



Noise and Vibration Management Plan

Googong Township IWC Project: Stage B Network

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1.0 Introduction

1.1 Context

This Noise and Vibration Management Plan (NVMP or Plan) forms part of the Construction Environmental Management Plan (CEMP) for the Googong Township IWC Project Stage B Network.

Refer to Section 1 and Section 2 of the CEMP for additional detail on the scope of Stage B Network to which this NVMP applies.

This NVMP has been prepared to address the requirements of the Minister's Conditions of Approval (CoA), the Statement of Commitments (SoC), the safeguards listed in the Googong Township water cycle project Environmental Assessment (EA), submissions report, and all applicable legislation.

1.2 Background

The Googong Township water cycle project EA assessed the potential noise and vibration impacts of construction and operation of the IWC Project.

As part of EA development, a detailed assessment was prepared to address the Director-General's Requirements issued by the **former** Department of Planning and Infrastructure (DP&I), **now known as the Department of Planning and Environment (DP&E)**. Noise and vibration was addressed in Section 13.4 and Appendix J of the EA.

The EA concluded that there were unlikely to be significant noise and vibration impacts associated with the construction and operation of the IWC Project, following the implementation of the proposed mitigation measures identified in the EA.

In March 2014, SLR Consulting undertook additional noise modelling of noise and vibration for construction activities associated specifically with Stage B Network and which has helped to inform this NVMP.

1.3 Environmental Management System overview

The overall Environmental Management System for Stage B Network and approach to managing environmental impacts during construction is described throughout the CEMP.

This NVMP is part of the environmental management framework for Stage B Network, as described in Section 1.6 of the CEMP. In accordance with CoA C20(d), this Plan has been developed in consultation with the Environment Protection Agency (EPA) (formerly the Office of Environment and Heritage) and Queanbeyan City Council (QCC).

2.0 Purpose and objectives

2.1 Purpose

The purpose of this Plan is to describe how GTPL and the contractor will manage noise and vibration impacts during construction of Stage B Network.

This Plan also assists in ensuring that the construction of Stage B Network meets the environmental objectives and targets as defined in Section 3.5 of the CEMP.

2.2 Objectives

The key objective of the NVMP is to ensure that construction noise and vibration impacts are minimised and that compliance with construction noise and vibration requirements is achieved. To realise these objectives, the following will be undertaken:

- Ensure appropriate controls and procedures are implemented during construction activities to avoid or minimise potential adverse noise and vibration impacts (refer Section 5.1).
- Ensure appropriate measures are implemented to address the relevant CoA and SoC, and the safeguards detailed in the EA and submissions report (refer Section 3.2 and Section 3.3).
- Ensure appropriate measures are implemented to comply with all relevant legislation and other requirements as described in Section 3.1 of this Plan.

3.0 Environmental requirements

3.1 Relevant legislation and guidelines

Section 3.1 of the CEMP identifies the legal and other requirements applicable to the IWC Project and the construction of Stage B Network. This section identifies the key legislation applicable to managing noise and vibration.

3.1.1 Legislative requirements

3.1.1.1 Environmental Planning and Assessment Act 1979 (EPA&A Act)

As outlined in Section 3.1 of the CEMP, the IWC Project has been assessed and approved by the Planning Assessment Commission under delegation from the Minister for Planning and Infrastructure under Part 3A (now repealed) of the EP&A Act.

3.1.1.2 Protection of the Environment Operations Act 1997 (POEO Act)

The POEO Act is the key piece of environment protection legislation, and is administered by EPA. The objective of the POEO Act is to protect restore and enhance the quality of the environment in NSW with a need to maintain ecologically sustainable development. To achieve this, the following tools are employed:

- Integrated environment protection licensing.
- Regulation of scheduled and non-scheduled activities.
- Environmental protection offences and penalties.
- Environmental protection notices.
- Establishment of a general duty to notify of environmental harm.
- Powers for authorised officers to investigate actual or potential pollution events.

Under Section 47 of the POEO Act, a Scheduled Development Environment Protection Licence (EPL) is required for construction of Stage B Network for construction works that will enable a scheduled activity (Sewage Treatment – as listed in Schedule 1 of the POEO Act).

GTPL has obtained an EPL (No. 20188) for construction activities and which outlines requirements for blasting and hours of operation. The conditions of the licence must be adhered to during the construction of Stage B Network (refer NV20).

3.1.2 Relevant guidelines

This NVMP has been prepared based upon the following documents:

- *Interim Construction Noise Guideline (ICNG)* (DECC, 2009).
- *Assessing vibration: A technical guideline* (DECC, 2006).
- Australian Standard AS 2436 *Guide to noise control on construction, maintenance and demolition sites* (AS 2436, 2010).
- British Standard BS 7385 *Evaluation and measurement for vibration in buildings Part 2* (BS 7385, 1993).
- *NSW Road Noise Policy* (DECCW, 2011)
- *Development Construction Specification C101 – General* (QCC, 2011).

- *Development Construction Specification C212 – Clearing and grubbing (QCC, 2011).*
- *Development Construction Specification C220 – Stormwater Drainage (QCC, 2011).*

3.2 Minister's Conditions of Approval

The CoA relevant to this Plan are listed in Table 1. A cross reference is also included to indicate where the condition is addressed in this Plan or other management documents.

