Recommended standard hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays</p>	<p>Noise affected RBL + 10 dB</p>	<p>The noise affected level represents the point above which there may be some community reaction to noise.</p> <p>Where the predicted or measured L_{Aeq} (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level.</p> <p>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.</p>
	<p>Highly noise affected 75 dB(A)</p>	<p>The highly noise affected level represents the point above which there may be strong community reaction to noise.</p> <p>Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.</p>
<p>Outside recommended standard hours</p>	<p>Noise affected RBL + 5 dB</p>	<p>A strong justification would typically be required for works outside the recommended standard hours.</p> <p>The proponent should apply all feasible and reasonable work practices to meet the noise affected level.</p> <p>Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should consult with the community.</p>

Representative RBLs for the area have been derived from noise monitoring described in Section 2. Table 3.7 presents the NMLs for representative residential receivers and Table 3.8 for the nearest non-residential sensitive receivers.

Table 3.7 Noise management levels at residential receivers

NCAS	TIME	RBL dBA	NOISE MANAGEMENT LEVEL dBA L_{eq}, 15 minute	HIGHLY NOISE AFFECTED LEVEL dBA L_{eq}, 15 minute
NCA 1 to 4	Standard hours	40	50	75
	Out-of-hours – Day	40	45	N/A
	Out-of-hours – Evening	40	45	
	Out-of-hours – Night	39	44	
NCA 5	Standard hours	47	57	75
	Out-of-hours – Day	47	52	N/A
	Out-of-hours – Evening	47	52	
	Out-of-hours – Night	41	46	
NCA 6	Standard hours	49	59	75
	Out-of-hours – Day	49	54	N/A
	Out-of-hours – Evening	48	53	
	Out-of-hours – Night	36	41	
NCA 7 to 8	Standard hours	51	61	75
	Out-of-hours – Day	51	56	N/A
	Out-of-hours – Evening	51	56	
	Out-of-hours – Night	43	48	

Table 3.8 Noise management levels for non-residential sensitive receivers

LAND USE	NOISE MANAGEMENT LEVEL (EXTERNAL) dBA L_{eq}, 15 minute
Active Recreation	65
Place of Worship	55 ¹
Commercial (offices)	70
Libraries ² (specified as a ‘library – reading area’ in accordance with AS 2107:2016)	55 ¹

(1) An internal to external correction of 10 dB has been applied as per the ICNG.

3.2.3 MAXIMUM NOISE LEVELS

Construction noise during the night has the potential to disturb people’s sleep patterns. Guidance in the ICNG references further information in the RNP that discusses criteria for the assessment of sleep disturbance.

The RNP suggests a screening level of $L_{1,1min}$ dBA, equivalent to the RBL + 15 dB. Where this level is exceeded, further analysis should be carried out. Section 5.4 of the RNP then goes on to state that:

- Maximum internal noise levels below 50 to 55 dBA would be unlikely to result in people’s sleep being disturbed
- If the noise exceeds 65 to 70 dBA once or twice each night the disturbance would be unlikely to have any notable health or wellbeing effects.

The guidance within the RNP indicates that internal noise levels of 50 to 55 dBA are unlikely to cause sleep awakenings. Therefore, at levels above 55 dBA, sleep disturbance would be considered likely. Assuming that receivers may have windows partially open for ventilation, a 10 dB outside to inside correction has been adopted as indicated in the ICNG. Therefore, sleep disturbance screening criteria of RBL+15 dB and L_{max} 65 dBA have been adopted in this report.

3.3 CONSTRUCTION TRAFFIC NOISE

The RNP provides guidance on the assessment of noise impacts from road traffic noise on sensitive receivers.

The RNP criteria apply to traffic generated by construction activities. The existing roads immediately surrounding the proposal are a mix of arterial, sub-arterial and local roads. Arterial, sub-arterial and collector roads are assessed over day (7.00 am-10.00 pm) and night (10.00 pm-7.00 am) periods and local roads are assessed over a one hour period (typically the peak hour) within the respective day and night periods.

Table 3.9 presents a summary of the applicable criteria for residences.

Table 3.9 Road traffic noise criteria for residential receivers on existing roads affected by additional traffic from land use developments

ROAD TYPE	ROAD TRAFFIC NOISE CRITERIA	
	DAY	NIGHT
Arterial/Sub-arterial/Collector	60 L_{eq} 15hr dBA	55 L_{eq} 9hr dBA
Local Roads	55 L_{eq} 1hr dBA	50 L_{eq} 1hr dBA

The RNP application notes state that ‘for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the development should be limited to 2 dBA above that of the noise level without the development. This limit applies wherever the noise level without the development is within 2 dBA of, or exceeds, the relevant day or night noise assessment criterion.’

Therefore, if the road traffic noise levels increase by more than 2 dBA as a result of the proposed construction traffic and the criteria in Table 3.9 are exceeded, investigation of mitigation options would be required.

3.4 VIBRATION

Construction vibration can lead to:

- Cosmetic and structural building damage.
- Loss of amenity due to perceptible vibration, termed human comfort.

Importantly, cosmetic damage is regarded as minor in nature; it is readily repairable and does not affect a building's structural integrity. Damage of this nature is typically described as hairline cracks on drywall surfaces, hairline cracks in mortar joints and cement render, enlargement of existing cracks, and separation of partitions or intermediate walls from load bearing walls. If there is no significant risk of cosmetic damage, then structural damage is not considered a significant risk and is not further assessed.

3.4.1 COSMETIC BUILDING DAMAGE

The CNVS presents minimum working distances based on the British Standard BS 7385-2: *Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration*. The CNVS details a general vibration screening criteria for intermittent vibration sources in Appendix A.3.4 based on BS 7385-2 as follows:

- reinforced or framed structures: 25.0 mm/s
- unreinforced or light framed structures 7.5 mm/s.

At locations where the predicted and/or measured vibration levels are greater than shown above (peak component particle velocity), a more detailed analysis of the building structure, vibration source, dominant frequencies and dynamic characteristics of the structure would be required to determine the applicable safe vibration level.

Heritage buildings and structures would be assessed as per the screening criteria in Section A.3.4 as they should not be assumed to be more sensitive to vibration unless they are found to be structurally unsound.

3.4.2 HUMAN COMFORT

The CNVS requires the assessment of vibration on human comfort in accordance with *Assessing Vibration – A technical guideline* (DEC, 2006).

The proposal may generate intermittent vibration during construction. The applicable criteria are shown in Table 3.10 as vibration dose value ($m/s^{1.75}$), with the proposed construction vibration limits shown in bold.

Table 3.10 Vibration limits for human exposure from intermittent vibration

LOCATION	ASSESSMENT PERIOD	Vibration Dose Value ($m/s^{1.75}$)	
		PREFERRED VALUES	MAXIMUM VALUES
Residences	Daytime	0.2	0.4
	Night	0.13	0.26
Offices, schools, educational institutions, and places of worship	Anytime	0.4	0.8
Workshops	Anytime	0.8	1.6

4 CONSTRUCTION NOISE ASSESSMENT

4.1 NOISE MODELLING METHODOLOGY

A noise model was prepared using the SoundPLAN 8 Industrial Module implementing the ISO 9613-2 calculation method.

A three-dimensional representation of the physical environment within the proposal site was simulated. Modelling inputs for each scenario included ground contours, locations of sensitive receivers, noise-generating equipment as well as any other inputs which have an effect on the noise environment, such as the buildings surrounding the proposal. The model considered noise sources, receivers and the effect of distance, ground topography, atmospheric attenuation and obstacles such as barriers and buildings.

The following assumptions were used in the modelling:

- all noise sources in each scenario operating simultaneously
- all noise sources modelled at two metres from ground level
- topography for the area has been provided by SIX Maps NSW
- NCA noise impacts assessed at the most affected representative receiver
- receiver heights 1.5 metres above ground level, or at the most affected storey.

The noise modelling is considered to be conservative as it assumes all equipment operating simultaneously at their closest point within the work area to the receivers. Actual measured noise levels would be expected to be lower.

4.2 ASSESSMENT SCENARIOS

The following scenarios outlined in Table 4.1 have been modelled as part of the quantitative assessment. Out-of-hours work is only expected to take place during the five nominated 48-hour rail possessions.

Table 4.1 Modelling scenarios

ACTIVITY ID	STAGE	ACTIVITIES	TIMING	DURATION (TOTAL)
1	Site establishment and enabling works	<ul style="list-style-type: none"> — site investigations and survey — establishment of site compounds (i.e. erect fencing, tree protection zones, site offices, amenities and plant/material storage areas) — establishment of temporary facilities as required (e.g. temporary access stairs, temporary toilets, construction lights etc.) — erect temporary hoarding around the different work fronts at station — relocation of minor services — installation of power where required — traffic control measures — retaining wall works — removal of seven trees inside the rail corridor. — power supply upgrades including modification to the existing station 11kV padmount transformer, construction of a new containment and submain cable including an underline crossing, and connection to the new main switchboard in the station building 	Standard hours and 48-hour rail shutdown periods	40 days
2	Lift, stairs and landing works	<ul style="list-style-type: none"> — excavate stair foundations and construct bottom flight of new stairs; demolish existing platform canopy — demolish existing stairs — construct temporary, footpath/walkway and stair access from Bexley Road — excavate lift foundations — piling, waterproofing (as required), installation of reinforcement, formwork and concrete to form the lift pit — construction of lift shaft structure, new landing and upper section of new stair case — lift installation and commissioning — architectural fit-out around lift shaft including new canopy and anti-throw screens. 	Standard hours and 48-hour rail shutdown periods	180 days

ACTIVITY ID	STAGE	ACTIVITIES	TIMING	DURATION (TOTAL)
3	Kingsgrove Avenue carpark works	<ul style="list-style-type: none"> — removal of existing trees adjacent to rail corridor — relocation of services (as required) — demolition/excavation of existing carpark surface — construction of new ramp/footpath between carpark and Bexley Road footpath — re-asphalting of existing carpark and line marking of parking spaces — installation of ancillary features and landscaping within car park area. 	Standard hours	30 days
4	Bexley Road footpath works	<ul style="list-style-type: none"> — demolition/excavation of existing non-compliant footpath — construction and regrading of footpath area to tie into existing. 	Standard hours	30 days
5	Platform modification works	<ul style="list-style-type: none"> — installation of new stormwater from new lift canopy to existing stormwater — platform regrading and asphalt resurfacing — ancillary works including adjustment to lighting, electrical upgrades, Opal card readers, new seating, relocation of rubbish bins, improvement to station communications systems (including CCTV cameras), public address, hearing loops, wayfinding signage and installation of TGSIs. 	Standard hours and 48-hour rail shutdown periods	60 days
6	Station building works	<ul style="list-style-type: none"> — reconfiguration of existing male and female toilets to provide a family accessible toilet and unisex ambulant toilet — installation of a new fire-rated electrical cupboard within the current customer services room. 	Standard hours	60 days

4.3 NOISE SOURCE LEVELS

The nominated equipment for the construction work scenarios and the sound power level (SWL) of each item are detailed in Table 4.2. SWLs have been sourced from the CNVS, *AS 2436:2010 - Guide to noise and vibration control on construction, demolition and maintenance sites*, and the *Department for Environment Food and Rural Affairs (United Kingdom), Update of noise database for prediction of noise on construction and open sites – Phase 3: Noise measurement data for construction plant used on quarries* (DEFRA noise database).

