



## APPROVAL CITY & SOUTHWEST ACOUSTICS ADVISOR

Sydney Metro City and South West Line Wide Works - CNVIS Addendum Report - Blues Point - Streetscaping Works	TK685-03-11F04 CNVIS_ADD2 C2B_P3 BP Streetscape (r6)
Daniel Weston Acoustics Advisor	Prepared by Renzo Tonin & Associates Pty Ltd
17 June 2022	16 June 2022

As approved Acoustics Advisor for the Sydney Metro City & Southwest project, and as required under A27 (d) of the project approval conditions (SSI 15-7400), I have reviewed and provided comment on the Construction Noise and Vibration Impact Statement (CNVIS) Addendum Report for the proposed Blues Point Streetscaping Works.

I am satisfied that the CNVIS Addendum Report is technically valid and includes appropriate noise and vibration mitigation and management. On this basis, I endorse the CNVIS Addendum Report referenced herein.

Daniel Weston, City & Southwest Acoustics Advisor



16 June 2022

# Sydney Metro City and South West Line Wide Works - CNVIS Addendum Report - Blues Point - Streetscaping Works

## 1 Introduction

## 1.1 Overview of works

This technical memorandum is an addendum to the report *Construction Noise and Vibration Impact Statement: Portion 3 – Blues Point (Blues Point CNVIS*<sup>1</sup>) and has been prepared on behalf of Systems Connect in accordance with the Construction Noise and Vibration Management Plan (CNVMP) [SMCSWLWC-SYC-1NL-PM-PLN-000032] for the Design and Construction of the Line-Wide Works (LWW) of the Sydney Metro City & Southwest Project (the Project).

Sydney Metro has instructed Systems Connect to undertake streetscaping works at the Blues Point Temporary Site to ensure key NSW Government program milestones are met and to reduce the duration of impacts on the surrounding community. The streetscaping works involves the removal of the existing road surface, pavement and footpaths, minor earthworks and construction of new pavement, footpaths, landscaping and lighting.

The works are mostly located outside and around the perimeter of the Blues Point worksite. The work area is shown in APPENDIX C. Details of the type and duration of activities addressed in this addendum are also provided in Appendix C Table C1.

This memorandum has been prepared to address the potential construction noise and vibration impacts from the streetscaping works. The works will be undertaken during standard construction hours and will be completed between May 2022 and December 2022.

<sup>&</sup>lt;sup>1</sup> Sydney Metro City & Southwest – Line Wide Works, Construction Noise and Vibration Impact Statement: Portion 3 – Blues Point, reference: TK685-03-11F01 CNVIS C2S\_P3 BP, revision 5, dated 4 March 2021





## 2 Construction noise assessment

### 2.1 Detailed design outcomes

During the site design process, Renzo Tonin & Associates played a key role in assisting Systems Connect to determine the noise mitigation measures required to reduce the site's noise impact, incorporating existing mitigation measures from previous stages of the project. These works are outside the Blues Point worksite boundary, within the Blues Point Road road reserve. Furthermore, the works are part of the reinstatement and finishing works, the fixed noise mitigation measures have now been removed from the site.

### 2.2 Construction activities

Key details regarding the location and layout of the noise generating plant that will operate during these works were informed by the Construction and Environmental Teams and are summarised in Table C1 in APPENDIX C. Table C1 presents the list of plant proposed to be used for these works and their assumed sound power levels.

There are no concurrent construction activities anticipated for Blues Point.

### 2.3 Predicted construction noise levels

#### 2.3.1 Construction activities

Table 2-1 presents a summary of the construction activities and aspects that are proposed to take place during the works. As noted above, all streetscaping works are on the surface, adjacent to the Blues Point worksite.