Table 1 Conditions of Approval relevant to noise and vibration management

CoA No.	Condition requirements	Document reference
A8	The Proponent shall ensure that employees, contractor and sub-contractors are aware of, and comply with, the conditions of this approval relevant to their respective activities.	Table 11 (NV1) Section 6.2
C7	Subject to conditions C9 and C10, construction works that would generate audible noise at any sensitive receiver shall only be undertaken during the following hours: a) 7:00 am to 6:00 pm, Mondays to Fridays, inclusive; b) 8:00 am to 1:00 pm on Saturdays; and c) at no time on Sundays or public holidays. <i>Note: this condition does not apply in the event of a direction from police or other relevant authority for safety reasons.</i>	Table 11 (NV5)
C8	The hours of construction specified under condition C7 may be varied with the prior written approval of the Director-General. Any request to alter the hours of construction shall be: a) considered on a case-by-case basis; b) accompanied by details of the nature and need for activities to be conducted during the varied construction hours and any other information necessary to reasonably determine that activities undertaken during the varied construction hours will not adversely impact on the acoustic amenity of receptors in the vicinity of the site; and c) require that affected residential receivers are informed of the timing and duration of any construction activities approved under this condition at least 48 hours before that work commences.	Table 11 (NV7) Out of Hours Works Procedure (Appendix 1)
C9	Any work generating high noise that has impulsive, intermittent, low frequency or tonal characteristics, including jack hammering, line drilling, pile driving, rock hammering, rock breaking, saw cutting, sheet piling, vibratory rolling but excluding blasting, shall only be undertaken: a) between the hours of 8.00 am and 6.00 pm Monday to Friday; b) between the hours of 8.00 am and 1.00 pm Saturday; and c) in continuous blocks of no more than three hours, with at least one hour respite between each block of work generating high noise impact, where the location of the work is likely to impact the same receivers; except as otherwise approved by the Director-General. For the purposes of this condition "continuous" includes any period during which there is less than a one hour respite between ceasing and recommencing any of the work the subject of this condition.	Table 11 (NV6)
C10	Blasting associated with the construction of the project is only permitted during the following hours: a) 9.00 am to 5.00 pm, Mondays to Fridays, inclusive; b) 9.00 am to 1.00 pm on Saturdays; and c) at no time on Sundays or public holidays. Where compelling safety reasons exist, the Director-General may permit blasting outside of these hours on a case-by-case basis where any request is accompanied by details of the nature and need for blasting outside the approved hours and the measures to be implemented to minimise impacts.	Table 11 (NV8, NV9)

CoA No.	Condition requirements	Document reference											
C11	The Proponent shall implement all reasonable and feasible noise mitigation measures to minimise noise generated by construction of the project, consistent with the requirements of the Interim Construction Noise Guidelines (DECC, July 2009)	Table 11 (NV2, NV4, NV10, NV12, NV13, NV14, NV15, NV16, NV17, NV18, NV19)											
C12	<p>The Proponent shall ensure that blasting and vibration resulting from construction of the project does not cause exceedances of the criteria in Table C1.</p> <p>Table C1: Blast impact criteria</p> <table border="1"> <thead> <tr> <th>Location</th> <th>Airblast overpressure (dB(Lin Peak))</th> <th>Ground vibration (mm/s)</th> <th>Allowable exceedance</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Residence on privately-owned land</td> <td>120</td> <td>10</td> <td>0%</td> </tr> <tr> <td>115</td> <td>5</td> <td>5% of the total number of blasts over a period of 12 months</td> </tr> </tbody> </table>	Location	Airblast overpressure (dB(Lin Peak))	Ground vibration (mm/s)	Allowable exceedance	Residence on privately-owned land	120	10	0%	115	5	5% of the total number of blasts over a period of 12 months	Table 11 (NV9)
Location	Airblast overpressure (dB(Lin Peak))	Ground vibration (mm/s)	Allowable exceedance										
Residence on privately-owned land	120	10	0%										
	115	5	5% of the total number of blasts over a period of 12 months										
C13	At least two weeks prior to commencing blasting activities, the Proponent shall notify Council and potentially affected landowners, including details of time, location and frequency of the blasting and providing a contact point for inquiries and complaints.	Table 11 (NV9) Section 5.1.2 Community Engagement and Stakeholder Management Plan											
C20(d)	A Noise and Vibration Management Plan to identify measures to monitor and manage noise and vibration and to identify all feasible and reasonable noise and vibration mitigation measures. The Plan shall be developed in consultation with OEH and Queanbeyan City Council and include, but not necessarily be limited to:	This Plan Section 1.3											
	(i) the identification [of] all potentially affected sensitive receivers (such as future residents of the Googong township due to the undertaking of final works associated with the water recycling plant), and noise management levels;	Section 4.1.1											
	(ii) a review of the assumptions made in Appendix J of the EA to the final determined construction noise levels;	Section 4.3											
	(iii) details of the measures to avoid and/or mitigate the actual noise levels, including the noise mitigation measures identified under section 13.4.4 of the Environmental Assessment;	Table 11 (NV4, NV10, NV13, NV14, NV15, NV16, NV17, NV18, NV19)											
	(iv) an assessment, if blasting is proposed, to calculate the maximum instantaneous charge (MIC) able to be used in order to meet amenity-based ground vibration and overpressure criteria in condition C12;	Table 11 (NV9)											
	(v) details of the consultation process for noise mitigation measures with any affected sensitive receivers; and	Table 11 (NV2, NV3) Section 5.1.2 Community Engagement and Stakeholder Management Plan											
	(vi) details of noise monitoring to be undertaken to manage potentially elevated noise levels.	Table 11 (NV11, NV12)											

3.3 Statement of Commitments

The SoC relevant to this Plan are listed in Table 2. A cross reference is also included to indicate where the condition is addressed in this Plan or other management documents.