Table 4.2 Sound power levels

ITEM	SWL dBA	ACTIVITY ID
Bobcat	107	1
Chainsaw ¹	119	1, 3
Concrete pump	109	3
Concrete saws ¹	118	2, 3, 4, 5, 6
Concrete truck	109	3, 4, 5
Excavator (10 tonne)	100	2, 3, 4, 6
Generator	103	1
Grinders	105	6
Hand tools	102	1, 2, 3, 4, 5, 6
Hi-rail Elevated Work Platform (EWP)	98	5
Hi-rail truck	103	2, 5
Impact wrenches	111	2
Jack hammers	113	2, 3, 4, 6
Lighting tower	80	6
Piling (bored)	112	2
Mobile crane	113	5
Trucks (medium rigid)	103	1, 3, 4

(1) A +5 penalty has been applied for special audible characteristics as per the CNVS

4.4 PREDICTED NOISE LEVELS

The predicted noise levels for each scenario are presented in Table 4.3 outlining the noise level within each NCA for each representative receiver type. As plant with special audible characteristics, such as the concrete saw or chainsaw, are not expected to operate for the majority of the construction works, values are included in brackets which indicate the predicted noise levels for each scenario excluding the plant with special noise characteristics. Predicted noise levels at buildings within each NCA are presented in Appendix B.

The maximum noise level assessment is presented in Table 4.4. The predicted noise levels have been assessed at the closest affected representative receiver within each NCA. Values are included in brackets which indicate the maximum noise level assessment for each scenario excluding the plant with special noise characteristics.

The calculations are conservative as they include all equipment operating simultaneously at their closest point to the receiver in a worst case 15-minute period. Actual noise levels from the construction site would be expected to be lower.

Where a predicted noise level exceeds a less stringent management level, it follows that the more stringent management levels are also exceeded.

The formatting within the construction noise assessment table indicates the following:

- The **orange shaded cells** show exceedances of the standard-hours day period.
- The **yellow shaded cells** show exceedances of the out-of-hours day period.
- The **green shaded cells** show exceedances of the out-of-hours evening period.
- The **blue shaded cells** show exceedances of the out-of-hours night period.
- The **cells with red text** show exceedances of highly noise affected noise management levels.

The formatting within the maximum noise level table indicates the following:

- The **grey shaded cells** show exceedances of the RBL + 15 criteria.
- The **blue shaded cells** show exceedances L_{max} criteria.

Table 4.3 Predicted construction noise levels

NCA	RECEIVER ID	RECEIVER TYPE	NML				ACTIVITY PREDICTED NOISE LEVEL dBA L _{eq} , 15 minute					
			STANDARD HOURS	OUT-OF-HOURS DAY	OUT-OF-HOURS EVENING	OUT-OF-HOURS NIGHT	ACTIVITY 1	ACTIVITY 2	ACTIVITY 3	ACTIVITY 4	ACTIVITY 5	ACTIVITY 6
1	R1	Residential	50	45	45	44	60 (50)	64 (57)	65 (56)	60 (51)	54	63 (53)
2	R2A	Residential	50	45	45	44	67 (47)	55 (48)	57 (48)	71 (62)	42	54 (44)
	R2B	Residential	50	45	45	44	84 (74)	84 (77)	82 (73)	88 (79)	69	81 (71)
3	C2	Commercial	70				86 (76)	81 (74)	79 (70)	90 (81)	69	79 (69)
	R3	Residential	50	45	45	44	70 (60)	70 (63)	69 (60)	70 (61)	61	74 (64)
	C3	Commercial	70				> 90	87 (80)	83 (74)	> 90	78	87 (77)
	P3	Place of worship	55				> 90	87 (80)	83 (74)	> 90	78	87 (77)
	L3	Library	55				81 (71)	75 (68)	77 (68)	67 (58)	70	85 (75)
	AR3	Active Recreation	65				83 (73)	74 (67)	76 (67)	71 (62)	67	87 (77)
4	R4	Residential	50	45	45	44	65 (55)	64 (57)	67 (58)	65 (56)	57	69 (59)
5	R5	Residential	57	52	52	46	62 (52)	62 (55)	65 (56)	63 (54)	54	66 (56)
6	R6	Residential	59	54	53	41	56 (46)	58 (51)	60 (51)	60 (51)	50	59 (49)
7	R7	Residential	61	56	56	48	61 (51)	60 (53)	61 (52)	61 (52)	53	65 (55)
8	R8	Residential	61	56	56	48	68 (58)	70 (63)	73 (62)	68 (59)	61	69 (59)

Note 1: Values in brackets indicate predicted noise levels excluding plant items with special audible characteristics (concrete saw, chainsaw)

Note 2: Activities 1, 2 and 5 occur during Standard Hours and Out-Of-Hours Works. Activities 3, 4 and 6 only occur during Standard Hours.

Table 4.4 Predicted sleep disturbance assessment

NCA	RECEIVER ID	NML		ACTIVITY PREDICTED MAXIMUM NOISE LEVEL L _{max} dBA		
		RBL +15 SCREENING CRITERIA	MAXIMUM NOISE LEVEL EVENT	ACTIVITY 1	ACTIVITY 2	ACTIVITY 5
1	R1	54	65	68 (58)	72 (65)	62
2	R2A	54	65	75 (65)	63 (56)	50
	R2B	54	65	> 90 (82)	> 90 (85)	77
3	R3	54	65	78 (68)	78 (64)	69
4	R4	54	65	73 (63)	72 (58)	65
5	R5	54	65	70 (60)	70 (63)	62
6	R6	54	65	65 (54)	68 (52)	59
7	R7	54	65	69 (59)	68 (54)	61
8	R8	54	65	76 (66)	78 (64)	69

Note: Values in brackets indicate predicted noise levels excluding plant items with special audible characteristics (concrete saw, chainsaw)

4.5 ASSESSMENT OF PREDICTED NOISE LEVELS

During construction activities, the predictions indicate that construction noise levels could significantly impact the closest receivers. This is expected to occur during the worst case 15 minutes when works are carried out during standard hours or rail possessions. These impacts include exceedance of noise management levels, highly noise affected receivers, and in some cases, sleep disturbance. However, works are expected to take place intermittently over a 12-month period, so these exceedances would not be expected to occur continuously over the duration of the proposal. Out of hours works will take place during rail possessions (occurring over a 48 hour period on a weekend) with only five rail possessions expected to occur over the duration of the proposal (i.e. up to around 12 months). Other works may also be required to occur outside of standard hours which are not part of rail possessions.

As noted above, the predictions are based on a worst case 15-minute period. As these predictions are conservative, and it is anticipated that the proposed works would be short term in nature, actual noise levels from the construction site are expected to be lower than those indicated.

As plant with special audible characteristics, such as concrete saws and chainsaws, represent the worst-case noise impacts (and are not expected to be in use for the majority of the duration of construction activities), a separate assessment has been undertaken excluding these plant items. This additional assessment is intended to provide a more representative assessment of potential noise impacts from a majority of the construction works.

Predicted noise levels including plant with special audible characteristics (concrete saw and chainsaw) indicated the following:

- exceedances of standard hours and out-of-hours NMLs within NCAs 1 to 4 at representative residential receivers during all activities, except for receiver R2A during Activity 5. Residential receiver R2B is predicted to be highly noise affected during all activities except Activity 5
- for NCAs 5 and 8, exceedances of standard hours and out-of-hours NMLs are indicated, with the exception of Activity 5 which only shows exceedances of out-of-hours evening NMLs
- NCA 6 shows exceedance of standard hours NMLs during Activities 3 and 4, exceedance of out-of-hours evening NMLs during Activity 1 and 2, and exceedance of out-of-hours night NMLs during Activity 5
- NCA 7 only shows exceedances of out-of-hours evening NMLs during Activities 1 and 2, exceedance of out-of-hours night NMLs during Activity 5, and exceedance of standard hours NMLs during Activity 6.

When plant with special audible characteristics (concrete saw, chainsaw) were not used, a significant decrease in noise levels and impacts was predicted as follows:

- a decrease in noise level of around 10dB was predicted for all activities except Activity 5
- the worst affected receivers in NCAs 1 to 4 were still predicted to have exceedances of the standard hours and out of hours NMLs for all activities. However, the level of exceedance was typically less than 10 dB which represents a significant decrease in impacts. The receiver at R2B was still predicted to be highly noise affected, however only during Activities 2 and 4
- for NCAs 5 to 8, during standard hours, the predicted noise levels were generally either below or marginally (up to 2 dB) above the NMLs. NCAs 6 and 7 were only predicted to experience exceedances of the night NML, with levels below the NMLs predicted during all other times. Predicted levels during the night period still exceeded the NMLs for all NCAs, however by a reduced amount.

Maximum noise level exceedances are predicted to occur during all out-of-hours work activities at all NCAs except for receiver R2A during Activity 5. Receiver R2B is expected to experience the greatest maximum noise level exceedances, predicted to be up to 25dB above the sleep disturbance criteria. Without plant with special audible characteristics, the predicted maximum noise levels are expected to be up to 10dB lower and receiver R6 would not exceed maximum noise level criteria for Activities 1 and 2, and receiver R7 would not exceed maximum noise level criteria for Activity 2.

Some non-residential receivers are predicted to exceed their NML. Receiver C2 is expected to exceed standard hours NMLs during all activities except for Activity 5. Receivers C3, P3, L3, and AR3 are expected to exceed the NMLs during all activities, with the worst affected non-residential receiver, P3, predicted to exceed NMLs by greater than 35dB.

When plant with special audible characteristics were excluded, AR3 was no longer predicted to exceed the NMLs during Activity 4, and C2 is no longer expected to exceed the NMLs during Activity 3 and 6. NMLs only apply when the premises are in use and therefore the premises would only be impacted when it is occupied.

As a result of the predicted exceedances of the NMLs and sleep disturbance goals, mitigation and management measures have been recommended in Section 6.

4.6 CONSTRUCTION TRAFFIC NOISE

The potential for noise impacts to occur due to light and heavy vehicle movements on public roads generated by the construction work has been assessed.

Construction traffic is expected to travel along Bexley Road to reach the proposal site. Traffic data from the nearest Roads and Maritime Services count station (Station ID: 24221) indicates an annual average daily traffic (AADT) of around 36,000 vehicles along Bexley Road. A worst case scenario of 10 heavy vehicle and 20 light vehicle movements generated by the construction work occurring within a one hour period was assessed. As a 60 per cent increase in traffic is required to increase traffic noise levels by more than 2 dB, it is expected that construction traffic due to the proposal would comply with the RNP criteria.

5 CONSTRUCTION VIBRATION ASSESSMENT

Certain construction activities would require the use of vibration intensive equipment that may affect the nearest sensitive receivers. The vibration intensive plant nominated as part of the work is jack hammering (Activities 2, 3, 4, and 6) and bored piling (Activity 2).

Table 5.1 presents the indicative minimum working distances for the nominated construction plant to minimise the risk of structural damage and human comfort for sensitive receivers, based on the data provided in the CNVS.

The minimum working distances are based on the typical distance from receivers' work permitted to be carried out to meet the limits set out in Section 3.4. The distances are indicative only and results may vary depending on the activity, equipment, local ground, and receiver conditions.

Table 5.1 Recommended minimum working distances for vibration intensive plant

PLANT ITEM	RATING/ DESCRIPTION	MINIMUM WORKING DISTANCE	
		COSMETIC DAMAGE	HUMAN RESPONSE
Jackhammer	Hand held	1 metre (nominal)	Avoid contact with structure
Piling Rig - Bored	≤ 800mm	2 metre (nominal)	N/A

Commercial receiver C3 is directly adjacent to Activities 1 and 4, therefore vibration intensive work may occur within the minimum working distances for this receiver. All residential receivers are outside the minimum working distances.

If minimum working distances are complied with, no adverse impacts are expected for cosmetic damage or human response on nearby sensitive receivers. If works occur within these minimum working distances, mitigation measures outlined in Section 6 should be considered.

6 CONSTRUCTION NOISE AND VIBRATION MITIGATION AND MANAGEMENT

6.1 STANDARD CONSTRUCTION NOISE AND VIBRATION MITIGATION

The CNVS outlines standard measures for mitigating and managing construction noise and vibration to be implemented across all TfNSW I&S construction proposals where reasonable and feasible. These standard measures are outlined in Appendix C.

Prior to commencement of works, a Construction Noise and Vibration Management Plan (CNVMP) would be prepared and implemented in accordance with the requirements of the ICNG and CNVS. The CNVMP would take into consideration measures for reducing the source noise levels of construction equipment by construction planning and equipment selection where practicable.