Activity	Aspect	Assessment reference	Work period	Duration
Blues Point Streetscaping works	Site establishment Site demobilisation / finishing works	SE	Standard hours (Day)	May 2022 August to September 2022
	Removal of existing road surface, pavement and footpaths	RR	Standard hours (Day)	May to June 2022
	Earthworks for drainage, rain gardens and heritage area	EW	Standard hours (Day)	Works complete
	Construct concrete pavement Paving and granite works Landscaping features and seating Commission new lighting	СР	Standard hours (Day)	Works complete

#### Table 2-1: Summary of construction activities

#### 2.3.2 ICNG assessment

Predicted construction noise levels at the closest noise sensitive receivers for the standard construction hours (daytime period) are summarised in Table 2-2 and compared to the ICNG NMLs (see APPENDIX B). Detailed noise predictions are presented in APPENDIX D.

The results presented in Table 2-2 show that the nearest receivers adjacent to the site are predicted to experience noise levels above the NMLs during the streetscaping works, in particular the operation of noisier plant like rockhammers during the removal of existing road surface, pavement and footpaths (RR). Some receivers in BP\_01 and BP\_02 are likely to experience highly intrusive noise levels during the daytime. Where practicable, noise mitigation measures (see Section 2.4) such as temporary screens will be used to reduce noise emission from the works.

Predicted noise levels are mostly consistent with the predicted noise levels in the CNVIS.

It is noted that the noise predictions in this CNVIS Addendum represent a realistic worst-case scenario when all equipment within each scenario is being operating simultaneously and continuously for the assessment period. Actual noise levels can often be less than the predicted levels presented in this CNVIS when measured over the assessment period.

#### Table 2-2: Predicted noise levels at the closest noise sensitive receivers during daytime (ICNG assessment)

	Address	Type of receiver	Predicted levels LAeq,15min, dB(A) ICNG NML LAeq						-Aeq,15min, dB(A)	
NCA			SE	RR-T	RR-H	EW-T	EW-H	СР	D(S)	HNA level
BP_01	14-28 BLUES POINT ROAD MCMAHONS POINT	Residential	67	67	80	67	80	67	61	75
BP_01	40 BLUES POINT ROAD MCMAHONS POINT	Residential	72	72	85	72	85	72	61	75
BP_01	42 BLUES POINT ROAD MCMAHONS POINT	Residential	63	63	76	63	76	63	61	75
BP_02	33 BLUES POINT ROAD MCMAHONS POINT	Residential	59	59	72	59	72	59	61	75
BP_02	1 WARUNG STREET MCMAHONS POINT	Residential	72	75	88	72	85	75	61	75
BP_02	2 WARUNG STREET MCMAHONS POINT	Residential	62	62	75	62	75	62	61	75
BP_02	3 WARUNG STREET MCMAHONS POINT	Residential	64	72	85	64	77	72	61	75
BP_02	5 WARUNG STREET MCMAHONS POINT	Residential	59	70	83	59	72	70	61	75
BP_02	7 WARUNG STREET MCMAHONS POINT	Residential	59	66	79	59	72	66	61	75
BP_02	9 WARUNG STREET MCMAHONS POINT	Residential	60	67	80	60	73	67	61	75
BP_02	3A WARUNG STREET MCMAHONS POINT	Residential	64	75	88	64	77	75	61	75
BP_02	1A HENRY LAWSON AVENUE MCMAHONS POINT	Residential	61	74	87	61	74	74	61	75
OSR	BARANGAROO RESERVE	Recreation	74	76	89	74	87	76	60	-

SYSTEMS CONNECT TK685-03-11F04 CNVIS\_ADD2 C2B\_P3 BP STREETSCAPE (R6)

Notes: D(S): standard construction hours from 7 am to 6 pm Monday to Friday and from 8 am to 1 pm Saturday

4

HNA: Highly noise affected level

H: includes construction with high noise impact plant (e.g. rockhammers and rollers)

T: includes construction without high noise impact plant

Bold text indicates predicted noise level is above NML; italic text indicates predicted noise level is above the Highly Noise Affected (HNA) level

## 2.4 Noise mitigation and management

#### 2.4.1 High noise impact activities

Consultation has been undertaken to understand stakeholders' noise and vibration expectations and preferences for timing of high impact noise respite. This is consistent with the requirements in CSSI-7400 Conditions E34 and E38. Works during standard construction hours will be managed to reduce noise impacts to nearby receivers. Potential impact from high noise impact activities would be minimised through the implementation of respite, as negotiated with the community. Respite from exposure to activities resulting in high noise impact will be provided as follows:

Time	Days of week	Mitigation strategy
7:00am to 8:00am	Monday to Saturday	1 hour respite
8:00am to 10:00am	Monday to Saturday	2 hours work (high impact activity)
10:00am to 11:00am	Monday to Saturday	1 hour respite
11:00am to 1:00pm	Monday to Saturday	2 hours work (high impact activity)
1:00pm to 2:00pm	Monday to Friday	1 hour respite
2:00pm to 4:30pm	Monday to Friday	2.5 hours work (high impact activity)
4:30pm to 6:00pm	Monday to Friday	1.5 hour respite

Table 2	2-3	Respite	strategy	for h	igh	noise	impact	activity

#### 2.4.2 Site noise control measures

In addition to the noise mitigation measures identified in the CNVIS (see Section 5.3.2), the following Table 2-4 presents additional noise control measures recommended to reduce and manage potential noise impacts. Table C1 in APPENDIX C notes specific management measures for the key construction stages to reduce noise impacts.

Control type	Control measure	Typical use
At source control measure	Use of slings rather than chains	For transfer of materials from delivery vehicles to the work area slings should be adopted to minimise extent of clangs and bangs compared to chains.
Path mitigation measures	Temporary noise screens	Temporary noise screens and or enclosures (e.g. Flexshield, Echo-barrier, or similar) should be used to provide additional noise reduction, where practicable. Temporary noise screens can provide 5 to 10 dB noise reduction, where they can break line of site.
		A three-sided acoustic tent was considered to reduce noise from the concrete pump. However, this activity occurs only during the day, will move around the site depending on the concrete pour location and does not generate 'high noise' impact. It was not considered reasonable to install the tent for these works.

Table	2-4·	Site	noise	control	measures
Tubic	<u> </u>	Sile	noise	control	measures

#### 2.4.3 Additional mitigation measures

Table 2-5 below will be used to advise the appropriate additional mitigation during construction.



Table 2-5: Additional airborne noise mitigation measures

APPENDIX E presents a summary of the additional noise mitigation measures applicable for construction activities where, after application of all reasonable and feasible mitigation options, construction noise levels are still above the relevant NMLs.

#### 2.4.4 Noise monitoring

Attended noise monitoring will be undertaken to verify that the construction activities are consistent with the assessed noise modelling scenarios and that noise levels resulting from construction works are not higher than the levels predicted in this CNVIS. Attended monitoring on private property is subject to obtaining the property owner/occupier's consent (where required).

Attended noise monitoring will be undertaken in the NCAs most impacted by the works. The nominated monitoring locations are identified in Table 2-6, and have been selected as they present the best opportunity to validate the predicted noise levels.

NCA	Nominated receiver address	Monitoring location at 1 m from
BP_01	14-28 BLUES POINT ROAD MCMAHONS POINT	Eastern façade
	40 BLUES POINT ROAD MCMAHONS POINT	Eastern façade
BP_02	1 WARUNG STREET MCMAHONS POINT	Southern façade

Note: Monitoring on private property is subject to owner consent and where relevant, occupier consent. If property access is denied, monitoring will still be carried out outside property boundaries.

If verification monitoring shows that the external noise levels from the construction works are above the predicted levels, investigation will be undertaken to understand the cause of the exceedance and relevant reasonable and feasible mitigation measures will be implemented.

## 3 Construction vibration impacts

### 3.1 Construction vibration goals

For **disturbance to human occupants of buildings**, we refer to '*Assessing Vibration*; *a technical guideline*' (Department of Environment and Conservation 2006). This document provides criteria which are based on the British Standard BS 6472-1992, '*Evaluation of human exposure to vibration in buildings* (*1-80Hz*)', as outlined in the CNVIS and the CNVMP (0).

As also described in the CNVIS and the CNVMP, to minimise the risk of **structural damage to buildings** a conservative vibration damage screening level per receiver type is given below:

- Reinforced or framed structures (Line 1): 25.0 mm/s
- Unreinforced or light framed structures (Line 2): 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.