Table 2 Statement of Commitments relevant to construction noise and vibration

Objective	Ref. No.	Commitment	NVMP reference
Minimise impacts on human amenity as a result of construction hours.	C2	Construction work will generally be undertaken between the hours of 6.00am and 7.00pm Monday to Friday, and 8.00am to 1.00pm Saturdays. At all other times, construction noise levels will be as agreed with the relevant receiver(s).	Table 11 (NV5)
Minimise the noise impact associated with construction.	N1	<p>Construction noise and vibration management strategies will be outlined in the CEMP. Measures will include the overall construction times (refer to C2) as well as the following:</p> <ul style="list-style-type: none"> ▪ Construction noise goals. ▪ Liaising with community to advise on likely timing and duration of noisy activities. ▪ Procedures for resolving complaints received from residents and landowners and dealing with exceedances (including the appointment of a liaison person to maintain relationships between the community and the construction contractor in accordance with <i>AS 2436:1981 Guide to noise control on construction, maintenance and demolition sites</i>). ▪ Using noise abatement measures (physical and managerial) where reasonable and feasible. ▪ Procedures for liaising with the relevant agencies to discuss the need to construct outside of regular hours, for specific cases. 	<p>Section 4.1.3 Section 5.1.2 Table 11 (NV2, NV3, NV4, NV7, NV10, NV11, NV12, NV13, NV14, NV15, NV16, NV17, NV18, NV19) Out of Hours Works Procedure (Appendix 1) Community Engagement and Stakeholder Management Plan</p>
Assess the potential for vibration impacts should blasting be required.	N1A	Should blasting at the WRP or SPS sites be necessary based on geotechnical information and construction methodology, a construction vibration assessment will be undertaken in accordance with <i>Assessing Vibration: A Technical Guideline</i> (DECC, 2006) to determine any additional management measures required for blasting activities.	Table 11 (NV9).
Meet noise requirements near the WRP site boundary during operations.	N2	The acoustic treatments specified for the WRP components, as outlined in Appendix J, will be implemented and then reviewed for effectiveness following noise measurement verification.	N/A. The WRP does not form part of the Stage B Network Project, to which this NVMP relates.

4.0 Environmental aspects and impacts

The following sections summarise the existing noise environment and identify the sensitive noise and vibration receivers. Identified impacts are then reviewed. The key reference documents are Section 13.4 and Appendix J of the EA and the supplementary construction noise and vibration assessment undertaken for Stage B Network in March 2014.

4.1 Environmental aspects

4.1.1 Existing noise environment

The area surrounding the Stage B Network site largely comprises farming land. Ambient noise surveys were carried out in February 2009 to characterise and quantify the noise environment for the area surrounding the IWC Project. Noise levels at the representative receiver sites were found to be low due to the predominantly rural nature of the area, with identified sources of noise including birds, distant vehicles, aircraft and livestock.

Due to the low ambient background noise levels (in the range of 24-28 dBA), the IWC Project adopted a rating background level (RBL) L_{A90} of 30 dBA. This is consistent with the methodology described in the Industrial Noise Policy (INP) (EPA, 2000), whereby where the rating background level is found to be less than 30 dB(A), it is set to 30 dBA.

Since the EA the noise environment has changed with increased noise during standard hours sourced from construction activities for other stages of the IWC Project and the township. However a conservative approach has been adopted for the noise modelling of the construction of Stage B Network and has kept the RBL at 30 dBA.

The updated noise assessment also needed to consider the new residential receivers of Neighbourhood 1A (NH1A) as residents begin moving into the township. An indicative N1HA receiver (R14) was added to the model, located at the boundary of potentially occupied houses closest to the Stage B Network for a worst case scenario (refer Figure 1).

There are two commercial receivers (ranger station and ACTEW treatment plant) and 15 residential receivers that have been identified in the IWC Project area that have been considered in this assessment. The closest receiver (R11) is located about 170 metres from the northern end of the Stage B Network site.

Figure 1 identifies the sensitive noise and vibration receivers for the Stage B Network.

4.1.2 Existing traffic volumes

Traffic volumes were measured for the EA on Old Cooma Road and Googong Dam Road. In particular, traffic volumes along Googong Dam Road were estimated at 260 vehicles per day. Since then, traffic along Googong Dam Road has likely increased due to construction activities associated other stages of the IWC Project but is under 1,000 vehicles per day. Traffic volumes under 1,000 vehicles per day may be characterised as a series of discrete events rather than as a steady noise source.