The CNVMP would outline measures to reduce the noise impact from construction activities. Reasonable and feasible noise mitigation measures which would be considered, include:

- avoiding any unnecessary noise when carrying out manual operations and when operating plant
- ensuring spoil is placed and not dropped into awaiting trucks
- avoiding/limiting simultaneous operation of noisy plant and equipment within discernible range of a sensitive receiver where practicable
- switching off any equipment not in use for extended periods e.g. heavy vehicles engines would be switched off whilst being unloaded
- avoiding deliveries at night/evenings wherever practicable
- no idling of delivery trucks
- keeping truck drivers informed of designated vehicle routes, parking locations and acceptable delivery hours for the site
- minimising talking loudly; no swearing or unnecessary shouting, or loud stereos/radios onsite; no dropping of materials from height where practicable, no throwing of metal items and slamming of doors.
- maximising the offset distance between noisy plant and adjacent sensitive receivers and determining safe working distances
- using the most suitable equipment necessary for the construction works at any one time
- directing noise-emitting plant away from sensitive receivers
- regularly inspecting and maintaining plant to avoid increased noise levels from rattling hatches, loose fittings etc
- using non-tonal reversing/movement alarms such as broadband (non-tonal) alarms or ambient noise-sensing alarms for all plant used regularly onsite (greater than one day), and for any out of hours works
- use of quieter and less vibration emitting construction methods where feasible and reasonable.

The most applicable standard management measures are outlined as follows:

- construction hours and scheduling:
 - works would generally be carried out during standard construction hours (i.e. 7.00 am to 6.00 pm Monday to Friday; 8.00 am to 1.00 pm Saturdays). Any works outside these hours may be undertaken if approved by TfNSW and the community is notified prior to these works commencing. An Out of Hours Work application form would need to be prepared by the Contractor and submitted to the TfNSW Environment and Planning Manager for approval prior to any works outside normal hours.
- respite periods:
 - where the $L_{Aeq(15\text{minute})}$ construction noise levels are predicted to exceed 75 dBA and/or 30 dB above the Rating Background Level at nearby affected sensitive receivers, respite periods would be observed, where practicable, and in accordance with the CNVS. This would include restricting the hours that very noisy activities can occur.
- vibration monitoring:
 - to avoid structural impacts as a result of vibration or direct contact with structures, the proposed works would be undertaken in accordance with the safe work distances and attended vibration monitoring or vibration trials would be undertaken where these distances are required to be challenged
 - vibration resulting from construction and received at any structure outside of the proposal would be managed in accordance with:
 - for structural damage vibration - British Standard *BS 7385 Part 2-1993 Evaluation and measurement for vibration in buildings* and for structurally unsound heritage items German Standard *DIN 4150: Part 3 – 1999 Structural Vibration in Buildings: Effects on Structures*.
 - for human exposure to vibration the acceptable vibration - values set out in the *Environmental Noise Management Assessing Vibration: A Technical Guideline* (Department of Environment and Conservation, 2006) which includes British Standard *BS 6472:1992 Guide to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)*.
 - property conditions surveys would be completed prior to any vibration intensive work being carried out at or within the minimum distances set out in the CNVS. Where a heritage item is determined to be structurally unsound and a reassessment of the minimum working distances would be required. Minimum working distances should be confirmed prior to carrying out any vibration intensive work on site.

Table 6.1 provides indicative benefits of typical engineering control mitigation measures for construction activities, based on guidance in AS 2436 and experience on similar construction proposals.

Table 6.1 - Indicative noise reduction from construction controls

ENGINEERING CONTROLS	POSSIBLE NOISE BENEFIT, dBA
Portable temporary screens	5-10
Screen or enclosure for stationary equipment	10-15
Maximising the offset distance between noisy plant items and sensitive receivers.	3-6
Avoiding using noisy plant simultaneously and/or close together, adjacent to sensitive receivers.	2-5
Orienting equipment away from sensitive receivers.	3-5
Carrying out loading and unloading away from sensitive receivers.	3-5
Using noise source controls, such as the use of residential class mufflers, to reduce noise from all plant and equipment including bulldozers, cranes, graders, excavators and trucks	5-10
Selecting site access points and roads as far as possible away from sensitive receivers	3-6

6.2 SITE SPECIFIC CONSTRUCTION NOISE MITIGATION

The following site specific construction noise mitigation measures should be considered:

- During site establishment (Activity 1), temporary barriers should be erected to ensure that work would be conducted behind temporary hoardings/screens wherever practicable. The installation of construction hoarding would take into consideration the location of sensitive receivers to ensure that ‘line of sight’ is broken, where feasible. This has the potential to reduce noise levels between 5 and 10 dB.
- During site establishment, lift, stairs and landing works, Kingsgrove Avenue carpark works, Bexley Road footpath works, and station works (Activities 1, 2, 3, 4, and 6), use of the concrete saw and/or chainsaw is the main contributor to construction noise. Both the chainsaw and concrete saw are particularly loud construction plant items which produces a noise the CNS identifies as having ‘special audible characteristics’ and incurs a +5 dB penalty.

Without the concrete saw and chainsaw, the total activity noise level is reduced by 8-10 dB. It is recommended that the use of these plant items is limited where possible, and works are undertaken during standard hours and avoid sensitive time periods. Where work is required outside of standard hours, the use of this equipment is to avoid sensitive periods such as after midnight and before 7a m.

- Due to the high exceedance of NMLs at place of worship receiver P3 (Olsens Funerals with Walters & Sons), when a concrete saw is to be used along the Bexley Road footpath near this receiver it is recommended that a temporary screen or enclosure (10-15 dB reduction) is placed around the works in conjunction with temporary barriers. This receiver is likely to be more sensitive during certain times of the day, such as when the chapel facility is in use. Therefore, further consultation should be undertaken to determine feasible construction periods and inform construction staging with respect to minimising impacts on receiver P3. As much as reasonably possible noise intensive construction works near affected educational buildings are to be minimised. It is also recommended that where reasonable and feasible the use of the concrete saw is limited to standard hours or when the premises are not in use. (e.g. between 7am and 9am, and 5pm and 6pm), to minimise the impact on this receiver.
- Application of the above mitigation measures has the potential to reduce the magnitude of exceedances during the activity with the greatest noise impact during standard hours (Activity 4) to a maximum of 19 dB at the most affected residential receiver (R2B), and the greatest noise impact during out-of-hours (Activity 1) to 20 dB.

6.3 ADDITIONAL CONSTRUCTION NOISE MITIGATION

Where all reasonable and feasible standard mitigation measures have been applied and exceedances are still predicted to occur, the CNVS provides guidance on additional mitigation measures to be implemented for each receiver depending on how far the predicted noise level is above the RBL and NML. Additional mitigation measures and their associated acronyms are outlined in Appendix C. Table 6.2 outlines when to implement the additional noise management measures.

Table 6.2 Implementation of additional management measures

CONSTRUCTION HOURS	RECEIVER PERCEPTION	dBA ABOVE RBL	dBA ABOVE NML	ADDITIONAL MANAGEMENT MEASURES ¹
Standard Hours Monday-Friday (7am-6pm) Saturday (8am-1pm)	Noticeable	5 to 10	0	-
	Clearly audible	> 10 to 20	< 10	-
	Moderately intrusive	> 20 to 30	> 10 to 20	PN, V
	Highly intrusive	> 30	> 30	PN, V
	75dBA or greater	N/A	N/A	PN, V, SN
OOHW Period 1 Monday-Friday (6pm-10pm) Saturday (7am-8am, 1pm-10pm) Sunday/PH (8am-6pm)	Noticeable	5 to 10	< 5	-
	Clearly audible	> 10 to 20	5 to 15	PN
	Moderately intrusive	> 20 to 30	> 15 to 25	PN, V, SN, RO
	Highly intrusive	> 30	> 25	PN, V, SN, RP ² , DR ²
OOHW Period 2 Monday-Saturday (12am-7am, 10pm-12am) Sunday/PH (12am-8am, 6pm-12am)	Noticeable	0 to 10	< 5	PN
	Clearly audible	> 10 to 20	5 to 15	PN, V
	Moderately intrusive	> 20 to 30	> 15 to 25	PN, V, SN, RP, DR
	Highly intrusive	> 30	> 25	PN, V, SN, AA, RP, DR

(1) Acronyms are defined in Appendix C

(2) Respite periods and duration reduction are not applicable when works are carried out during OOHW Period 1 Day only

6.4 ADDITIONAL CONSTRUCTION VIBRATION MITIGATION

Where vibration intensive activities occur within the minimum working distances, all reasonable and feasible standard mitigation measures have been applied, and exceedances of vibration management levels are expected, the CNVS provides guidance on additional mitigation measures to be implemented for each receiver. Additional mitigation measures and the associated acronyms are outlined in Appendix C. Table 6.3 outlines how to implement the additional noise management measures.

Table 6.3 Implementation of additional vibration management measures

CONSTRUCTION HOURS	RECEIVER PERCEPTION	ABOVE VIBRATION LIMIT	ADDITIONAL MANAGEMENT MEASURES ³
Standard hours	Human disturbance	> HVML ¹	PN, V, RO
	Building damage	> DVML ²	V, AC
OOHW Period 1	Human disturbance	> HVML ¹	PN, V, SN, RO, RP, DR
	Building damage	> DVML ²	V, AC
OOHW Period 2	Human disturbance	> HVML ¹	PN, V, SN, RO, AA, RP, DR
	Building damage	> DVML ²	V, AC

- (1) Human vibration management level – see maximum vibration dose values for human comfort outlined in Section 3.4
- (2) Damage vibration management level – see screening criteria for cosmetic damage outlined in Section 3.4
- (3) Acronyms are defined in Appendix C

7 OPERATIONAL NOISE ASSESSMENT

With the exception of the proposed reconfiguration, the operation of Bexley North Station would remain unchanged as a result of the proposal. There would be no expected changes to the operation of the rail and, as such, this has not been assessed.

New plant and equipment associated with the upgrade to Bexley North Station would include a new lift, equipment for the communications/equipment room and provision of a family accessible toilet.

Operational noise from the proposal would need to be designed to meet the NPfI noise goals presented in Section 3.1. Mechanical plant details are yet to be finalised. It is expected that mechanical noise emissions would not have a significant impact on the surrounding environment, and that the use of standard controls such as quiet plant selection, and duct lining and/or attenuators, would allow mechanical plant noise to be reduced to acceptable levels.

If required, operational noise emissions shall be addressed during the detailed design phase in order to comply with operational noise criteria as per the NPfI.

8 CONCLUSION

WSP has undertaken a noise and vibration assessment for the proposed Bexley North Station upgrade.

