Blast Monitoring Program

Project Name: M6 Stage 1

Project number:	M6S1
Document number:	M6S1-CGU-NWW-NV-RPT-050504
Revision date:	07/07/2023
Revision:	04

Document approval

Rev	Date	Prepared by	Reviewed by	Remarks
00	25/05/2023	A Broger	C Gibson M Malcolm	For consultation and endorsement
01	31/05/2023	A Broger	C Gibson	Updated following ER review and consultation period
02	05/06/2023	A Broger	C Gibson	For endorsement
03	03/07/2023	A Broger	M Malcolm	Updated to address DPE comments
04	07/07/2023	A Broger	C Gibson	Updated to address DPE comments

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Glossary/ Abbreviations

Term/ Abbreviations	Expanded Text
AA	Acoustic Advisor
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.
Attenuation	The reduction in the level of sound or vibration.
BMS	Blast Management Strategy
CEMP	Construction Environmental Management Plan
CNVG	Construction Noise and Vibration Guideline (Roads and Maritime 2016)
CNVIS	Construction Noise and Vibration Impact Statement
CoA	Condition of Approval
CSSI	Critical State Significant Infrastructure
dBA	Decibels using the A-weighted scale measured according to the frequency of the human ear.
DPIE	NSW Department of Planning, Industry and Environment
EIS	Environmental Impact Statement
EMS	Environmental management system
Environmental aspect	Defined by AS/NZS ISO 14001:2015 as an element of an organisation's activities, products or services that can interact with the environment.
Environmental impact	Defined by AS/NZS ISO 14001:2015 as any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's environmental aspects.
EMM	Environmental Management Measure
Environmental objective	Defined by AS/NZS ISO 14001:2015 as an overall environmental goal, consistent with the environmental policy, that an organisation sets itself to achieve.
Environmental target	Defined by AS/NZS ISO 14001:2015 as a detailed performance requirement, applicable to the organisation or parts thereof, that arises from the environmental objectives and that needs to be set and met in order to achieve those objectives.
EPA	NSW Environment Protection Authority
EP&A Act	Environmental Planning and Assessment Act 1979
ER	Environmental Representative
ERG	Environmental Review Group
EWMS	Environmental Work Method Statements
Feasible and reasonable	Consideration of best practice taking into account the benefit of proposed measures and their technological and associated operational application in the NSW and Australian context. Feasible relates to engineering considerations and what is practical to build. Reasonable relates to the application of judgement in arriving at a decision, taking into account mitigation benefits and cost of mitigation versus benefits provided, community views and nature and extent of potential improvements.

Term/ Abbreviations	Expanded Text
ICNG	Interim Construction Noise Guideline (DECC, 2009)
INP	NSW Industrial Noise Policy (EPA 2000)
$L_{Aeq(15min)}$	The A-weighted equivalent continuous (energy average) A-weighted sound pressure level of the construction works under consideration over a 15-minute period and excludes other noise sources such as from industry, road, rail and the community.
$L_{A(max)}$	the A-weighted maximum noise level only from the construction works under consideration, measured using the fast time weighting on a sound level meter.
NCA	Noise catchment areas
NML	Noise Management Level
NVMP	Noise and Vibration Management Sub Plan (this document)
OEH	Office of Environment and Heritage
OOHW	Out-of-hours works
RBL	The Rating Background Level for each period is the medium value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period (day, evening and night)
SWP	Sound Power Level
SSI	State Significant Infrastructure
SPL	Sound Pressure Level
TfNSW	Transport for NSW (formerly Roads and Maritime Services, RMS)
VDV	Vibration Dose Value

1. Introduction

1.1. Context

This Blast Monitoring Program (the Program) has been prepared for the Design and Construction of the M6 Stage 1 (the Project). The Program has been prepared to address the requirements of the Minister's Conditions of Approval (CoA), the Environmental Management Measures (EMMs) listed in the M6 Stage 1 Submissions Report and all applicable legislation. A separate Blast Management Strategy (BMS) has been prepared for the Project to specifically address Conditions E87-E89 of the Planning Approval. This Program should be read in conjunction with the BMS.