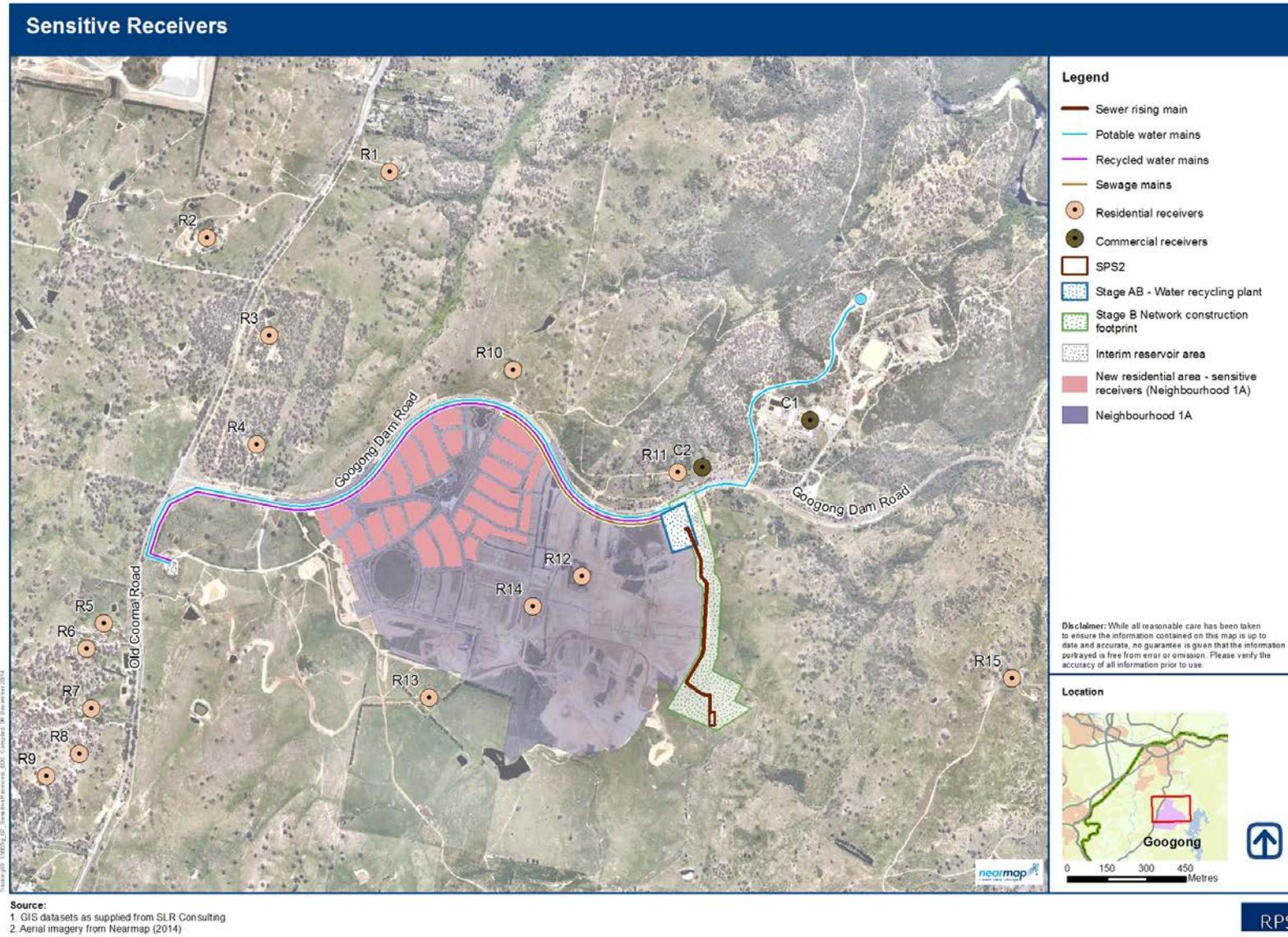


Figure 1 Sensitive receivers [updated construction footprint]

4.1.3 Construction noise criteria

Noise management levels for the construction of Stage B Network have been calculated using the methodology outlined in the ICNG and are provided in Table 3. They have been calculated using the RBL + 10 dB for standard hours.

The ICNG also prescribes a level which is referred to as 'highly noise affected' and is the point above where there may be strong community reaction to noise. This is set in the ICNG at 75 dBA. Also listed in the ICNG are noise management levels for commercial receivers. These levels are independent of the RBL and are standard across all construction sites.

Table 3 Stage B Network construction noise management levels (approved working hours)

Receiver type	Noise management level (dBA) $L_{Aeq}(15 \text{ min})$
Residential receiver – noise affected	40
Residential receiver – highly noise affected	75
Commercial receiver (industrial)	75
Commercial receiver (office)	70

4.1.4 Construction vibration criteria

4.1.4.1 Human response

Acceptable values for intermittent vibration in terms of vibration dose values (VDV) are provided in Table 4. These are based on *Assessing vibration: a technical guideline* (DECC, 2006).

Table 4 Acceptable intermittent vibration dose values ($m/s^{1.75}$)

Location	Daytime ¹ preferred	Maximum
Residences	0.20	0.40
Offices, schools, educational institutes and places of worship	0.40	0.80

1. Daytime is 7.00 am to 10.00 pm.

4.1.4.2 Building response

British Standard BS 7385 Evaluation and measurement for vibration in buildings Part 2 (BS 7385, 1993) provides criteria against which the likelihood of building damage from ground vibration can be assessed. Table 5 provides the building damage vibration criteria for the construction of Stage B Network. The values are based on a conservative value to achieve a minimal risk of cosmetic damage.

Table 5 Transient vibration guide values

Building type	Peak component particle velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
Unreinforced or light framed structures – residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

4.1.5 Blasting criteria

The *Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration* (ANZECC, 1990) are used to assess potential blast emissions impacts at residential and other noise and vibration receivers. Blast impact criteria for PPV and airblast overpressure are provided in Table 6 as required by CoA C12.