Where heritage items are identified, Section 4.2.3 of the CNVMP outlines the following approach to manage potential vibration impacts:

- Identify heritage items where the 2.5 mm/s peak component particle velocity objective may be exceeded during specific construction activities
- 2) Structural engineering report to be undertaken on identified heritage items, to confirm structural integrity of the building and confirm if item is 'structurally sound'
- 3) If item confirmed as 'structurally sound', the vibration damage screening criteria above shall be adopted, or
- If item confirmed as 'structurally unsound', the more conservative cosmetic damage objectives of 2.5 mm/s peak component particle velocity would be adopted.

## 3.2 Minimum working distances for vibration intensive plant

From the list in APPENDIX C, the dominant vibration generating plant and equipment include:

• Excavator w/rock hammer (up to 30t)

The recommended minimum working distances for vibration intensive plant are presented in Table 3-1 and Table 3-2. Where the above listed plant works outside these minimum working distances, the risk of building damage from vibration intensive plant is low. Site specific minimum working distances for vibration intensive plant items must be measured on site where plant and equipment are likely to operate close to or within the minimum working distances for cosmetic damage (Table 3-1). At Blues Point, site specific minimum working distances have been identified for a 30T excavator with hammer attachment.

Table 3-1: Minimum worki	ng distances (m)	for cosmetic damage	(continuous vibration)
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	Minimum working distance (m)					
Plant item	Reinforced or framed structures (e.g. commercial buildings) <sup>1</sup>	Unreinforced or light framed structures (e.g. residential buildings) <sup>1</sup>	Sensitive structures (e.g. heritage structures) <sup>2</sup>			
Excavator with rock hammer (up to 30t)	2 <sup>4</sup>	3 <sup>4</sup>	74			

Notes 1) Initial screening test criteria reduced by 50% due to potential dynamic magnification in accordance with BS7385. 2) In accordance with Section 5.8.1 of CNVMP, a site inspection should determine whether a heritage structure is structurally unsound.

3) Minimum working distances are in 5m increments only to account for the intrinsic uncertainty of this screening method.4) Site specific minimum working distances, (reference: TK685-03-11F03 Blues Point Vibration Monitoring Report (r1), 8 February 2022)

#### Table 3-2: Minimum working distances (m) for human annoyance (continuous vibration)

	Minimum working distances, m						
Plant item	Critical	Residences		or: 34	Workshops <sup>4</sup>		
	areas <sup>1,4</sup>	Day <sup>2</sup>	Night <sup>2</sup>	Offices			
Excavator with rock hammer (up to 30t)	40 <sup>5</sup>	25 <sup>5</sup>	-	15 <sup>5</sup>	10 <sup>5</sup>		

Notes 1) Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring.2) Daytime is 7 am to 10 pm; Night-time is 10 pm to 7am.

3) Examples include offices, schools, educational institutions and place of worship.

4) Applicable when in use.

5) Site specific minimum working distances, (reference: TK685-03-11F03 Blues Point Vibration Monitoring Report (r1), 8 February 2022)

### 3.3 Vibration assessment

#### 3.3.1 Structural damage

The numbers of buildings which are close to or within the minimum working distances for cosmetic damage are shown in Table 3-3.

Table 2 2.	Number	of buildings	within	minimum	working	dictancoc	for coc	motic d	lamaga
Table 5-5.	number (	Ji bununigs	WILIIII	mmmum	working	uistances	IOI COS	metic u	amaye

		Number of buildings						
Works	Plant item	Screening criteria for non-heritage structures	Screening criteria for heritage structures					
Removal of existing road surface, pavement and footpaths	Excavator with rock hammer (up to 30t)	0	3					

The excavators (up to 30t) with rock hammer will be used to remove the existing road surface, pavement and footpaths. The contractor will ensure that the excavator with rock hammer attachment will not operate within the MWD of the heritage listed stone retaining wall, bus stop, stone sea wall and ferry wharf to reduce the risk of vibration impact, where practicable.