1.2. Scope

The scope of this Program is to define how the CPB Contractors, Ghella, UGL Engineering (CGU) joint venture intends to monitor potential impacts during controlled blast activities on the Project.

2. Purpose and objectives

2.1. Purpose

The purpose of the Program is to describe how CGU will monitor and capture vibration level data during blasting. Blasting activities will commence following the Planning Secretary's approval of this Program.

This monitoring Program will be implemented for the duration of the Project's blasting activities, unless a longer period is specified by the Secretary of the Department of Planning and Environment (DPE).

2.2. Objective

The key objective of this Program is to ensure that the monitoring of blasting is conducted in accordance with all relevant CoAs, EMMs, and licence/permit requirements relating to controlled blasting are described, scheduled, and assigned responsibility as outlined in:

- The Environmental Assessments prepared for the Project;
- Conditions of Approval granted to the project on 18th December 2019;
- RMS specifications G36;
- Environment Protection Licence (EPL); and
- All relevant legislation and other requirements described in Section 3 of the CNVMP.

A summary of relevant requirements to this Program are included in Table 1.

Table 1 Conditions of Approval Relevant to Blast Monitoring Program

CoA	Condition Requirements	Document Reference
A5	Where the terms of this approval require a document or monitoring program to be prepared, or a review to be undertaken, in consultation with identified parties, evidence of the consultation undertaken must be submitted to the Planning Secretary with the document. The evidence must include: (a) documentation of the engagement with the party identified in the condition of approval that has occurred before submitting the document for approval; (b) a log of the dates of engagement or attempted engagement with the identified party and a summary of the issues raised by them; € documentation of the follow-up with the identified party where engagement has not occurred to confirm that they do not wish to engage or have not attempted to engage after repeated invitations; (d) outline of the issues raised by the identified party and how they have been addressed; a€(e) a description of the outstanding issues raised by the identified party and the reasons why they have not been addressed.	Section 3.2
A26 (d)	Review documents identified in Conditions A17, C1, C4 and C13 and any other documents that are identified by the Planning Secretary, to ensure they are consistent with requirements in or under this approval and if so: (i) make a written statement to this effect before submission of such documents to the Planning Secretary (if those documents are required to be approved by the Planning Secretary); or (ii) make a written statement to this effect before the implementation of such documents (if those documents are required to be submitted to the Planning Secretary / Department for information or are not required to be submitted to the Planning Secretary / Department);	Section 3.4

