

14 February 2019

TH511-02 01.06.04 F02 BN CNVIS Addendum 1 (r2)

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Sydney Metro Chatswood to Sydenham – TSE Works - Out-Of-Hour Spoil Barge Loading

1 Introduction

1.1 Overview of works

This technical memorandum is an addendum to the report *Construction Noise and Vibration Impact Statement: Barangaroo Construction Site*¹ (Barangaroo CNVIS) and has been prepared on behalf of John Holland CPB Ghella Joint Venture (JHCPBG) in accordance with the Construction Noise and Vibration Management Plan (CNVMP) [SMCSWTSE-JCG-TPW-EM-PLN-002012]² for the Design and Construction of the Tunnel and Station Excavation (TSE) Works of the Sydney Metro City & Southwest Project (the Project).

JHCPBG is proposing to extend operating hours the spoil barge loading operations in the spoil loadout area into the E2 evening period (i.e. 8pm to 10pm) and night-time period (i.e. 10pm to 7am), 7 days per week.

This memorandum has been prepared to address the potential construction noise and vibration impacts from the extension of the construction hours for these activities. These works have been assessed in isolation, and no other project construction activities are currently proposed to take place concurrently with the spoil barge loading operations during the evening and night period.

¹ Report TH511-02 01.06.04 F01 BN CNVIS (r11), dated 21 November 2018 (Barangaroo CNVIS)

² Sydney Metro City & Southwest – TSE Works Construction Noise and Vibration Management Plan (SMCSTSE-JCG-TPW-EN-PLN-002012)

1.2 Justification for out of hours construction works

Under EPL20971 L4.4 (a) and (b), tunnelling activities and tunnelling ancillary surface supports works and haulage and delivery of spoil and materials are permitted to occur 24/7. The Special Dictionary defines Tunnelling ancillary surface support works as: *"surface works and activities that are required to be undertaken outside of standard construction hours outlined in Condition L4.1 in order to maintain 24/7 tunnelling activities including, but not necessarily limited to, plant and equipment maintenance, and spoil, water, grout and ventilation management."*

OOH Barge loading is required in order to maintain 24/7 tunnelling activities. Failure to load out spoil out of hours would result in the foreshore shed spoil storage areas becoming spoil bound and would prevent tunnelling from occurring 24/7.

2 Construction noise assessment

2.1 Construction activities

The spoil barge loading operations assessed in this addendum have already been assessed in the Barangaroo CNVIS for the daytime/evening period (i.e. 7am to 8pm).

Key details regarding the location and layout of the noise generating plant and equipment that will operate during the spoil barge loading operations were informed by the Design and Construction Teams. The location of the construction activities is shown in Figure C1 in the Barangaroo CNVIS.

Noise measurements were undertaken on site on 13th December 2018 by Renzo Tonin & Associates (RTA) to verify the sound power levels of the barge loading activities and the associated plant and equipment.

Table 2.1 presents the list of plant that are proposed to be used during the out-of-hour (OOH) barge loading operations and the associated sound power levels.

Table 2.1: Construction activities and applicable sound power levels

Construction Work Area	Key plant and equipment	Qty	Sound power level, dB(A)		Comments
			L _{Aeq}	L _{A1}	
Spoil loadout – barge area	Telestack – Mobile conveyor (diesel)	1	106 ¹	110 ¹	In the barge loading area outside the spoil shed
	Caterpillar 966H wheeled loader	1			Transporting spoil from inside the shed and loading the conveyor hopper outside the shed
	4.5T excavator with bucket	1	103	106	Redistributing spoil on the barge

Note: 1-Sound power level of barge loading operation was verified on site on 13/12/2018

Predicted noise levels associated with the barge loading operations at the nearest noise sensitive receivers to the work site are presented in Table 2.2.