Table 6 Blast impact criteria as per CoA C12

Location	Airblast overpressure (dB(Lin Peak))	Ground vibration (mm/s)	Allowable exceedance
Residence on privately-owned land	120	10	0%
	115	5	5% of the total number of blasts over a period of 12 months

4.1.6 Road traffic noise criteria

The NSW Road Noise Policy (DECCW, 2011) presents guidelines for road traffic noise assessment. The policy document provides road traffic noise criteria for proposed road, residential and industrial developments that are provided in Table 7.

Table 7 Road traffic noise assessment criteria for residential land uses

Road category	Type of project	Assessment criteria dBA	
		Day (7am to 10pm)	Night (10pm to 7am)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use development	L _{Aeq(1hour)} 55 dBA (external)	L _{Aeq(1hour)} 50 dBA (external)

4.2 Construction activities

Key aspects of the construction of Stage B Network that could result in adverse construction noise and vibration impacts on sensitive receivers include:

- Formation of access road.
- Installation of temporary power and water.
- Site mobilisation.
- Earthworks.
- Concrete works.
- Storage installation.
- Mechanical installation.
- Electrical installation.
- Telemetry installation.
- Commissioning.
- Permanent site access.
- Demobilisation and rehabilitation.
- Blasting **will be required at the SPS 2**

Guideline ACT shall prepare and implement a Blast Management Plan for the project to the satisfaction of the GTPL and QCC. This plan will consist:

1. be prepared in consultation with QCC and GTPL;
2. be submitted to the GTPL for approval;
3. The plan will describe the mitigation measures that would be implemented to ensure compliance with the relevant conditions of this approval;
4. The plan will describe the measures that would be implemented to ensure that the public can get up-to-date information on the proposed blasting schedule on site.
5. Plan will include a blast monitoring program for evaluating the performance of the project, including:
6. Compliance with the applicable criteria; and minimising the environmental effect and constraints on the project.

7. A risk assessments for blasting will be undertaken identifying key blast hazards, risk ranking (existing controls), and the existing controls and proposed additional management actions to be implemented further mitigate potential blast impacts

Plant and equipment required to construct the Stage B Network are identified in Table 8.

4.3 Noise and vibration impacts

4.3.1 Construction noise impacts

The construction noise assessment for the Stage B Network was undertaken using noise modelling software (SoundPLAN v7.1) which takes into account the topographic information, the receiver locations, an estimate of the type/quantity of machinery and equipment and their sound levels that are proposed for the various stages (refer Table 8).

The model is used to predict a noise level (measured in dBA) at each receiver location, which is compared to the noise management level for that receiver type (refer Figure 1 for receiver locations). Exceedances of the noise management levels indicate where noise is likely to be an issue and where mitigation measures may need to be applied.

The modelling for the construction of Stage B Network has been undertaken for a worse case scenario (i.e. it assumes all construction equipment will be operated simultaneously for each stage). The results of the noise modelling for Stage B Network construction works are displayed in Table 9.

Table 8 Plant and equipment associated with each activity used in the noise model

Activity	Plant and equipment	Sound power levels (dBA)
Formation of access road	Grader	118
	Excavator	112
Installation of temporary power and water	Ditch witch	120
Site mobilisation	Semi-trailers (trucks) x 2	109
	Power hand tools x 4	106
	Excavator	112
Earthworks	Grader	118
	Semi-trailers (trucks) x 2	109
	Compactor	116
	Water cart	109
	Excavator with pneumatic rock breaker attachment	127
	Bulldozer	120
	Front end loader	109
Concrete works	Standard concrete truck	115
	Truck mounted concrete pump x 2	120
	Power hand tools	118
Storage installation	Standard concrete truck x 2	115
	Truck mounted concrete pump	120
	Semi-trailers (trucks) x 2	109
	20T Franna crane	115
Mechanical installation	Semi-trailers (trucks) x 2	109
	Power hand tools	118
	20T Franna crane	115
Electrical installation	Semi-trailers (trucks) x 2	109

Activity	Plant and equipment	Sound power levels (dBA)
	Power hand tools	118
Telemetry installation	Power hand tools	118
Commissioning	Testing equipment Water cart	109
Permanent site access	Grader	118
	Semi-trailers (trucks)	109
	Vibrating roller	116
	Road sealing truck	106
Site demobilisation and rehabilitation	Excavator	112
	20T Franna crane	115
	Power hand tools	118
	Semi-trailers (trucks) x 2	109
	4WD x 6	105

Table 9 Predicted activity-specific construction noise impacts (predicted LAeq(15 min) construction noise levels (dBA))

Receiver	Formation of access road	Installation of temporary water and power	Site mobilisation	Earth works	Concrete works	Storage installation	Mechanical installation	Electrical installation	Telemetry installation	Commissioning	Permanent site access	Demobilisation and rehabilitation
R1	36	34	31	46	38	37	34	33	32	<30	38	36
R2	34	33	30	44	37	36	33	32	31	<30	36	35
R3	34	34	31	44	38	37	34	33	32	<30	36	36
R4	36	35	32	46	39	38	35	34	33	<30	38	37
R5	34	32	<30	44	36	35	32	31	30	<30	36	34
R6	34	32	<30	44	36	35	32	31	30	<30	36	34
R7	34	32	<30	44	36	35	32	31	30	<30	36	34
R8	32	33	30	42	37	36	33	32	31	<30	34	35
R9	32	32	<30	42	36	35	32	31	30	<30	34	34
R10	36	32	<30	46	36	35	32	31	30	<30	38	34
R11	49	39	36	59	43	42	39	38	37	<30	51	41
R12	52	47	44	62	51	50	47	46	45	36	54	49
R13	42	41	38	52	45	44	41	40	39	30	44	43
R14	49	46	43	59	50	49	46	45	44	35	51	48
R15	39	36	33	49	40	39	36	35	34	<30	41	38
C1	39	31	<30	49	35	34	31	30	<30	<30	41	33
C2	49	40	37	59	44	43	40	39	38	29	51	42

Exceedances of the noise management noise levels are shaded and marked in **bold** in Table 9. As can be seen, construction noise management levels are likely to be exceeded at some sensitive receivers for a worse case scenario, however there would not be any exceedances of the highly noise affected level of 75 dBA.