<table>
<tr><th>CoA</th><th>Condition Requirements</th><th>Document Reference</th></tr>
<tr><td>A31 (d)</td><td>Review all noise and vibration documents required to be prepared under the terms of this approval and, should they be consistent with the terms of this approval, endorse them before submission to the Planning Secretary (if required to be submitted to the Planning Secretary) or before implementation (if not required to be submitted to the Planning Secretary)</td><td>Section 3.4</td></tr>
<tr><td>C13</td><td>The Construction Monitoring Programs set out in Table 5 must be prepared and implemented to enable comparison of the actual construction performance against the predicted performance. The Construction Monitoring Programs must be prepared in consultation with the relevant government agencies and councils as identified for each Construction Monitoring Program.
(a) Table 5: Construction Monitoring and relevant public authorities
<table>
<tr><th></th><th>Required Construction Monitoring Programs</th><th>Relevant government agencies to be consulted for each Construction Monitoring Program</th></tr>
<tr><td>(d)</td><td>Blast Monitoring Program</td><td>EPA</td></tr>
</table></td><td>This document</td></tr>
<tr><td rowspan="14">C14</td><td>Construction Monitoring Programs must provide:</td><td></td></tr>
<tr><td>(a) details of baseline data available;</td><td>Section 4</td></tr>
<tr><td>(b) details of baseline data to be obtained and when;</td><td>Section 4</td></tr>
<tr><td>(c) details of all monitoring that will be undertaken;</td><td>Section 5</td></tr>
<tr><td>(d) the parameters of the project to be monitored;</td><td>Section 5.1</td></tr>
<tr><td>(e) the frequency of monitoring;</td><td>Section 5.2</td></tr>
<tr><td>(f) the location of monitoring;</td><td>Section 5.3</td></tr>
<tr><td>(g) the reporting of monitoring and analysis results against relevant criteria, including details of the timing and frequency for reporting the results to the Planning Secretary and relevant government agencies;</td><td>Section 6</td></tr>
<tr><td>(h) details of the methods that will be used to analyse the monitoring data;</td><td>Section 7</td></tr>
<tr><td>(i) procedures to identify and implement additional mitigation measures where results of monitoring indicate adverse impacts or levels above relevant criteria;</td><td>Section 7</td></tr>
<tr><td>(j) any consultation to be undertaken in relation to the monitoring programs; and</td><td>Section 3.2</td></tr>
<tr><td>(k) any specific requirements as required by Conditions C15 to C18, as relevant.</td><td>NA</td></tr>
<tr><td>C19</td><td>The Construction Monitoring Programs must be developed in consultation with the relevant government agencies as identified in Condition C13 of this approval, and must identify information, including monitoring parameters, requested by a relevant agency to be included in a monitoring program.</td><td>Section 3.2</td></tr>
</table>

CoA	Condition Requirements	Document Reference
C20	The Construction Monitoring Programs must be endorsed by the ER and then submitted to the Planning Secretary for approval at least one (1) month prior to the commencement of construction.	Section 3.4
C21	Construction, which is required to be monitored under the Construction Monitoring Programs, must not commence until the Planning Secretary has approved all of the required Construction Monitoring Programs and all relevant baseline data for the specific construction activity has been collected.	Section 2.1
C22	The Construction Monitoring Programs, as approved by the Planning Secretary and including any minor amendments approved by the ER, must be implemented for the duration of construction and for any longer period set out in the monitoring program or specified by the Planning Secretary, whichever is the greater.	Section 3.4
C23	The results of the Construction Monitoring Programs must be made publicly available in the form of a Construction Monitoring Report at the frequency identified in the relevant Construction Monitoring Program. Note: Where a relevant CEMP Sub-plan exists, the relevant Construction Monitoring Program may be incorporated into that CEMP Sub-plan.	Section 6

3. Environmental Requirements

3.1. Relevant standards and guidelines

All guidelines relevant to this monitoring program are listed in the BMS.

3.2. Consultation

This Program was prepared in consultation with NSW Environmental Protection Authority (EPA) in accordance with CoA C13(d). Table 2 outlines any issues raised by the EPA and the actions CGU undertook to address these matters.

Table 2 Consultation with Stakeholders

Relevant Public Authority	Date and type of engagement	Comments Raised	How Addressed	Outstanding Issues
EPA	30/05/2023 – submission of BMP to EPA 31/5/2023 – EPA email stating they are reviewing the document 31/5/2023 – email from EPA with draft licence conditions and references to BMP 1/06/2023 – email from EPA stating they have no comments on the BMP.	The EPA advised that the EPL will be updated to include conditions relating to blasting, blast monitoring and consultation, as well as referencing the Blast Monitoring Program once approved by DPE. EPA noted they have no comments on the Program.	NA	NA

3.2.1. Ongoing Consultation

The Communications Strategy (CS) outlines the methods by which the Project will engage with the community on an ongoing basis to effectively notify stakeholders and manage any feedback that is provided. The mechanisms and channels for notification identified within the CS will be followed for any blasting activities on the Project. Any community feedback and complaints relating to blasting activities will be managed in accordance with the CS and Complaints Management System. The latest version of the Communications Strategy is available on the Project website (https://caportal.com.au/rms/m6/approvals-and-eis).