Table 2.2: Predicted noise levels at the closest noise sensitive receivers

Address	Type of receiver	Assumed external to internal noise reduction, dB(A)	Predicted external LAeq construction noise level, dB(A)	ICNG NMLs (reference guide only)	External equivalent NML, dB(A) - Condition E41 (8pm to 7am)	Compliance with E41 condition?
25 EDWARD STREET BALMAIN EAST	Residential	10	45	46	55	Yes
40-40A HIGH STREET MILLERS POINT	Residential	10	51	45	55	Yes
65-69 KENT STREET MILLERS POINT	Residential	10	50	45	55	Yes
89-105 KENT STREET MILLERS POINT	Hotel	20	50	60	65	Yes
35-37 BETTINGTON STREET MILLERS POINT	Hotel	20	52	60	65	Yes
24 MUNN STREET BARANGAROO	Residential	10	52	45	55	Yes

Notes 1. All noise levels are LAeq,15min

As can be noted from Table 2.2, the predicted noise levels are expected to be slightly above the ICNG NMLs but well below the PPA Condition E41 external equivalent NMLs at the nearest noise sensitive receivers during barge loading operations. Potential noise mitigation measures such as temporary screens around the work area or quieter noise plant have been considered but they were deemed neither feasible nor reasonable.

Based upon the noise monitoring of the barge loading operations undertaken by RTA, the highest $L_{A1\ 1\text{minute}}$ noise levels associated with the barge loading operations would be from the operations of the wheeled loader when loading the conveyor. The predicted $L_{A\text{max}}$ noise levels associated these noise events could exceed the sleep disturbance screening level at the nearest residential receivers, however they are predicted to be well below the sleep disturbance 'awakening reaction' internal NML of 55 dB(A) $L_{A1\ (1\text{minute})}$.

2.2 Noise mitigation and management

Based upon the assessment, there are no additional noise mitigation or management measures applicable beyond those outlined in the Barangaroo CNVIS for the works reviewed in this technical memorandum.

2.2.1 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 memorandum or the relevant NMLs. 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. A minimum of one representative receiver in each NCA is to be monitored. The nominated monitoring locations are identified in Table 2.3, and have been selected as they present the best opportunity to validate the predicted noise levels.

Table 2.3: Nominated verification monitoring locations

NCA	Nominated receiver address	Monitoring location at 1 m from
BN_02	24 MUNN STREET BARANGAROO	Southern facade
BN_03	40-40A HIGH STREET MILLERS POINT	Western facade
BN_06	25 EDWARD STREET BALMAIN EAST	Eastern facade
OSR	89-105 KENT STREET MILLERS POINT	Western facade

Note: Monitoring on private property is subject to owner consent and where relevant, occupier consent

If verification monitoring shows that the external noise levels are consistently above the predicted levels, investigation should be undertaken to understand the cause of the exceedance. In addition, if the verification monitoring shows that the external noise levels are also consistently above the equivalent external NML at night, more detailed analysis should be conducted to quantify the building façade loss and the potential of being above the internal NML of 45dB(A) $L_{Aeq,15min}$ specified in PPA Conditions E41/E42. If internal noise levels are found to be above 45dB(A) $L_{Aeq,15min}$, consideration will be given to the provision of at-property treatments, additional on-site measures or other management measures.

2.2.2 Consultation with affected receivers (PPA Condition E33)

As outlined in Section 5.4.1 of the Barangaroo CNVIS, consistent with requirements in PPA Conditions E33, JHCPBG has commenced and will continue to consult with potentially affected stakeholders including business and residential receivers regarding specific mitigation measures applicable to the construction works at the Barangaroo site.

The following receivers have been previously identified for compliance with the PPA condition E34:

- 89-105 KENT STREET MILLERS POINT: predicted levels are expected to be below ICNG NML (see Table 2.2)
- 89-105 KENT STREET MILLERS POINT: predicted levels are expected to be below ICNG NML (see Table 2.2)

- 37 HIGH STREET MILLERS POINT (Ku Lance Childcare): the childcare centre is not likely to be in use during the out-of-hour spoil barge loading.

2.3 Other assessments

The following other assessments are covered in the *Barangaroo CNVIS*:

- Construction vibration;
- Ground-borne noise impacts;
- Construction traffic noise;
- Cumulative noise and vibration impacts.

There are no additional recommendations applicable for the works reviewed in this technical memorandum.

3 Conclusion

This technical memorandum is an addendum to the report *Barangaroo CNVIS* to review the potential noise and vibration impacts for the proposed extension of the barge loading operations to the E2 evening period (i.e. 8pm to 10pm) and night-time period (i.e. 10pm to 7am), 7 days per week.