If the 30T excavator with rock hammer is within the site-specific minimum working distance for heritage structures (2.5mm/s), an alternative construction method with lower vibration intensive plant such as concrete saws or electric jackhammer shall be used to breakdown the concrete into smaller pieces which will be carefully removed using an excavator with bucket attachment. Vibration monitoring shall be conducted to verify that vibration levels from the concrete saw, electric jackhammer and excavator with bucket attachment comply with the vibration criterion of 2.5mm/s ppv.

If vibration levels are above 2.5mm/s ppv, WORKS MUST STOP, and:

- Investigate the cause of exceedance
- Structural engineer and heritage consultant to inspect the heritage items (photos shall be taken)
- If no cosmetic damage is found, a different construction method with lower source of vibration is to be used
- If cosmetic damage has been identified, repair damage and a different construction method with lower source of vibration is to be used.

#### 3.3.2 Human annoyance

Properties where vibration levels may be above the vibration disturbance goals in Table 4.2 of the *Blues Point CNVIS* and there is a probability of adverse comment are shown in Table 3-4.

Table 3-4: Number	of buildings	within	minimum	working	distances	for	human	annovance

Werke	Diant item	Critical	Residence	es⁵	- Officer <sup>3,4</sup>	Workshops <sup>4</sup>	
WORKS	Plant item	areas <sup>1,4</sup>	Day <sup>2</sup>	Night <sup>2</sup>	Onces		
Removal of existing road surface, pavement and footpaths	Excavator with rock hammer (up to 30t)	0	8	-	0	0	

Notes:

1. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring.

2. Daytime is 7 am to 10 pm; Night-time is 10 pm to 7am.

3. Examples include offices, schools, educational institutions and place of worship.

4. Applicable when in use.

5. Hotels and childcare centres are included in the residence category.

During hammering there are 8 residential receivers that are within the minimum working distances for human annoyance. Properties are shown in APPENDIX F.

The above assessment is based on vibration-generating equipment operating at the closest location to a receiver. When vibration-generating equipment operates further from the closest point, vibration levels will reduce along with the probability of adverse comment. The above plant will be operating both within and outside the MWD for human annoyance during the activity, which is expected to take

approximately 4 weeks to complete during standard construction hours. The vibration may be noticeable at times, however the risk of annoyance is considered low.

It is recommended that attended vibration measurement is only required in the event of complaint to confirm that vibration is within the acceptable range for human annoyance. If measurement results indicate exceedances of the vibration objectives for human annoyance at these locations, vibration control and management measures will be provided to reduce vibration impact (see Section 6.3.1 of the *Blues Point CNVIS*).

After applying all feasible and reasonable vibration mitigation measures, if vibration monitoring still identifies that measured vibration levels are above the relevant vibration criteria for human annoyance, appropriate additional mitigation measures will be considered (see Section 6.3.2 of the *Blues Point CNVIS*).

### 3.4 Other assessments

Ground-borne noise, Construction related traffic and Cumulative impacts were respectively assessed in Sections 7, 8 and 9 of the *Blues Point CNVIS*.

For this assessment, the findings within the *Blues Point CNVIS* for Ground-borne noise, Construction related traffic and Cumulative impacts is unchanged (i.e. no adverse impacts). The number of heavy vehicle movements modelled in this addendum do not exceed the predicted heavy vehicle movements detailed in section 8 of the Blues Point CNVIS.

## 4 Conclusion

This technical memorandum is an addendum to the report *Blues Point CNVIS* to review the potential noise and vibration impacts for the proposed streetscaping works program at the Blues Point worksite. The works will be completed between May 2022 and Sept 2022.

#### **Construction noise**

The noise levels from works are predicted to be above the NMLs at the nearest noise sensitive receivers for all assessment periods. The noise predictions in this CNVIS represent a realistic worst-case scenario when all equipment within each scenario is being operating simultaneously and continuously for the assessment period. Actual noise levels can often be less than the predicted levels presented in this CNVIS when measured over the assessment period. Respite period timings have been determined through consultation with the community and will be implemented during high noise impact activity in accordance with the requirements in CSSI-7400 Conditions E34 and E38. Additional mitigation measures will be implemented in accordance with the CNVMP and the SMCSNVS. Noise monitoring will be undertaken to verify compliance with the predicted noise levels.