Under the CS, CGU must develop an activity specific Communication and Stakeholder Plan with Transport for New South Wales. This short Plan ties together specific communication and

stakeholder strategies that will be implemented for blasting. This Plan may include but not limited to:

- Door knocks to sensitive receivers above the dyke where the activity will occur,
- Bespoke emails to sensitive receivers in vicinity of this activity,
- Notifications:
    - A description of the activity will be included in the Arncliffe construction and tunnelling monthly update (sent at the beginning of each month).
    - A detailed update on the specific activity in the appropriate tunnelling notification (sent between the monthly updates - around mid-month).
    - Direct notifications sent digitally via consultation manager.
    - A fact sheet explaining controlled blasting, including providing specific answers to: why we need to use it, when and where will be happening, what to expect and safety, will it damage my property and the purpose of property condition surveys.
    - The fact sheet will be linked to notifications and used during door knocks and communications to sensitive receivers.
- Project web-portal will be updated to include a blasting home page banner for stakeholders looking for information. This communication will include a link to the fact sheet.

In addition to this, CGU will undertake community notification requirements outlined in the Project Environmental Protection Licence 21600 (EPL).

3.3. Environment Protection Licence Monitoring Requirements

The Project holds an EPL (21600) granted by the NSW Environment Protection Authority (EPA) which has been updated to detail the management and monitoring requirements associated with blasting. The management and monitoring of blasting activities will be undertaken in accordance with this EPL.

3.4. Endorsements and Approvals

In accordance with CoA A31(d) the Project Acoustic Advisor (AA) must review all noise and vibration documents required to be prepared under the Project Approval and endorse as appropriate prior to submission to the Secretary. This document will be provided to the AA and endorsement obtained prior to submission to DPE, in accordance with this condition.

In accordance with CoA C20, this Monitoring Program will be endorsed by the Environmental Representative (ER) and then submitted to the Secretary for approval. Following DPE approval of this Monitoring Program any minor amendments will be lodged with the ER for approval and will be implemented for the duration of blasting activities.

Following endorsement from the AA and ER, this Program will be submitted to DPE for approval in accordance with CoA C20.

4. Baseline Data

Due to the nature of blasting, there is no baseline data available. The Australian Standard AS2187.2 2006 – Use of Explosives[2] formula will be used to design the trial blast using site specific criteria as detailed in the Blast Management Strategy (BMS).

4.1. Trial Blasting

Initial small scale trial blasting will be conducted prior to production blasting to determine site specific blast response characteristics and to define allowable blast sizes to meet airblast overpressure and ground vibration limits in the approval. The recorded trial blast data will be analysed to determine a relationship between vibration level, distance and explosive quantity.

The site trial will be a small heading blast designed to ensure compliance with the permissible 10mm/s vibration criterion. The trial blast will most likely involve shorter length (≈2 metres) single-hole explosive charges with the resulting vibration levels measured at multiple locations around the blast area. Should the measured data differ significantly from the expected values, the blast areas will be remodelled based upon the new site-specific relationship.

5. Monitoring

Blast monitoring will be undertaken in accordance with Australian Standard AS2187.2 recommendations and as required under the Project's EPL.

5.1. Parameters

The parameters to be monitored are outlined in Section 5.1.1 and 5.1.2 below. The table below contains the relevant target criteria for vibration and airblast.

Parameter	Target
Vibration – peak particle velocity	≤10mm/s
Airblast overpressure	≤120 dBL (Lin peak)

5.1.1. Vibration

The vibration monitoring system will consist of a series of individual monitors which will be positioned at key locations around the blast (refer to Section 5.3). Each vibration monitor will have a minimum of three recording channels.

An external geophone (transducer) will monitor and electronically record ground vibration in three directions (transverse, vertical and longitudinal particle velocities) and report the level in mm/s.