It can also be noted from the modelling that receivers R11, R12, R13 and R14 (indicative NH1A receiver) and R15 are likely to be the most affected. The modelling also shows that the key stage for potential noise impacts is bulk earth works, which is likely to extend for a period of about four weeks. The noise impacts for the other stages of construction are likely to be less than for earthworks.

A range of noise management measures to minimise noise impacts are outlined in Table 11. These management measures are to be implemented where feasible and reasonable. Management measures and work practices include limiting use of reversing alarms, switching off plant and equipment when not in use and ensuring work occurs within approved working hours.

4.3.2 Construction traffic noise impacts

During the worst-case scenario during construction for traffic generation (ie during the concrete pouring for the wet well), it is predicted that up to 10 truck movements per day will travel along Googong Dam Road. However, this is only applicable during the foundation works when concrete pours occur (ie approximately eight weeks). As existing traffic volumes along Googong Dam Road are not significant, in combination with light vehicles/utility vehicles driven by construction workers and personnel, this additional construction-related traffic has the potential of causing noise disturbance.

The closest sensitive receiver to Googong Dam Road is R11 at approximately 75 metres from the road verge. Based on the likely hourly peak flows, the $L_{Aeq(1 \text{ hour})}$ noise level is predicted to be 53 dBA. This is below the daytime criterion of 55 dBA (refer Table 7). Road traffic noise at all the other receivers is, therefore, also predicted to be within the daytime criterion.

4.3.3 Construction vibration impacts

4.3.3.1 Human response

The major vibration generating activities will occur during site preparation (earthworks) and construction of Stage B Network, resulting from heavy vehicle movement, and the use of vibratory rollers and rock breakers. It is also likely that blasting will be required, and the potential vibration impacts associated with blasting will be considered in a separate Blast Management Plan to be prepared (refer Table 11, NV9).

Due to the distance of vibration causing activities and sensitive receivers (all identified sensitive receivers are located at least 50 metres from vibratory activities), the level of vibration will be below the level of human perception. For example a large vibratory roller would generate a vibration level of <0.1 mm/s (PPV) at a distance of 200 metres and the criterion for daytime residential receivers is 0.2 mm/s.

4.3.3.2 Building response

Due to the separation of buildings from the works (the closest building is about 75 metres from vibratory activities), vibration due to vibratory rollers, truck traffic and rock breaking is likely to be below the criterion for 'minimal risk of cosmetic damage'.

The details of any blasting will be confirmed upon completion of additional geotechnical investigations and detailed design. The contractor will then be responsible for preparing and implementing a Blast Management Plan. The Blast Management Plan will identify the maximum instantaneous charge (MIC) possible to ensure that vibration levels do not exceed the criteria listed in Table 5 and Table 6.

4.3.4 Cumulative noise and vibration impacts

GTPL and its contractors will be carrying out other construction work packages adjacent to the Stage B Network over a similar time period. The proposed Stage B Network construction works are expected to occur concurrently with the following construction stages for other Googong development components:

- WRP:
 - Below ground civil works (installation of yard pipework).
 - Structural works (installation of concrete structures).
- Earth works for Googong Township neighbourhood Stages 4A, 4B, 5A and 6A.

4.3.4.1 WRP construction works

The noise assessment concluded that construction activities at the WRP are likely to dominate the general noise impact potentially experienced at the assessed sensitive receivers. The only exception is the Stage B Network earth works where the impact is similar. The predicted cumulative noise impact of the “Below ground civil works” of the WRP and the Stage B Network earth works are presented in Table 10.

Table 10 indicates that the predicted cumulative noise impact continues to exceed the “Noise Affected” noise management level (NML) of 40 dBA at each receiver; but that the noise levels are predicted to be below the “Highly Noise Affected” NML target of 75 dBA.

Table 10 Potential cumulative noise LAeq(15 min) construction noise levels (dBA)

R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
47	46	47	47	46	45	45	44	43	48	68	62	53	62	51

4.3.4.2 Bulk earth works for Googong neighbourhood

Bulk earth works are typically the one of the noisiest construction stages. Due to closer proximity to the sensitive receivers in general, the bulk earth works for Googong Township neighbourhood Stages 4A, 4B, 5A and 6A are likely to dominate the overall noise impact experienced at the sensitive receivers should there be any overlap.

All of these construction activities are likely to be similar to construction events that have already occurred in and around the project area during earlier stages of the entire project.

Each work package will be managed through a separate CEMP. GTPL, as the Proponent of each package of work, will ensure that the separate projects liaise with one another to ensure that high noise generating activities (such as blasting) are scheduled alternately to minimise cumulative construction noise impacts at sensitive receivers as far is as practical (refer to Table 11, NV19).