#### **Construction vibration**

A vibration assessment for work involving the removal of the existing roads, pavements and footpaths has found the heritage listed stone retaining wall, bus stop and the stone sea wall and ferry wharf may within the minimum working distances established for cosmetic damage during use of the equipment. No rock hammering will be conducted within the minimum working distance of the heritage structures instead alternative construction methodologies and vibration monitoring, which have been described in Section 3.3.1 will be adopted to minimise the risk of structural damage to buildings/ structures.

For human annoyance, it has been identified that there are some residential receivers that are within the minimum working distances. Vibration monitoring will be undertaken at these residential receivers during the vibratory intensive works in the event of complaint to confirm that vibration is within the acceptable range for human annoyance.

The vibration management measures, outlined in Section 6.3 of the *Blues Point CNVIS* will be provided to reduce vibration impacts.

#### Ground-borne noise, Construction traffic and Cumulative impacts

For this assessment, the findings within the *Blues Point CNVIS* for Ground-borne noise, Construction related traffic and Cumulative impacts is unchanged (i.e. no adverse impacts).

## **Document control**

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
08.04.2022	Initial issue	0	1	D. Auld	T. Gowen	T. Gowen
19.04.2022	Update following Systems Connect review	-	2	T. Gowen	-	T. Gowen
26.04.2022	Minor edits	-	3	T. Gowen	-	T. Gowen
11.05.2022	Respond to AA comments	-	4	D. Auld	T. Gowen	T. Gowen
25.05.2022	Respond to AA comments	-	5	T. Gowen	-	M. Tabacchi
16.06.2022	Update vibration criterion	-	6	D. Auld	T. Gowen	T. Gowen

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Important Disclaimers:

The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian/New Zealand Standard AS/NZS ISO 9001.

This document is issued subject to review and authorisation by the suitably qualified and experienced person named in the last column above. If no name appears, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

This document is prepared for the particular requirements of our Client referred to above in the 'Document details' which are based on a specific brief with limitations as agreed to with the Client. It is not intended for and should not be relied upon by a third party and no responsibility is undertaken to any third party without prior consent provided by Renzo Tonin & Associates. The information herein should not be reproduced, presented or reviewed except in full. Prior to passing on to a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission.

In preparing this report, we have relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, we have not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

We have derived data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination and re-evaluation of the data, findings, observations and conclusions expressed in this report.

We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural buildability and fit-for-purpose, waterproofing and the like. Supplementary professional advice should be sought in respect of these issues.

External cladding disclaimer: No claims are made and no liability is accepted in respect of any external wall and/or roof systems (eg facade / cladding materials, insulation etc) that are: (a) not compliant with or do not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes; or (b) installed, applied, specified or utilised in such a manner that is not compliant with or does not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes; or (b) installed, applied, specified or utilised in Such a manner that is not compliant with or does not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes.

## APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of every day sounds:
	0dB The faintest sound we can hear
	30dB A quiet library or in a quiet location in the country
	45dB Typical office space. Ambience in the city at night
	60dB CBD mall at lunch time
	70dB The sound of a car passing on the street
	80dB Loud music played at home
	90dB The sound of a truck passing on the street
	100dBThe sound of a rock band
	115dBLimit of sound permitted in industry
	120dBDeafening
dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L <sub>Max</sub>	The maximum sound pressure level measured over a given period.
L <sub>Min</sub>	The minimum sound pressure level measured over a given period.

L <sub>1</sub>	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L <sub>10</sub>	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L <sub>90</sub>	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L <sub>eq</sub>	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