Six construction scenarios have been assessed for eight noise catchment areas surrounding the proposal site. The key findings of this assessment include:

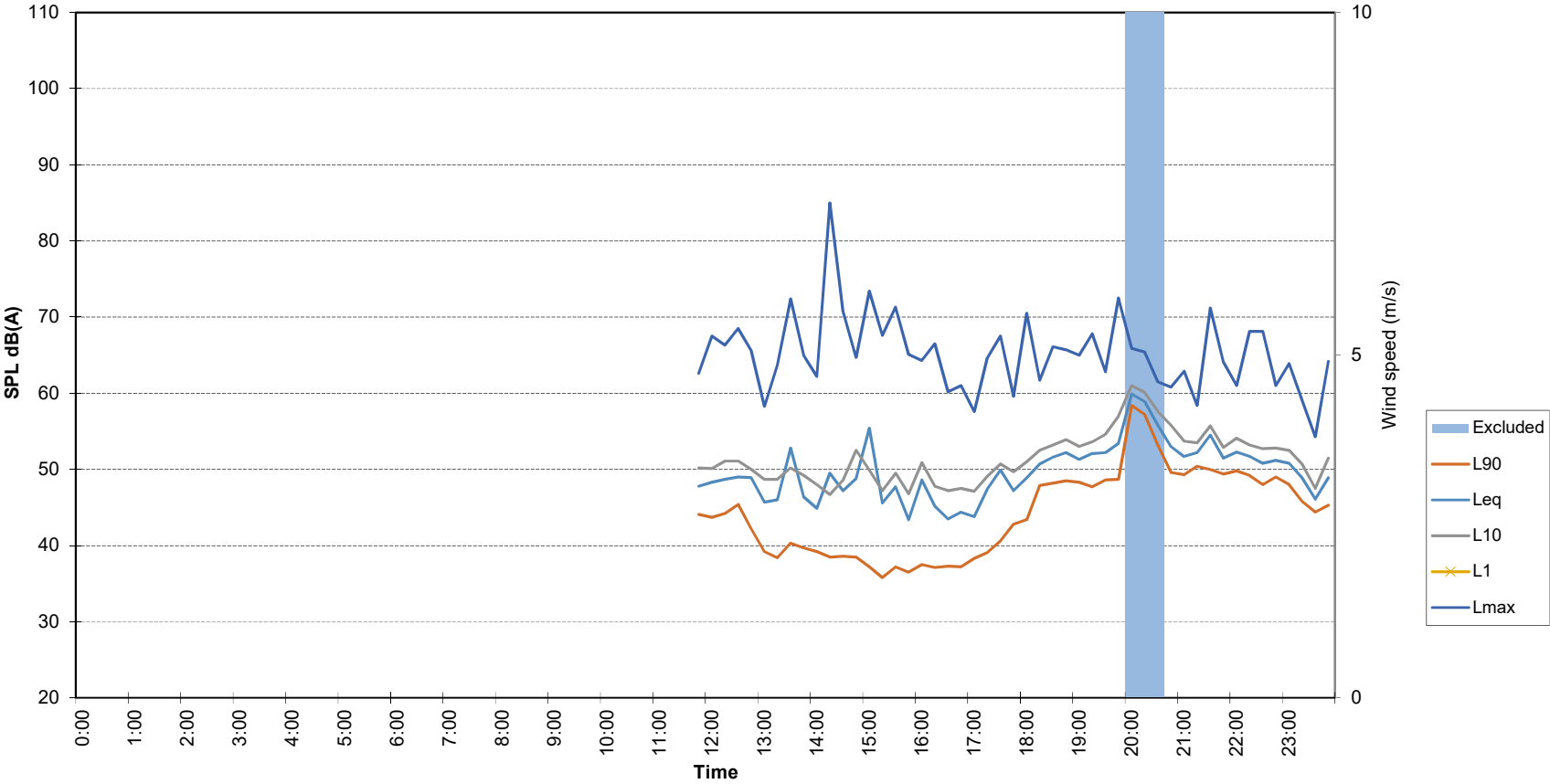
- NMLs were derived for residential and non-residential sensitive land uses using the ICNG in accordance with the CNVS based on background noise monitoring
- NML exceedances are predicted at a majority of residential receivers for all activities. Predicted noise levels decrease considerably when equipment with special audible characteristics (concrete saw, chainsaw) are not in use. When this equipment is not in use during standard hours, most receivers in NCAs 5 to 8 are not expected to exceed NMLs, with receivers in NCAs 1 to 4 still exceeding NMLs but to a significantly lesser degree. During out-of-hours works, exceedances of NMLs are still expected
- minimum working distances for vibration intensive equipment to nearby receivers has been identified based on the CNVS. If minimum working distances are maintained, then adverse impacts in terms of human comfort or cosmetic damage are not expected
- site specific noise mitigation measures have been recommended including:
 - providing temporary barriers
 - using temporary screening or enclosures around works involving a concrete saw when used along the Bexley Road footpath near commercial and place of worship receiver C/P3 (Olsens Funerals with Walters & Sons).
 - further consultation with the identified place of worship receiver (Olsens Funerals with Walters & Sons) to minimise impacts during sensitive periods and on sensitive facilities within the receiver.
- the standard CNVS construction noise and vibration management measures and additional mitigation measures are recommended for the receivers within NCAs with predicted exceedances of the NMLs or within minimum working distances for vibration
- construction traffic noise has been assessed in accordance with the RNP, and the noise increase due to increased traffic is expected to be within the RNP criteria
- mechanical plant has not yet been finalised. Mechanical plant is not expected to significantly impact the existing environment, and standard noise controls are expected to reduce noise emissions to acceptable levels as outlined in the NPfI. Operational noise emissions should be designed to meet the NPfI noise triggers derived in this report.

APPENDIX A

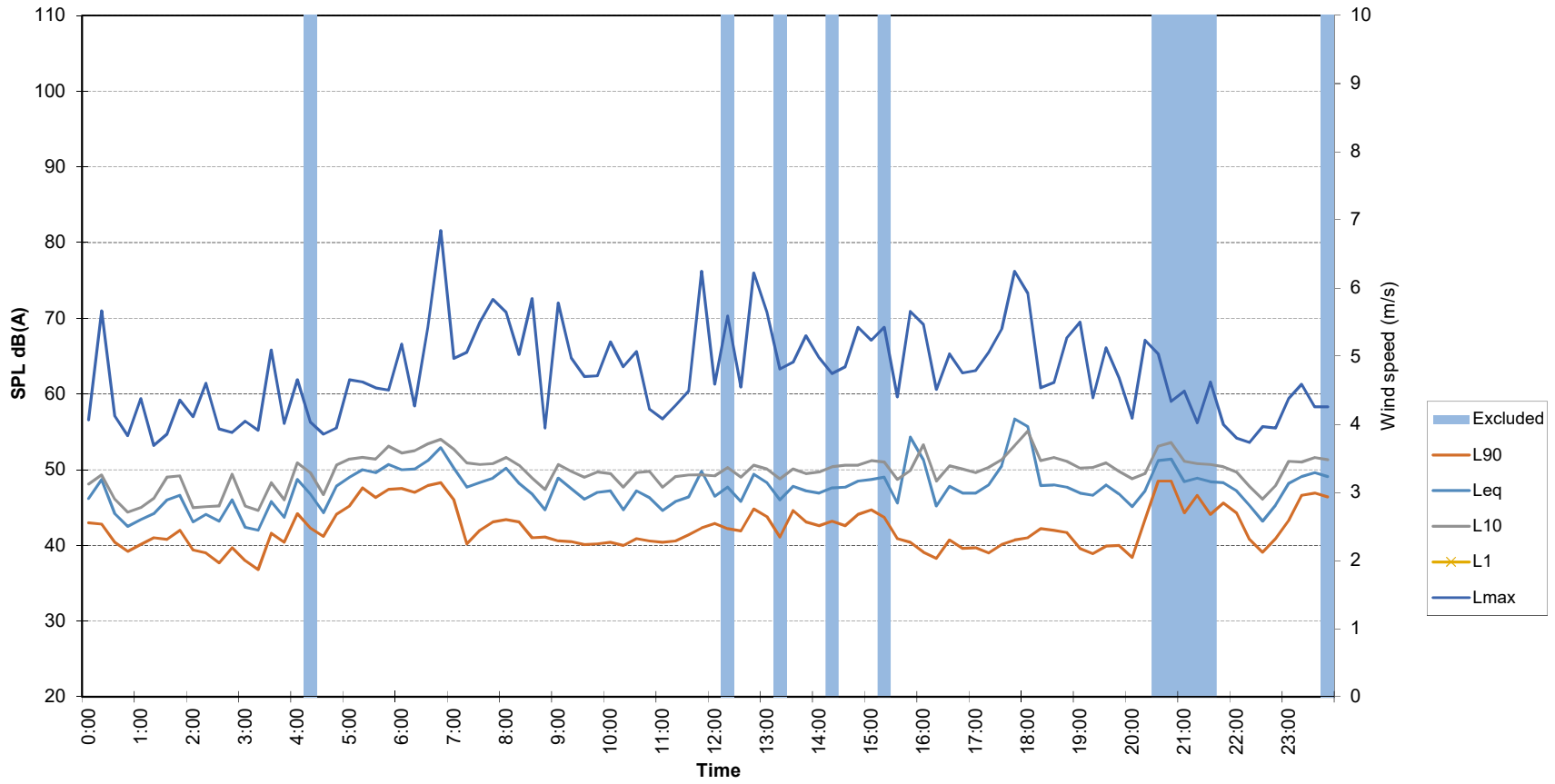
NOISE MONITORING GRAPHS



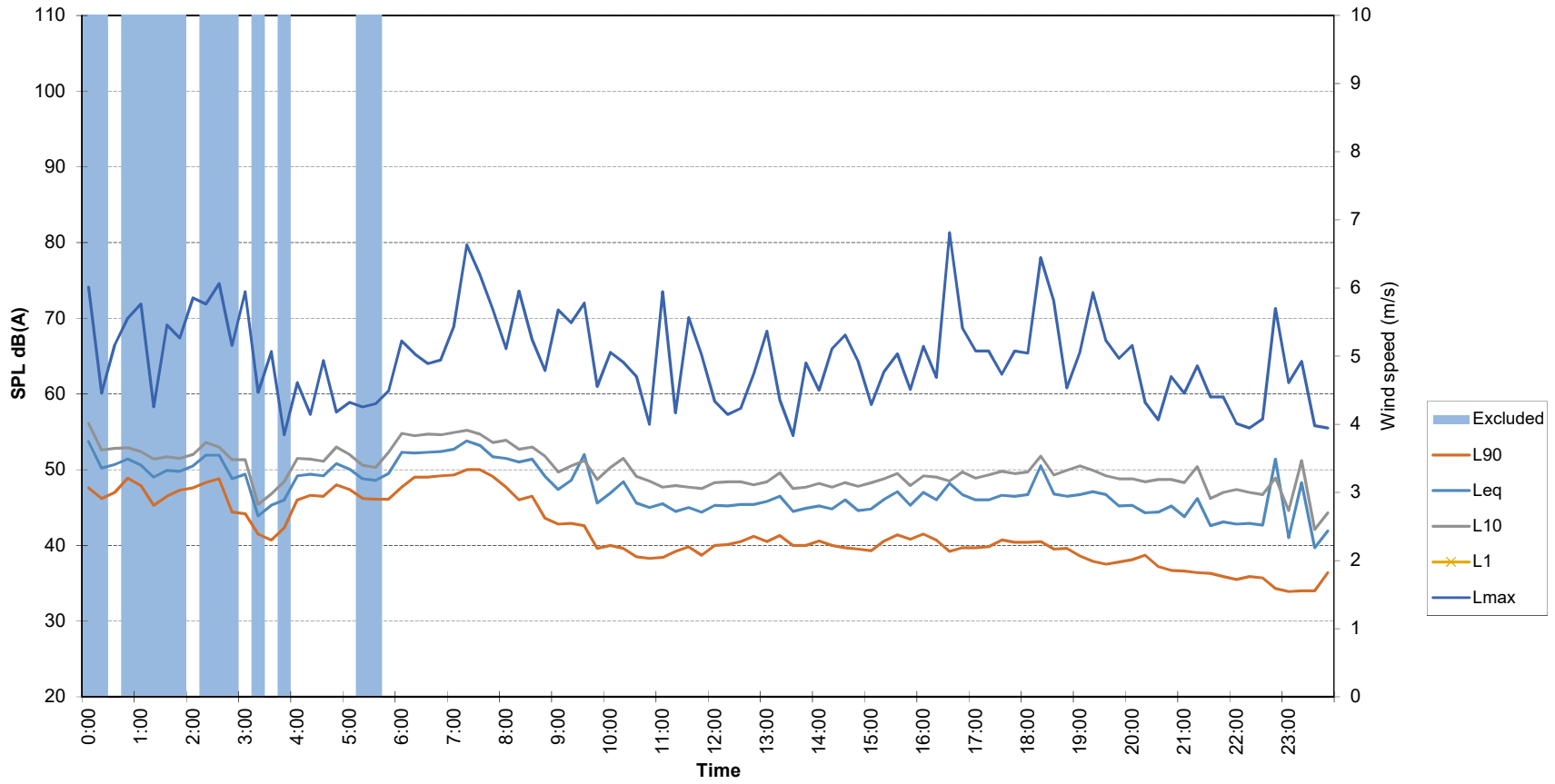
Location - NM01
Measured Noise Levels - Tuesday 06-11-2018