5.0 Environmental control measures

5.1 Noise and vibration mitigation and management measures

A range of environmental requirements and control measures are identified in the various environmental documents, including the CoA, SoC and the EA. Specific measures and requirements to address noise and vibration impacts are outlined in Table 11. Responsibilities have been assigned to roles that GTPL considers will be required by the contractor. However the contractor will be responsible for confirming roles prior to the commencement of construction.

Table 11 Noise and vibration mitigation measures

ID	Measure	When to implement	Reference	Responsibility
NV1	All project personnel will be provided training on the requirements of this Plan through site inductions, toolbox talks or specific training.	Prior to construction, construction	CoA A8	Environment Manager Project Engineer
NV2	<p>Consultation will be undertaken in accordance with the communication tools outlined in the Community Engagement and Stakeholder Engagement Plan in particular Appendix A - Community Information Plan. The following will be implemented by the contractor at a minimum:</p> <ul style="list-style-type: none"> The contractor is responsible for consultation with nearby receivers and new incoming residents that may be affected by noise or vibration generating activities during standard construction hours prior to that activity commencing (including noisy construction activities, and other activities that may result in noise and/or vibration complaints). The notification should take the form of a written letter and must be issued two weeks prior to the works occurring. The notification letter provided to the community must include a description of the works, advise if exceedances of ICNG criteria are likely, when the works will occur and for how long. It will also include the community information line (1800 838 438), project email address (iwc@googong.net) for lodging noise complaints. The contractor will issue a copy of the notification letter for GTPL to review prior to it being distributed. The contractor will also provide details of all notification to GTPL as well as two points of contact for the works in case complaints are made to the community hotline number. 	Prior to construction, construction	CoA C11 CoA C20(d)(v) SoC N1	Construction Manager Environment Manager Project Engineer
NV3	<p>Noise complaints will be received, recorded and investigated in accordance with the Complaints Management Procedure, which is included as Appendix B to the Community Engagement and Stakeholder Management Plan.</p> <p>The Environment Manger will forward any complaints to GTPL who will respond within the timeframes specified in the Complaints Management Procedure.</p> <p>As per Condition of Approval A17, the initial response to complaints should be made within 48 hours of the complaint and need to be recorded in the Project consultation manager database.</p>	Construction	CoA C20(d)(v) SoC N1	Construction Manager Environment Manager Project Engineer GTPL Assistant Project Director

ID	Measure	When to implement	Reference	Responsibility
NV4	<p>Where construction noise impacts on sensitive receivers significantly exceed the noise criteria outlined in Table 3 the Environment Manager and Construction Manager will consider the following mitigation measures to reduce noise (and in consultation with GTPL if required):</p> <ul style="list-style-type: none"> Physical noise controls (e.g. temporary noise screens). Noise impact management strategies (e.g. implementation of respite periods or other). <p>The decision to implement mitigation measures should be based on consideration of the following factors:</p> <ul style="list-style-type: none"> Duration of noise-generating activity. Severity of noise impacts. Cost considerations. Feasibility of implementing proposed mitigation measures. Impacts to construction schedule. 	Construction	CoA C11 C20(d)(iii) CoA C20(d)(v) SoC N1	<p>Construction Manager</p> <p>Environment Manager</p> <p>Project Engineer</p>
NV5	<p>Construction works, other than blasting and high noise activities, will only be undertaken during the following hours (unless otherwise approved by the Director-General (DP&E)):</p> <ul style="list-style-type: none"> 7:00 am to 6:00 pm, Mondays to Fridays. 8:00 am to 1:00 pm on Saturdays. At no time on Sundays or public holidays. 	Construction	CoA C7 SoC C2	<p>Construction Manager</p> <p>Environment Manager</p> <p>Project Engineer</p>
NV6	<p>Any work generating high noise that has impulsive, intermittent, low frequency or tonal characteristics, including jack hammering, line drilling, pile driving, rock hammering, rock breaking, saw cutting, sheet piling, vibratory rolling but excluding blasting, will be undertaken (unless otherwise approved by the Director-General (DP&E)):</p> <ul style="list-style-type: none"> Between the hours of 8.00 am and 6.00 pm Monday to Friday. Between the hours of 8.00 am and 1.00 pm Saturday. In continuous blocks of no more than three hours, with at least one hour respite between each block of work generating high noise impact, where the location of the work is likely to impact the same receivers. 	Construction	CoA C9	<p>Construction Manager</p> <p>Environment Manager</p> <p>Project Engineer</p>
NV7	<p>In accordance with the Out of Hours Works Procedure (Appendix 1) the hours of construction activities specified in NV5 may only be varied with prior written approval from the EPA and the Director-General of DP&E.</p> <ul style="list-style-type: none"> Requests for out of hours approval will be considered for construction activities which cannot be undertaken during standard construction hours for technical or other justifiable reasons and will be considered on a case by case or activity-specific basis. Any request to alter the hours of construction will: Be accompanied by details of the nature, need and justification for activities conducted during the varied construction hours. Include any other information necessary to reasonably determine that activities undertaken during the varied construction hours will not adversely impact sensitive receivers. 	Construction	CoA C8 SoC N1	<p>Construction Manager</p> <p>Environment Manager</p> <p>Project Engineer</p>