# APPENDIX B Noise management levels

#### Table B1: Noise sensitive receivers and construction noise management levels

Nearest construction			Existing Noise Levels, dB(A)			Residential NMLs based on ICNG (external)				Sleep Dist. L <sub>Amax</sub>		- Commente	
NCA	work area	Receiver Type	Reference RBL	RBL Day	<b>RBL Evening</b>	RBL Night	NMLDS	NMLDO	NMLE	NMLN	Screening <sup>1</sup>	Max <sup>1</sup>	- comments
BP_01	Blues Point	Residential apartments east of Blues Point Rd	C2S EIS B.16	51	49	40	61	56	54	45	55	65	
BP_02	Blues Point	Residential apartments west of Blues Point Rd	C2S EIS B.14	51	49	40	61	56	54	45	55	65	
BN_02	Barangaroo Station	Residential buildings north of Argyle St and	C2S EIS B.12	50	45	40	60	55	50	45	55	65	
		Bettington St											
BN_04	Barangaroo Station	Mixed residential and commercial west of	C2S EIS B.13	62	62	52	72	67	67	57	67	65	
		Harbour Bridge											
Other sensitive	e receivers												
Studio building	(music recording studio)						45	45	45	45			Source: AS2107 'maximum', assuming a conservative façade loss of 20 dB(A)
Studio building	(film or television studio)						50	50	50	50			Source: AS2107 'maximum', assuming a conservative façade loss of 20 dB(A)
Cinema space,	theatre, auditorium						55	55	55	55			Source: AS2107 'maximum', assuming a conservative facade loss of 20 dB(A)
Hotel (Sleeping	areas: Hotels near major	roads)					60	60	60	60			Source: AS2107 'maximum', assuming a conservative façade loss of 20 dB(A)
Classrooms at s	chools and other educatio	onal institutions					55	55	55	55			Source: ICNG, assuming a conservative façade loss of 10 dB(A)
Chilcare centre	(internal play and sleeping	g areas)					50	50	50	50			Source: AAAC - guideline for Child Care Centre Acoustic Assessment, assuming a
													conservative façade loss of 10 dB(A)
Hospital wards	and operating theatres						65	65	65	65			Source: ICNG, assuming a conservative façade loss of 20 dB(A)
Places of worsh	ip						55	55	55	55			Source: ICNG, assuming a conservative façade loss of 10 dB(A)
Library (reading	g areas)						65	65	65	65			Source: AS2107 'maximum', assuming a conservative façade loss of 20 dB(A)
Office building	(general office areas)						65	65	65	65			Source: AS2107 'maximum', assuming a conservative façade loss of 20 dB(A)
Hotel (bars and	lounges)						70	70	70	70			Source: AS2107 'maximum', assuming a conservative façade loss of 20 dB(A)
Community cer	ntres – Municipal Buildings	5					60	60	60	60			Source: AS2107 'maximum', assuming a conservative façade loss of 10 dB(A)
Restaurant, ba	(Bars and lounges/ Resta	urant)					70	70	70	70			Source: AS2107 'maximum', assuming a conservative façade loss of 20 dB(A)
Railway platfor	m and concourse areas						75	75	75	75			Source: AS2107 'maximum', assuming a conservative façade loss of 20 dB(A)
Café/ Restaura	nt/ Bar (outdoors)						60	60	60	60			Source: AS2107 'maximum1'
Passive recreat	ion areas (e.g. area used f	or reading, meditation)					60	60	60	60			Source: ICNG
Active recreation	on areas (e.g. sports fields)						65	65	65	65			Source: ICNG
Commercial pr	emises (including offices a	nd retail outlets)					70	70	70	70			Source: ICNG
Industrial prem	ises						75	75	75	75			Source: ICNG

Notes: 1 - Levels are estimated assuming an open windows (i.e. 10dBA façade losss)

D(S): standard construction hours from 7 am to 6 pm Monday to Friday and from 8 am to 1 pm Saturday

D(O): out-of-hours day period from 1 pm to 6 pm Saturday and 8 am to 6 pm Sunday and Public holidays - OOHW P1

E: evening period from 6 pm to 10 pm Monday to Sunday - OOHW P1

NS: night shoulder period from 10 pm to 12 am Monday to Sunday - OOHW P1

N: night-time period from 10 pm to 7 am Monday to Friday, from 10 pm am to 8 am Saturday, Sunday and Public holidays - OOHW P2

MS: morning shoulder period from 5 am to 7 am Monday to Friday, from 6 am to 8 am Saturday, Sunday and Public holidays - OOHW P1