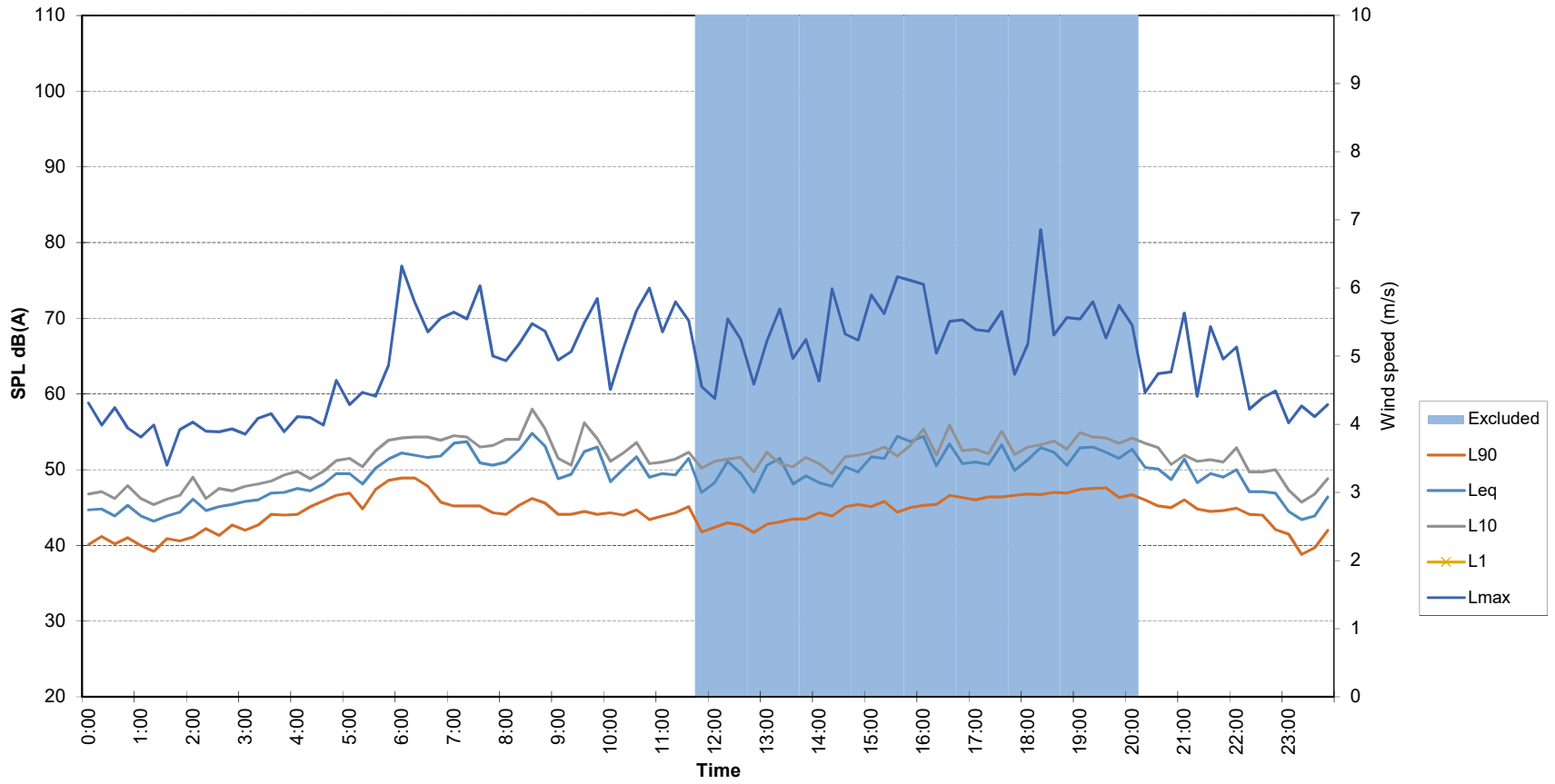
Location - NM01
Measured Noise Levels - Wednesday 07-11-2018



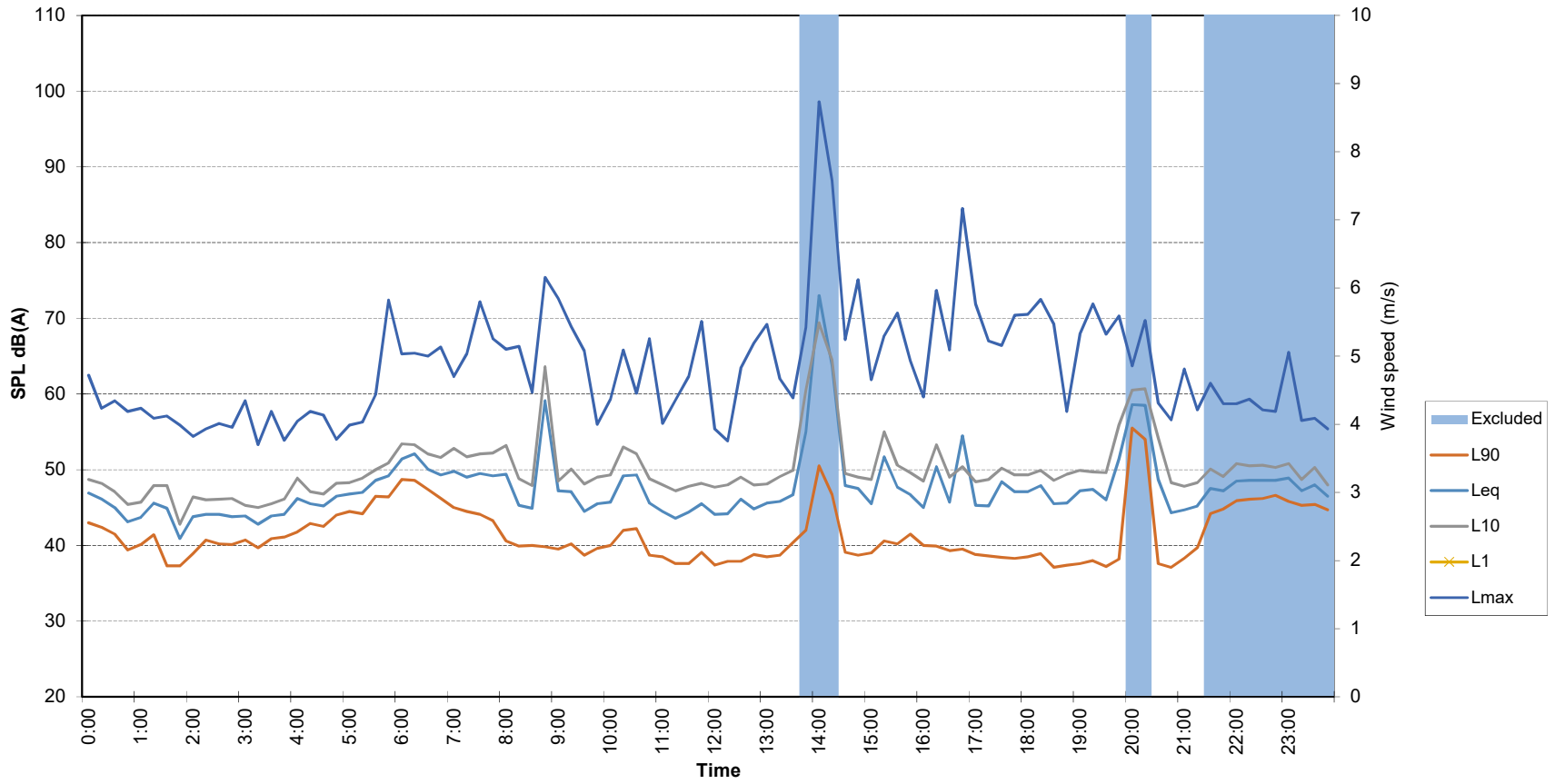
Location - NM01
Measured Noise Levels - Thursday 08-11-2018



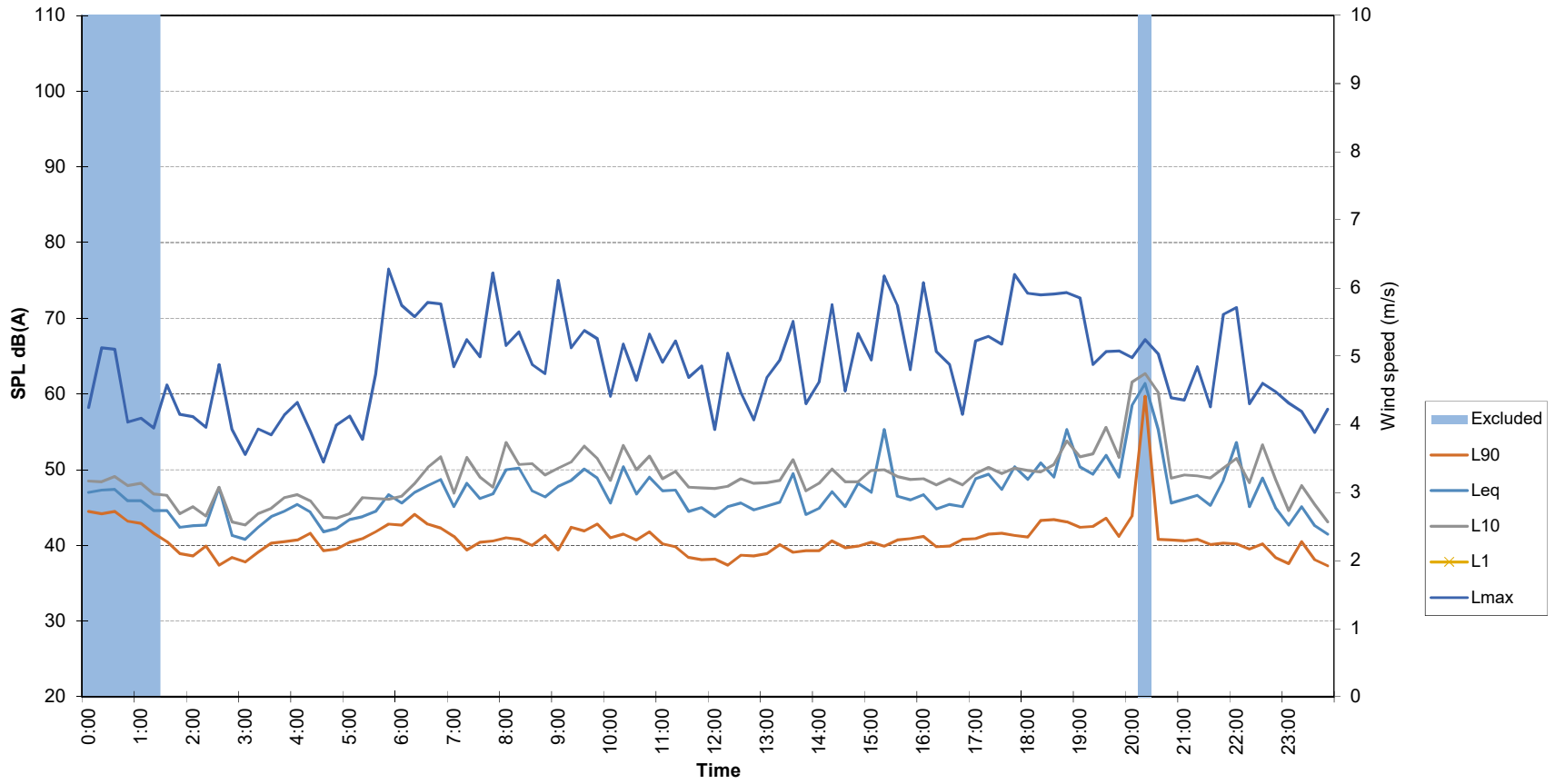
Location - NM01
Measured Noise Levels - Friday 09-11-2018