These works are required to be extended outside standard construction hours to maintain 24/7 tunnelling activities by preventing the foreshore shed spoil storage areas from becoming spoil bound.

These works have been assessed in isolation and no other project construction activities are currently proposed to take place concurrently with the spoil barge loading operations during the evening and night period.

Noise levels are predicted to comply with the PPA Condition E41 NMLs at the nearest noise sensitive receivers. Noise monitoring will be undertaken on a regular basis to verify compliance with the predicted noise levels and NMLs.

The consultation and notification process in accordance with PPA Condition E33 will continue and from now on will also include these additional out-of-hour works.

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Authorised
18/12/2018	Issued	0	1	M. Tabacchi	M. Tabacchi	A. Leslie
14/02/2019	Update following AA's comments	1	2	M. Tabacchi	M. Tabacchi	T. Gowen

Important Disclaimer:

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

This document is issued subject to review and authorisation by the Team Leader noted by the initials printed in the last column above. If no initials appear, 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 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.

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 100dB The sound of a rock band 115dB Limit of sound permitted in industry 120dB Deafening
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 _{Max}	The maximum sound pressure level measured over a given period.
L _{Min}	The minimum sound pressure level measured over a given period.

L ₁	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L ₁₀	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L ₉₀	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 _{eq}	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.

**ENDORSEMENT
CITY & SOUTHWEST ACOUSTIC ADVISOR**

Review of	Construction Noise and Vibration Impact Statement: Barangaroo Site – addendum for OOH spoil barge loading	Document reference:	SYDNEY METRO CITY & SOUTHWEST-TSE WORKS - Barangaroo Site – addendum for OOH spoil barge loading
Prepared by:	Dave Anderson, Acoustic Advisor		<i>TH511-02 01.06.04 F02 BN CNVIS Addendum 1 (r2) dated 14 February 2019</i>
Date of issue:	2 March 2019		

As approved Acoustic Advisor for the Sydney Metro City & Southwest project, I previously reviewed and commented on the Construction Noise and Vibration Impact Statement (CNVIS) for the Barangaroo Site (as required under A27 (d) of the project approval conditions) and endorsed revision 13 today.

This addendum to the CNVIS documents TSE’s proposal to extend operating hours for spoil barge loading. The predicted noise levels presented in the CNVIS addendum indicate that noise management levels may be exceeded by around 5dBA at some of the nearest affected residential properties. Following discussion with TSE and Renzo Tonin Associates I note that the predicted noise levels represent the realistic worst case and that there are no further feasible and reasonable mitigation options available at this stage. I also note that the internal noise limit of 45dBA (ref condition E41) will be met, even if windows are left open.

I endorse the addendum to the Barangaroo Site CNVIS.



Dave Anderson, City & Southwest Acoustic Advisor

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

2 March 2019

Ref: TSE BA Add. CNVIS

Dear Stuart

RE: Endorsement of Addendum - TSE Construction Noise and Vibration Impact Statement: Barangaroo Out of Hour Spoil Barge Loading - Sydney Metro City & Southwest

Thank you for providing the following document for Environmental Representative (ER) review.

- Addendum - Construction Noise and Vibration Impact Statement: Barangaroo Construction Site (dated 14 February 2019).
- Acoustic Advisor (AA) Endorsement (of the above document) dated 2 March 2019

The Addendum to the CNVIS is required under Condition E33 of the Infrastructure Approval SSI 15_7400. As an approved ER for the Sydney Metro City & Southwest project, and as required by Condition A24d of the Infrastructure Approval, I have reviewed the above documents. The review did not comprise a technical review, as the ER has relied upon the AA's review of technical aspects of the document.

On the basis of the endorsement of the document by the AA, the document referenced is endorsed as required by Condition A24d. The endorsement is provided on the condition that if numerous complaints are received relating to the works described in Addendum, then JHCPBG will re-evaluate the activities and address the issues raised in the complaints.

Yours sincerely



Michael Woolley
Environmental Representative – Sydney Metro – City and South West

**ENDORSEMENT
CITY & SOUTHWEST ACOUSTIC ADVISOR**

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Dave Anderson, City & Southwest Acoustic Advisor