5.1.2. Airblast

For any blasting in the tunnel where overpressure may vent to the surface at elevated values, an external microphone will also measure the level of overpressure, reporting the data in units of dBL. The monitors will be configured with a vibration threshold trigger to record blast events which exceed a minimum value, typically around 0.3mm/s. The recording duration will be set to exceed the duration of the blast.

Blasting will take place over a kilometre away from the tunnel access point, located at Shed B within the C1 Arncliffe construction ancillary facility. Refer to Figure 1 and Figure 2. Due to the distance the airblast would have to travel to reach sensitive receivers, overpressure impacts are likely to be minimal.

Figure 1 Location of Shed B

Figure 2 Indicative distance from blasting area to Shed B

5.2. Frequency

Vibration monitoring will be conducted for each blast, or as otherwise indicated in the Project's EPL. Overpressure monitoring will be undertaken for the initial production blast to confirm impacts are below AS2187.2 2006 recommendations. Due to the minimal risk posed by overpressure, monitoring will discontinue after this.

5.3. Locations

5.3.1. Vibration

Vibration monitoring locations will be identified prior to each blast by CGU, in consultation with a blasting specialist and blasting contractor. This will ensure monitoring is conducted at the most representative and impacted sensitive receivers identified by the model. At a minimum, the monitoring locations will include:

- The nearest two sensitive sites, generally a property either side of the blast zone.
- If identified during the pre-blast discussions or the condition survey, any commercial property that contains potentially sensitive equipment, such as electronic or scientific apparatus or other equipment with tight tolerances for vibration impacts.
- Heritage properties identified during the modelling process that would require monitoring.

For all monitoring sites identified by the blast specialist or CGU environment team, access will be confirmed and arranged by the community relations team. Where access cannot be obtained, a suitable alternative property would be utilised.

A register of the specific monitoring locations will be provided to the EPA prior to blasting being undertaken. Where monitoring locations change, the register will be updated and provided to EPA prior to blasting taking place. Monitoring will be conducted with conditions outlined in the Project EPL.

The approximate blast areas are shown below in Figure 3.