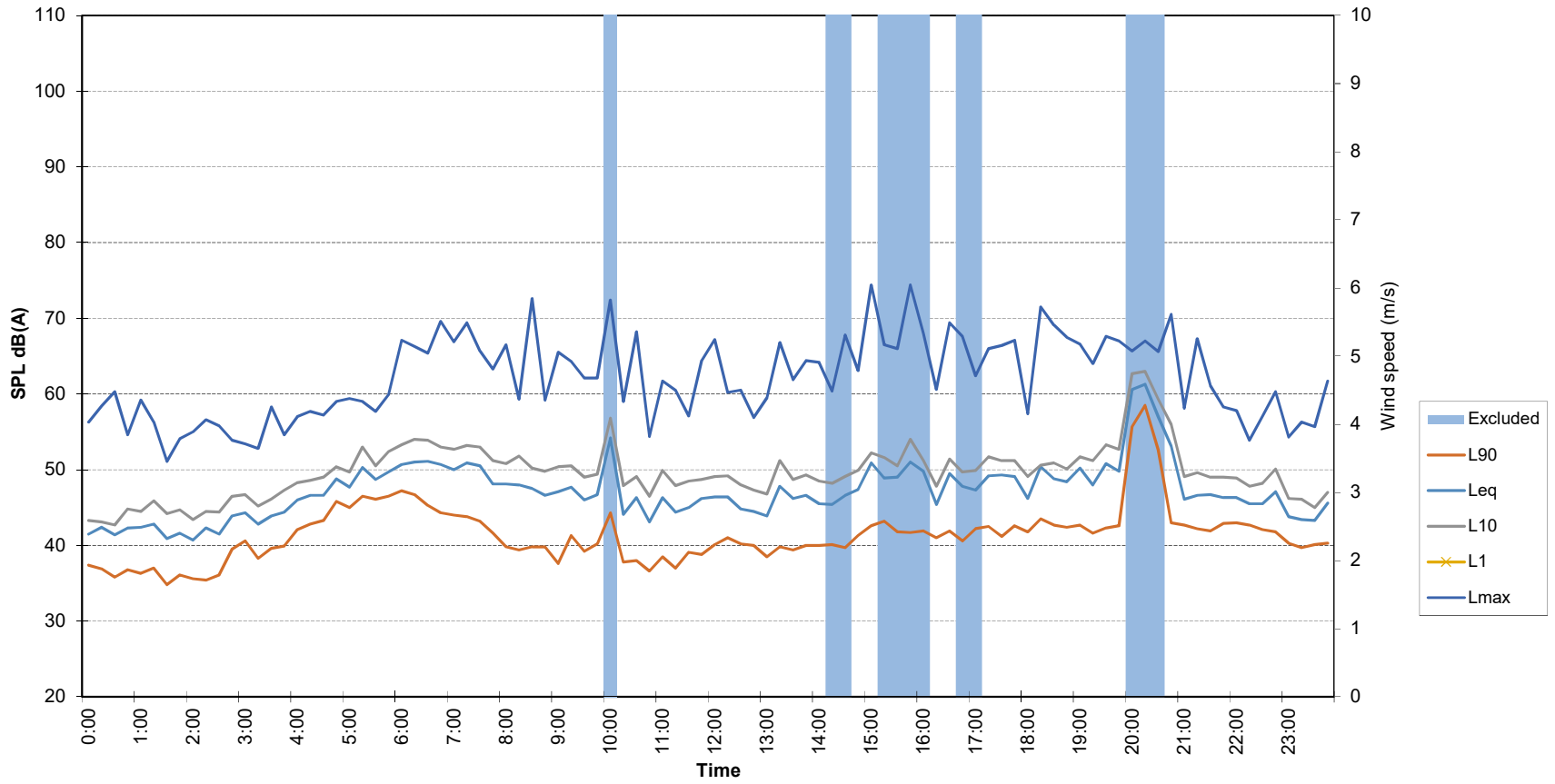
Location - NM01
Measured Noise Levels - Saturday 10-11-2018



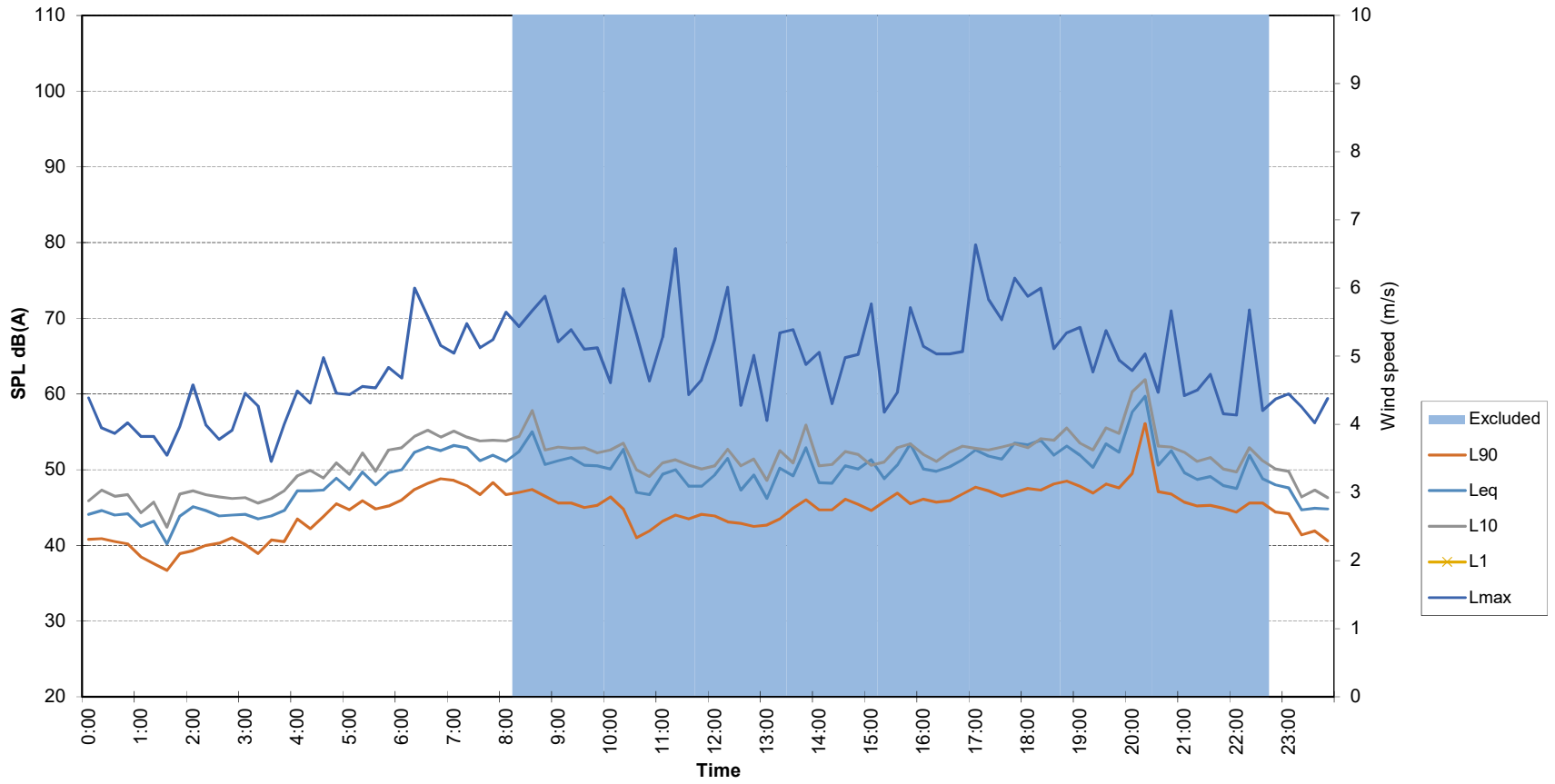
Location - NM01
Measured Noise Levels - Sunday 11-11-2018



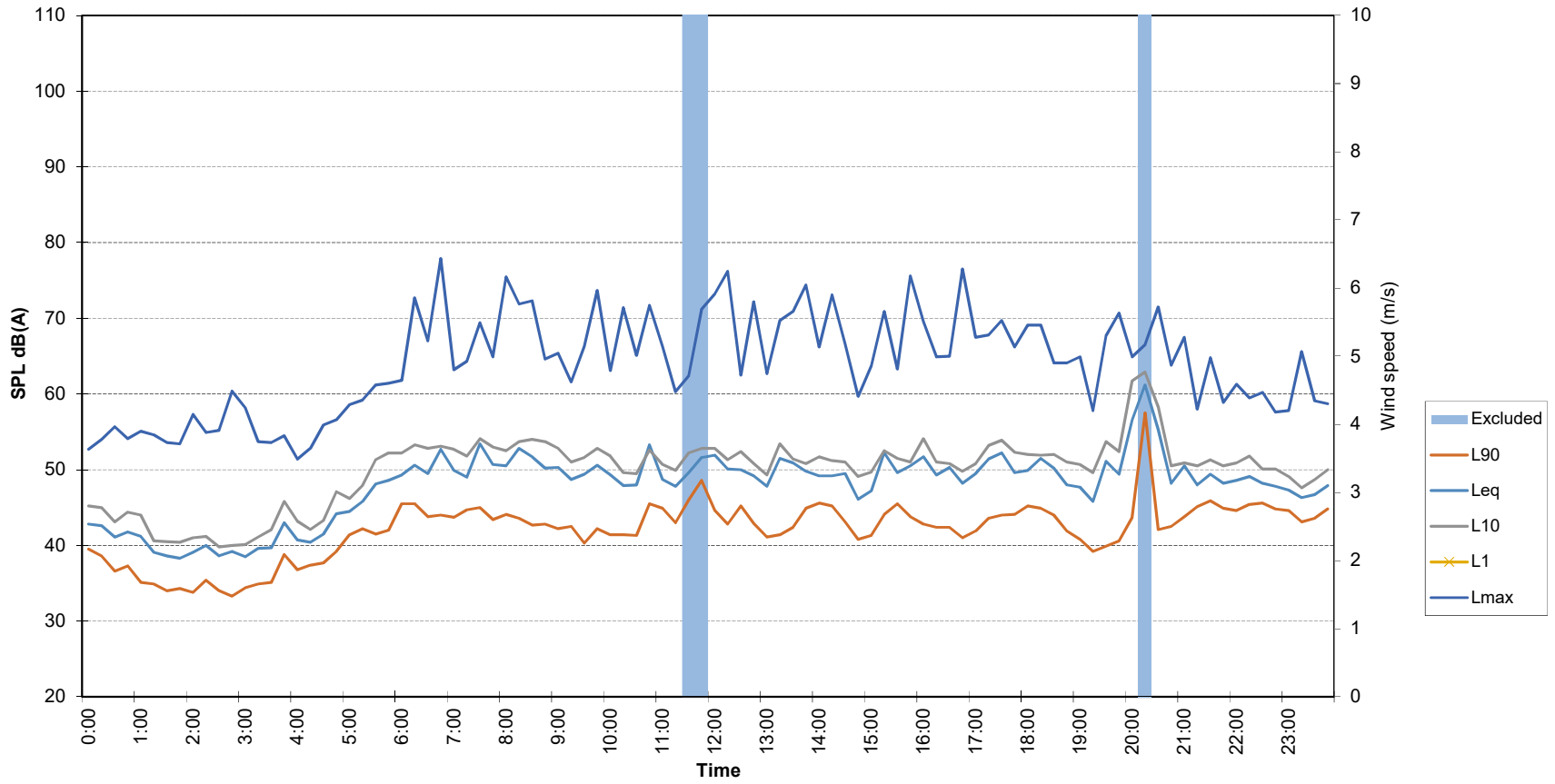
Location - NM01
Measured Noise Levels - Monday 12-11-2018