**Blues Point** 





#### LEGEND

Residential Mixed use Commercial 📯 Industrial = Hotel/Motel/Hostel Medical facility Place of Worship Community centre O Recording studio 📏 Library/Museum A Childcare

NCA

Work area



Educational Theatre/Auditorium 🔲 Cinema Laboratory Flight simulator Horse Stable **Recreational - Passive** Recreational - Active Other Heritage





# APPENDIX C Construction timetable/ activities/ management

## Table C1: Construction Timetable/ Activities/ Equipment

Work activity/ Work Area	Aspect	Indicative timing/	Modelling ID	D Plant/ Equipment (as provided by client)	Day	Evening	Night	Sound Power Level (Lw re: 1pW) in Noise Model, dB(A)		High noise plant	Vibration	Notes	
		duration			7am - 6pm	6pm - 10pm	10pm - 7am	L <sub>Aeq</sub>	Penalty	<b>L</b> Amax	(EPL E1)	intensive plant	
Blues Point	Site establishment	May 2022	SE	Truck deliveries	2-4 per hour			106	-	111	-	-	
Streetscaping works	Site demobilisation /	August to		Franna / forklift	1			99	-	103	-	-	
	finishing works	September 2022		Light vehicles	2			89	-	100	-	-	
				Hand Tools - H/S Drill, Impact Sockets etc	various			107	-	118	-	-	
				Waste disposal trucks (weekly)	1			106	-	111	-	-	
	Removal of existing road	May to June 2022	RR	Road saw	1			121	5	129	HN	-	
	surface, pavement and			Excavator with rock hammer (20t)	1			118	5	123	HN	Х	Plant will not be used within minimum working distance of heriatage structures
	footpaths			Excavator with bucket (20t)	1			103	-	108	-	-	
				Truck deliveries	2-4 per hour			106	-	111	-	-	
				Light vehicles	2			89	-	100	-	-	
				Hand Tools - H/S Drill, Impact Sockets etc	various			107	-	118	-	-	
				Street sweeper	1			104	-	107	-	-	
				Vacuum truck (for service location)	1			107	-	111	-	-	
				Waste disposal trucks (weekly)	1			106	-	111	-	-	
				Utility bucket trucks (service dislocation)	1			95	-	98	-	-	
	Earthworks for drainage,	June to July 2022	EW	Excavator with bucket (20t)	2			103	-	108	-	-	
	rain gardens and heritage			Truck deliveries	2-4 per hour			106	-	111	-	-	
	area			Roller (10t) - Static Mode	1			109	5	113	HN	-	
				Light vehicles	2			89	-	100	-	-	
				Hand Tools - H/S Drill, Impact Sockets etc	various			107	-	118	-	-	
				Street sweeper	1			104	-	107	-	-	
				Waste disposal trucks (weekly)	1			106	-	111	-	-	
				Franna / forklift	1			99	-	103	-	-	
	Construct concrete pavement	October to December	СР	Truck deliveries	2-4 per hour			106	-	111	-	-	
	Paving and granite works	2022		Concrete truck deliveries	2-4 per hour			108	-	111	-	-	
	Landscaping features and seating			Concrete Pump	1			103	-	107	-	-	
	Commission new lighting			Concrete vibrator	2			97	-	100	-	-	
				Excavator with bucket (20t)	1			103	-	108	-	-	
				Light vehicles	2			89	-	100	-	-	
				Hand Tools - H/S Drill, Impact Sockets etc	various			107	-	118	-	-	
				Franna / forklift	1			99	-	103	-	-	
				Waste disposal trucks (weekly)	1			106	-	111	-	-	
				Street sweeper	1			104	-	107	-	-	

# 15/06/2022

## **Blues Point**

## APPENDIX D Detailed predicted construction noise levels

The detailed predicted levels have been provided to Systems Connect in a spreadsheet table in order to more adequately mitigate and manage potential noise impacts.

## APPENDIX E Additional noise mitigation

The detailed additional mitigation requirements have been provided to Systems Connect in a spreadsheet table in order to more adequately mitigate and manage potential noise impacts.

# APPENDIX F Vibration minmum working distances





Sheet 1 of 1