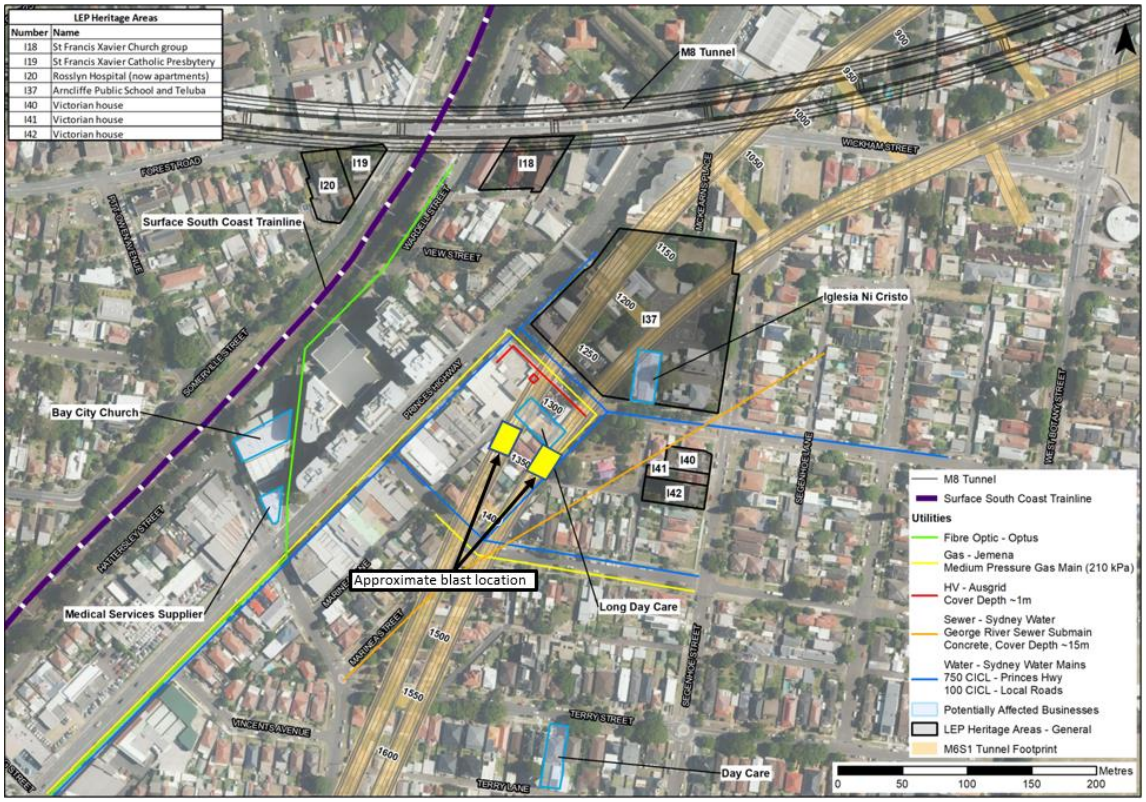

Figure 3 Blast location and adjacent infrastructure

5.3.2. Overpressure

Overpressure monitoring will be undertaken at the closest sensitive receiver to the temporary shaft (refer Figure 1 and Figure 2) for the first production blast.

6. Reporting

The blast monitoring results will be communicated to the blasting contractor after each blast for analysis. The results will enable the blasting contractor to optimise the design of subsequent blasts. In addition to any reporting required under the EPL conditions, in accordance with CoA C23, blast monitoring results will be summarised in a monthly report. The monthly report will include the following information:

- Approximate location of each blast, referenced by the tunnel and chainage.
- Specific monitoring locations for each blast.
- The serial numbers of the monitoring units to confirm the monitoring locations.
- Blast monitoring results and criteria outlined in the Project EPL.

Monitoring results will be reported through the EPL Monthly Report and made publicly available within 14 business days following the end of each reporting window. The report will also be issued for information to DPE via the Planning Portal.

7. Continual Improvement

Monitoring data will be analysed throughout the blasting campaign, to refine and improve future blasts. As outlined in Section 4.1, data will be analysed against the relevant criteria and the site-specific relationship between vibration level, distance, and explosive quantity.

Due to the implementation of a locale specific trial blast supervised by the blast specialist, along with the implementation of a conservative program and safety buffer, no exceedances are expected to occur. However, should the measured data exceed the target criteria the following will occur:

1. Blasting will cease.
2. The blasting specialist will review blast monitoring data to assess the cause of the exceedance and determine appropriate action. Several mitigation procedures are available and include:
    i. limiting the quantity of explosive by further reducing the length of the blasthole or the length of the explosive column.
    ii. introducing additional explosive columns within the blasthole (ie decking)
    iii. reducing the blasthole diameter
    iv. alternative explosive types, including both low density products and cartridge explosives.
3. DPE and EPA will be notified of any confirmed exceedances which will be managed in accordance with Section 3.8 and Appendix A7 of the CEMP.
4. The blast areas will be remodelled based upon the revised site-specific relationship. (refer to BMS for more information on the site-specific relationship).
5. Blasting activities will resume in accordance with the BMS, this Program and the Project EPL.

Continual improvement of this Program will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives and targets and Project performance outcomes of the EIS for the purpose of identifying opportunities for improvement.

The continual improvement process will be undertaken in accordance with Section 3.2 of the CEMP and the intention of this process is to:

- Identify areas of opportunity for improvement of environmental management and performance;
- Determine the cause or causes of non-conformances and deficiencies;
- Develop and implement a Program of corrective and preventative action to address any non-conformances and deficiencies;
- Verify the effectiveness of the corrective and preventative actions;
- Document any changes in procedures resulting from process improvement; and
- Make comparisons with objectives and targets.