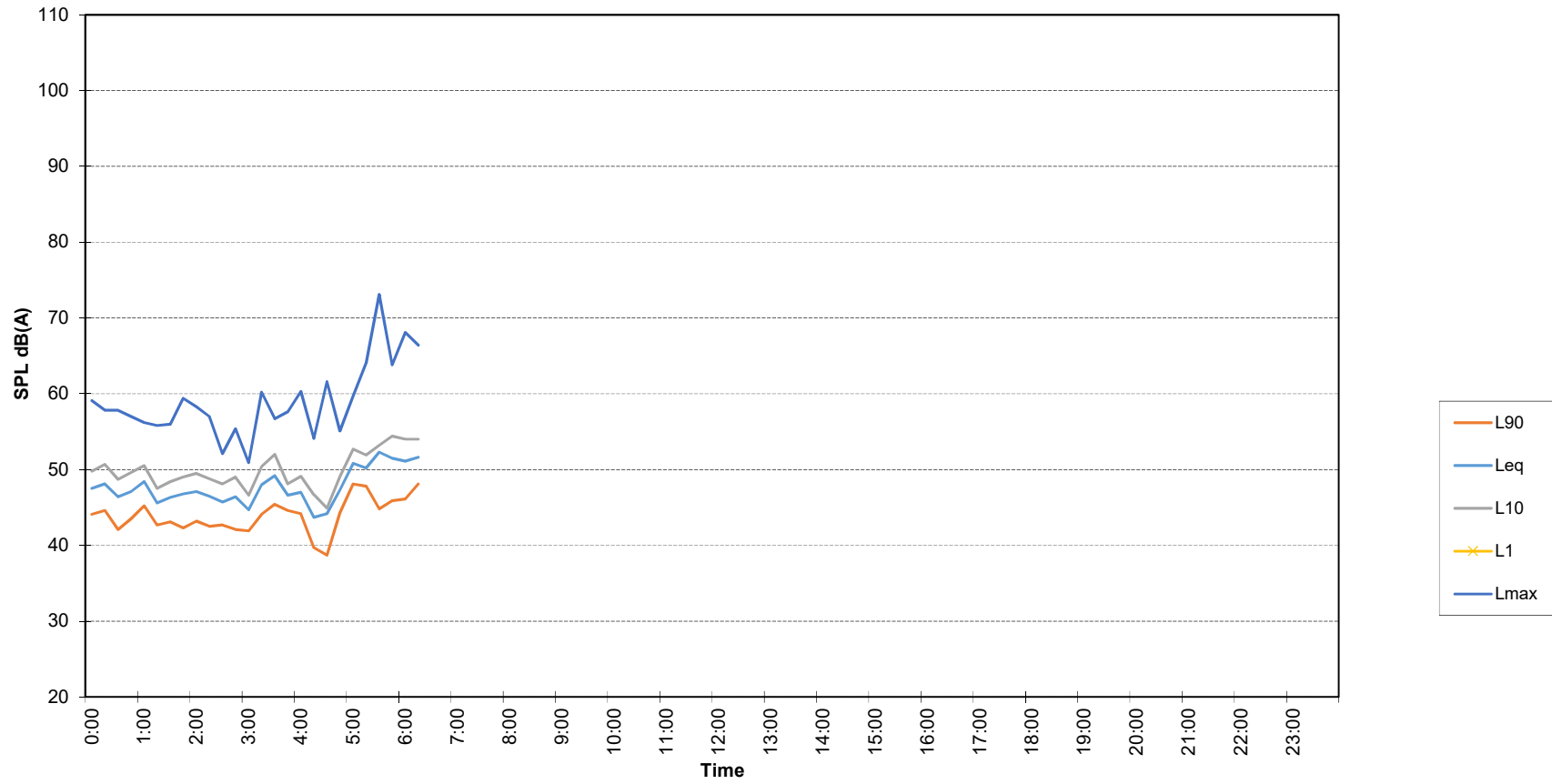
Location - NM01
Measured Noise Levels - Tuesday 13-11-2018



Location - NM01
Measured Noise Levels - Wednesday 14-11-2018



Location - NM01
Measured Noise Levels - Thursday 15-11-2018







APPENDIX B

PREDICTED NOISE MAPS










Map: BN_Act1	Author: TJG			Legend  Project Location	Noise level, dBA Leq 15min 	TAP 3: North Strathfield Upgrade Activity 1 - Site establishment and enabling works
Date: 2018-11-27	Approved by: CXM					





































To be read in conjunction with WSP document: PS110578-TJG-BexleyNorthNVIA
 Map Source: NSW Six Maps

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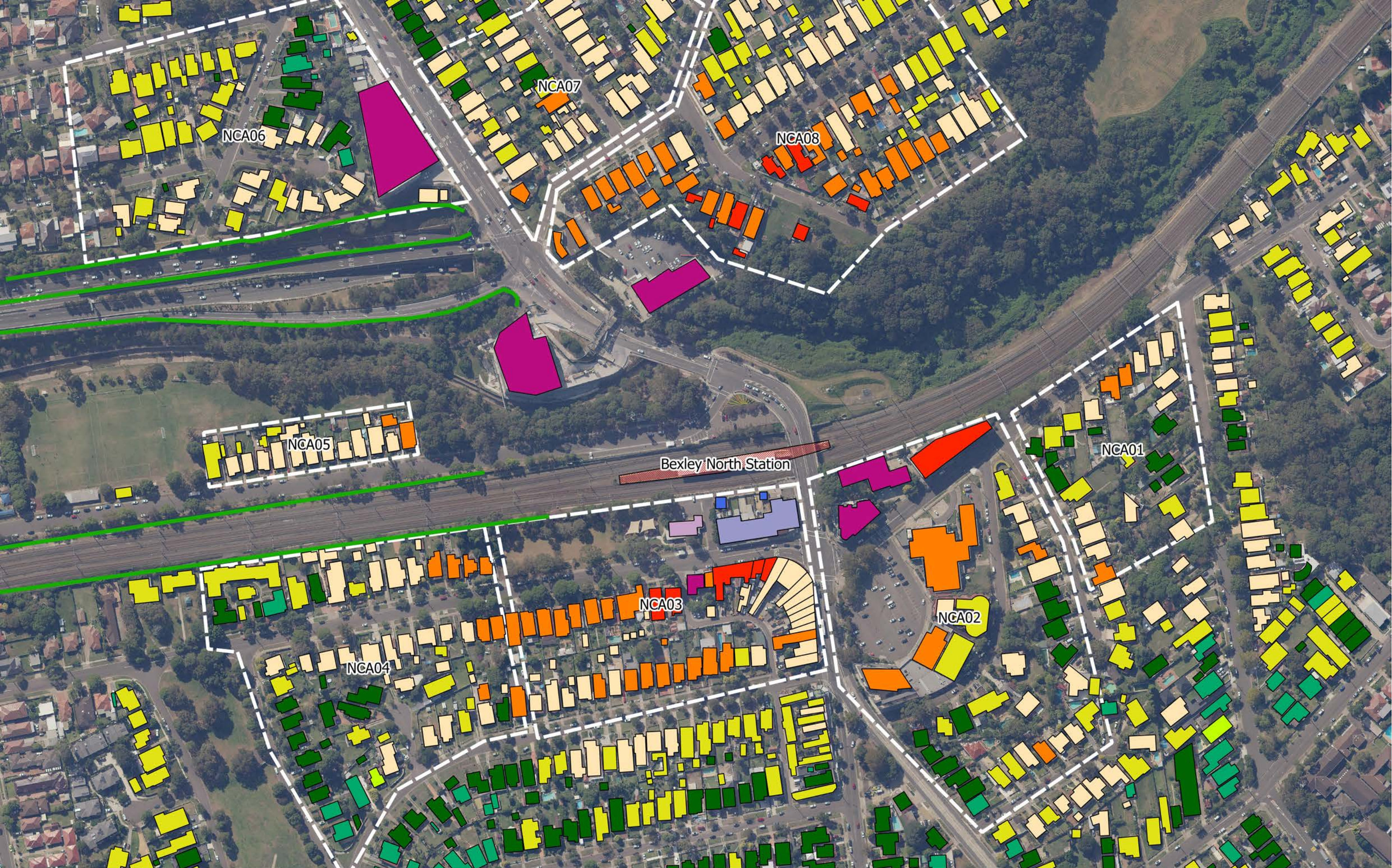
Map: BN_Act2	Author: TJG			Legend  Project Location	Noise level, dBA Leq 15min 	TAP 3: North Strathfield Upgrade Activity 2 - Lift, stairs and landing works	
Date: 2018-11-27	Approved by: CXM						








Map: BN_Act3	Author: TJG			Legend  Project Location	Noise level, dBA Leq 15min				TAP 3: North Strathfield Upgrade Activity 3 - Kingsgrove Avenue carpark works																	
Date: 2018-11-27	Approved by: CXM				<table border="0"> <tr> <td> < 35</td> <td> 50 - 55</td> <td> 70 - 75</td> <td colspan="2"></td> </tr> <tr> <td> 35 - 40</td> <td> 55 - 60</td> <td> 75 - 80</td> <td colspan="2"></td> </tr> <tr> <td> 40 - 45</td> <td> 60 - 65</td> <td> > 80</td> <td colspan="2"></td> </tr> <tr> <td> 45 - 50</td> <td> 65 - 70</td> <td colspan="3"></td> </tr> </table>					 < 35	 50 - 55	 70 - 75			 35 - 40	 55 - 60	 75 - 80			 40 - 45	 60 - 65	 > 80			 45 - 50	 65 - 70
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 45 - 50	 65 - 70																									
To be read in conjunction with WSP document: PS110578-TJG-BexleyNorthNVIA <small>Map Source: NSW Six Maps</small>		1:2,500 at A3 <small>© WSP Australia Pty Ltd (WSP). Copyright in the drawings, information and data recorded ("the information") is the property of WSP. This document and the information are solely for the use of the authorised recipient and the document may not be used, copied or reproduced in whole or part for any purpose other than that which it is supplied by WSP. WSP makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon the document or the information. NCS Certified Quality Systems ISO 9001. © APPROVED FOR AND ON BEHALF OF WSP Australia Pty Ltd.</small>																								







Map: BN_Act4	Author: TJG			Legend Project Location	Noise level, dBA Leq 15min <div style="display: flex; flex-wrap: wrap;"> <div style="width: 50%;"> < 35</div> <div style="width: 50%;"> 50 - 55</div> <div style="width: 50%;"> 70 - 75</div> <div style="width: 50%;"> 35 - 40</div> <div style="width: 50%;"> 55 - 60</div> <div style="width: 50%;"> 75 - 80</div> <div style="width: 50%;"> 40 - 45</div> <div style="width: 50%;"> 60 - 65</div> <div style="width: 50%;"> > 80</div> <div style="width: 50%;"> 45 - 50</div> <div style="width: 50%;"> 65 - 70</div> </div>	TAP 3: North Strathfield Upgrade Activity 4 - Bexley Road footpath works
Date: 2018-11-27	Approved by: CXM					



Map: BN_Act5	Author: TJG			Legend  Project Location	Noise level, dBA Leq 15min 	TAP 3: North Strathfield Upgrade Activity 5 - Platform modification works	
Date: 2018-11-27	Approved by: CXM						



Map: BN_Act6	Author: TJG			Legend  Project Location	Noise level, dBA Leq 15min 	TAP 3: North Strathfield Upgrade Activity 6 - Station building works
Date: 2018-11-27	Approved by: CXM					

To be read in conjunction with WSP document: PS110578-TJG-BexleyNorthNVIA
 Map Source: NSW SIX Maps
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APPENDIX C

STANDARD AND ADDITIONAL NOISE AND
VIBRATION MITIGATION MEASURES



C1 STANDARD MITIGATION MEASURES

Table C.1 Standard management measures to reduce construction noise and vibration

ACTION REQUIRED	APPLIES TO	DETAILS
Implementation of any proposal specific mitigation measures required	Airborne noise Ground-borne noise & vibration	In addition to the measures set out in this table, any project specific mitigation measures identified in the EIA documentation (e.g. REF, submissions or representations report) or approval or licence conditions must be implemented.
Implement stakeholder consultation measures (refer to Sections 8.2.1 and 8.3 for further details of community consultation measures)	Airborne noise Ground-borne noise & vibration	<p>Periodic notification (monthly letterbox drop and website notification) detailing all upcoming construction activities delivered to sensitive receivers at least 7 days prior to commencement of relevant works.</p> <p>In addition to Periodic Notification, the following strategies may be adopted on a case-by-case basis:</p> <ul style="list-style-type: none"> • Project Specific Website • Project Infoline • Construction Response Line • Email Distribution List • Web-based Surveys • Social Media • Community and Stakeholder Meetings and • Community Based Forums (if required by approval conditions).
Register of noise and vibration sensitive receivers	Airborne noise Ground-borne noise & vibration	<p>A register of most affected noise and vibration sensitive receivers (NVSRs) would be kept on site. The register would include the following details for each NVSR:</p> <ul style="list-style-type: none"> • Address of receiver • Category of receiver (e.g. Residential, Commercial etc.) • Contact name and phone number. <p>The register may be included as part of the Project's Community Liaison Plan or similar document and maintained in accordance with the requirements of this plan.</p>
Construction hours and scheduling	Airborne noise Ground-borne noise & vibration	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating noise with special audible characteristics and/or vibration levels should be scheduled during less sensitive time periods.
Construction respite period	Ground-borne noise & vibration Airborne noise	<p>Noise with special audible characteristics and vibration generating activities (including jack and rock hammering, sheet and pile driving, rock breaking and vibratory rolling) may only be carried out in continuous blocks, not exceeding 3 hours each, with a minimum respite period of one hour between each block. 'Continuous' includes any period during which there is less than a 1 hour respite between ceasing and recommencing any of the work.</p> <p>No more than two consecutive nights of noise with special audible characteristics and/or vibration generating work may be undertaken in the same NCA over any 7-day period, unless otherwise approved by the relevant authority.</p>
Site inductions	Airborne noise Ground-borne noise & vibration	<p>All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include:</p> <ul style="list-style-type: none"> • All relevant project specific and standard noise and vibration mitigation measures • Relevant licence and approval conditions • Permissible hours of work • Any limitations on noise generating activities with special audible characteristics

ACTION REQUIRED	APPLIES TO	DETAILS
Site inductions <i>continued</i>		<ul style="list-style-type: none"> • Location of nearest sensitive receivers • Construction employee parking areas • Designated loading/unloading areas and procedures • Site opening/closing times (including deliveries) • Environmental incident procedures.
Behavioural practices	Airborne noise	<p>No swearing or unnecessary shouting or loud stereos/radios on site.</p> <p>No dropping of materials from height, throwing of metal items and slamming of doors.</p> <p>No excessive revving of plant and vehicle engines.</p> <p>Controlled release of compressed air.</p>
Monitoring	Airborne noise Ground-borne noise & vibration	A noise monitoring program should be carried out for the duration of works in accordance with the Construction Noise and Vibration Management Plan and any approval and licence conditions.
Attended vibration measurements	Ground-borne vibration	Attended vibration measurements shall be undertaken at all buildings within 25 m of vibration generating activities when these activities commence to confirm that vibration levels are within the acceptable range to prevent cosmetic building damage.
Update Construction Environmental Management Plans	Airborne noise Ground-borne noise & vibration	The CEMP must be regularly updated to account for changes in noise and vibration management issues and strategies.
Building condition surveys	Vibration Blasting	Undertake building dilapidation surveys on all buildings located within the buffer zone prior to major project construction activities with the potential to cause property damage.

Table C.2 Standard source measures to reduce construction noise and vibration

ACTION REQUIRED	APPLIES TO	DETAILS
Plan worksites and activities to minimise noise and vibration	Airborne noise Ground-borne vibration	Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site.
Equipment selection	Airborne noise Ground-borne noise & vibration	<p>Use quieter and less vibration emitting construction methods where feasible and reasonable, see APPENDIX C.</p> <p>For example, when piling is required, bored piles rather than impact-driven piles will minimise noise and vibration impacts. Similarly, diaphragm wall construction techniques, in lieu of sheet piling, will have significant noise and vibration benefits.</p>
Maximum noise levels	Airborne-noise	The noise levels of plant and equipment must have operating Sound Power or Sound Pressure Levels compliant with the allowable noise levels in APPENDIX C.
Rental plant and equipment	Airborne-noise	The noise levels of plant and equipment items are to be considered in rental decisions and in any case cannot be used on site unless compliant with the allowable noise levels in APPENDIX C.
Use and siting of plant	Airborne-noise	<p>Simultaneous operation of noisy plant within discernible range of a sensitive receiver is to be avoided.</p> <p>The offset distance between noisy plant and adjacent sensitive receivers is to be maximised.</p> <p>Plant used intermittently to be throttled down or shut down.</p> <p>Noise-emitting plant to be directed away from sensitive receivers.</p>
Non-tonal reversing alarms	Airborne noise	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out-of-hours work, including delivery vehicles.

ACTION REQUIRED	APPLIES TO	DETAILS
Minimise disturbance arising from delivery of goods to construction sites	Airborne noise	Loading and unloading of materials/deliveries is to occur <i>as far as possible</i> from sensitive receivers.
Minimise disturbance arising from delivery of goods to construction sites <i>continued</i>		Select site access points and roads as far as possible away from sensitive receivers. Dedicated loading/unloading areas to be shielded if close to sensitive receivers. Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible.
Construction Related Traffic	Airborne noise	Schedule and route vehicle movements away from sensitive receivers and during less sensitive times. Limit the speed of vehicles and avoid the use of engine compression brakes. Maximise on-site storage capacity to reduce the need for truck movements during sensitive times.
Silencers on Mobile Plant	Airborne noise	Where possible reduce noise from mobile plant through additional fittings including: Residential grade mufflers Damped hammers such as “City” Model Rammer Hammers Air Parking brake engagement is silenced.
Prefabrication of materials off-site	Airborne noise	Where practicable, pre-fabricate and/or prepare materials off-site to reduce noise with special audible characteristics occurring on site. Materials can then be delivered to site for installation.
Engine compression brakes	Airborne noise	Limit the use of engine compression brakes at night and in residential areas. Ensure vehicles are fitted with a maintained original equipment manufacturer exhaust silencer or a silencer that complies with the National Transport Commission’s ‘In-service test procedure’ and standard.

Table C.3 Standard path measures to reduce construction noise and vibration

ACTION REQUIRED	APPLIES TO	DETAILS
Shield stationary noise sources such as pumps, compressors, fans etc	Airborne noise	Stationary noise sources should be enclosed or shielded whilst ensuring that the occupational health and safety of workers is maintained. Appendix F of AS 2436: 1981 lists materials suitable for shielding.
Shield sensitive receivers from noisy activities	Airborne noise	Use structures to shield residential receivers from noise such as site shed placement; earth bunds; fencing; erection of operational stage noise barriers (where practicable) and consideration of site topography when siting plant.

C2 ADDITIONAL MITIGATION MEASURES

Table C.4 Additional mitigation measures

MEASURE	DESCRIPTION	ABBREVIATION
Periodic Notification	<p>For each I&S project, a notification entitled ‘Project Update’ or ‘Construction Update’ is produced and distributed to stakeholders via letterbox drop and distributed to the project postal and/or email mailing lists. The same information will be published on the TfNSW website (www.transport.nsw.gov.au).</p> <p>Periodic notifications provide an overview of current and upcoming works across the project and other topics of interest. The objective is to engage, inform and provide project-specific messages. Advanced warning of potential disruptions (e.g. traffic changes or noisy works) can assist in reducing the impact on stakeholders. The approval conditions for projects specify requirements for notification to sensitive receivers where works may impact on them.</p> <p>Content and length is determined on a project-by-project basis and must be approved by TfNSW prior to distribution.</p> <p>Most projects distribute notifications on a monthly basis. Each notification is graphically designed within a branded template.</p> <p>In certain circumstances media advertising may also be used to supplement Periodic Notifications, where considered effective.</p> <p>Periodic Notification may be advised by the I&S Community Engagement Team in cases where AMMM are not triggered as shown in Tables 9 to 11, for example where community impacts extend beyond noise and vibration (traffic, light spill, parking etc). In these circumstances the I&S Community Engagement Team will determine the community engagement strategy on a case-by-case basis.</p>	PN
Verification Monitoring	<p>Verification monitoring of noise and/or vibration during construction may be conducted at the affected receiver(s) or a nominated representative location (typically the nearest receiver where more than one receiver has been identified). Monitoring can be in the form of either unattended logging (i.e. for vibration provided there is an immediate feedback mechanism such as SMS capabilities) or operator attended surveys (i.e. for specific periods of construction noise).</p> <p>The purpose of monitoring is to confirm that:</p> <ul style="list-style-type: none"> • construction noise and vibration from the project are consistent with the predictions in the noise assessment • mitigation and management of construction noise and vibration is appropriate for receivers affected by the works <p>Where noise monitoring finds that the actual noise levels exceed those predicted in the noise assessment then immediate refinement of mitigation measures may be required and the CNVIS amended. Refer to Section 8.4 for more details.</p>	V
Specific Notification	<p>Specific notifications are in the form of a personalised letter or phone call to identified stakeholders no later than seven calendar days ahead of construction activities that are likely to exceed the noise objectives. Alternatively (or in addition to), communications representatives from the contractor would visit identified stakeholders at least 48 hours ahead of potentially disturbing construction activities and provide an individual briefing.</p> <ul style="list-style-type: none"> • Letters may be letterbox dropped or hand distributed • Phone calls provide affected stakeholders with personalised contact and tailored advice, with the opportunity to provide comments on the proposed work and their specific needs • Individual briefings are used to inform stakeholders about the impacts of noisy activities and mitigation measures that will be implemented. Individual briefings provide affected stakeholders with personalised contact and tailored advice, with the opportunity to comment on the project <p>Specific notifications are used to support periodic notifications, or to advertise unscheduled works and must be approved by TfNSW prior to implementation/distribution.</p>	SN
Respite Offer	<p>The purpose of a project specific respite offer is to provide residents subjected to lengthy periods of noise or vibration respite from an ongoing impact. The offer could comprise pre-purchased movie tickets, bowling activities, meal vouchers or similar offer. This measure is determined on a case-by-case basis, and may not be applicable to all I&S projects.</p>	RO

MEASURE	DESCRIPTION	ABBREVIATION
Alternative Accommodation	Alternative accommodation options may be provided for residents living in close proximity to construction works that are likely to incur unreasonably high impacts. Alternative accommodation will be determined on a case-by-case basis and should provide a like-for-like replacement for permanent residents, including provisions for pets, where reasonable and feasible.	AA
Alternative construction methodology	Where the vibration assessment identifies that the proposed construction method has a high risk of causing structural damage to buildings near the works, the proponent will need to consider alternative construction options that achieve compliance with the VMLs for building damage. For example, replace large rock breaker with smaller rock breakers or rock saws.	AC
Respite Period	OOHW during evening and night periods will be restricted so that receivers are impacted for no more than 3 consecutive evenings and no more than 2 consecutive nights in the same NCA in any one week. A minimum respite period of 4 evenings/5 nights shall be implemented between periods of consecutive evening and/or night works. Strong justification must be provided where it is not reasonable and feasible to implement these period restrictions (e.g. to minimise impacts to rail operations), and approval must be given by TfNSW through the OOHV Approval Protocol (Section 6). Note; this management measure does not apply to OOHV Period 1 – Days (See Table 1).	RP
Duration Reduction	Where Respite Periods (see management measure above) are considered to be counterproductive to reducing noise and vibration impacts to the community it may be beneficial to increase the number of consecutive evenings and/or nights through Duration Reduction to minimise the duration of the activity. This measure is determined on a project-by-project basis, and may not be applicable to all I&S projects. Impacted receivers must be consulted and evidence of community support for the Duration Reduction must be provided as justification for the Duration Reduction. A community engagement strategy must be agreed with and implemented in consultation with I&S Community Engagement Representatives.	DR