ID	Measure	When to implement	Reference	Responsibility
	<ul style="list-style-type: none"> Require that affected residential receivers are informed of the timing and duration of any construction activities approved under this condition at least 48 hours before that work commences. 			
NV8	<p>Blasting associated with the construction of Stage B Network will only occur during the following hours (unless otherwise approved by the Director-General (DP&E!)):</p> <ul style="list-style-type: none"> 9.00 am to 5.00 pm, Mondays to Fridays, inclusive. 9.00 am to 1.00 pm on Saturdays. At no time on Sundays or public holidays. 	Construction	CoA C10	<p>Construction Manager</p> <p>Environment Manager</p> <p>Project Engineer</p>
NV9	<p>The contractor will prepare a Blast Management Plan for any blasting activities. The Blast Management Plan will:</p> <ul style="list-style-type: none"> Undertake a vibration assessment in accordance with Assessing Vibration: A Technical Guideline (DECC, 2006) to determine if any additional mitigation measures are required. Stipulate permitted blasting hours as per CoA C10. Identify the maximum instantaneous charge (MIC) possible to ensure that vibration levels do not exceed the criteria in Table 5 and Table 6. Include procedures for notification. The notification at a minimum should take the form of a written letter and must be issued to council, emergency services and potentially affected landowners <u>two weeks</u> prior to the works occurring. The notification letter must include the time, location and frequency of the blasting. It must also include the community information line (1800 838 438), project email address (iwc@googong.net) for lodging complaints. The contractor will issue a copy of the notification letter for GTPL to review prior to it being distributed. The contractor will provide details of all notification to GTPL as well as two points of contact for the works in case complaints are made to the community hotline number. 	Construction	<p>CoA C10</p> <p>CoA C12</p> <p>CoA C13</p> <p>CoA C20(d)(iv)</p> <p>SoC N1A</p>	<p>Construction Manager</p> <p>Environment Manager</p> <p>Project Engineer</p>
NV10	Noise mitigation and management measures will be installed or implemented prior to relevant works commencing to reduce impact/nuisance to surrounding sensitive receivers.	Prior to construction, construction	<p>CoA C11</p> <p>CoA C20(d)(iii)</p> <p>SoC N1</p>	<p>Construction Manager</p> <p>Environment Manager</p> <p>Project Engineer</p>
NV11	Noise monitoring at sensitive receivers will be carried out in the event of a noise related complaint. Should monitoring indicate significant exceedances of the construction noise impacts identified in Table 4.9 the contractor will consult with GTPL, the acoustic engineer and the Environmental Representative and implement additional and feasible mitigation measures as necessary.	Construction	<p>CoA C20(d)(vi)</p> <p>SoC N1</p>	<p>Construction Manager</p> <p>Environment Manager</p> <p>Project Engineer</p> <p>GTPL Assistant</p> <p>Project Director</p>
NV12	Vibration monitoring may be carried out in response to complaints, exceedances, or for the purpose of refining construction methods or techniques to minimise vibrations. Impacts will be avoided by changing work methods	Construction	CoA C11	<p>Construction</p>

ID	Measure	When to implement	Reference	Responsibility
	/ equipment, or by providing some form of building protection where possible.		CoA C20(d)(vi) SoC N1	Manager Environment Manager Project Engineer GTPL Assistant Project Director
NV13	Where reasonable and feasible: <ul style="list-style-type: none"> Site sheds, materials and stockpiles will be located to provide acoustic shielding. Temporary noise barriers and/or hoardings will be installed around construction sites and site compounds. 	Construction	CoA C11 CoA C20(d)(iii) SoC N1	Construction Manager Environment Manager Project Engineer
NV14	Compounds will be designed to promote one way traffic so that the requirement for vehicles to reverse is minimised, and noise from reversing alarms is minimised.	Pre-construction, construction	CoA C11 CoA C20(d)(iii) SoC N1	Construction Manager Environment Manager Project Engineer
NV15	Machines that are used intermittently such as dump trucks, rollers, bulldozers, excavators, bobcats, mulchers etc will be shut down when not operated for more than 15 minutes.	Construction	CoA C11 CoA C20(d)(iii) SoC N1	Construction Manager Environment Manager Project Engineer
NV16	All plant and equipment will be well maintained and fitted with adequately maintained silencers, will have engine covers fitted and be maintained in good order.	Construction	CoA C11 CoA C20(d)(iii) SoC N1	Construction Manager Environment Manager Project Engineer
NV17	Plant or machinery will not be permitted to 'warm-up' before nominated working hours.	Construction	CoA C11 CoA C20(d)(iii) SoC N1	Construction Manager Environment Manager Project Engineer
NV18	Reversing of vehicles and equipment, and use of horns will be minimised to prevent noise emissions to nearby sensitive receivers.	Construction	CoA C11 CoA C20(d)(iii) SoC N1	Construction Manager Environment Manager

ID	Measure	When to implement	Reference	Responsibility
				Project Engineer
NV19	GTPL will oversee the scheduling of high noise work for Stage B Network, with other IWC Project or Googong Township subdivision works. Cumulative noise impacts will be minimised as far as practical.	Pre-construction, construction	CoA C11 CoA C20(d)(iii) SoC N1	GTPL Assistant Project Director
NV20	The contractor will adhere to and implement the conditions of any Environment Protection Licences (EPLs) held for the IWC Project. The EPL will be available for inspection by all personnel and will be kept on site at all times. The EPL will be produced to any authorised officer of the EPA who asks to see it.	Construction	CoA A7	Construction Manager Environment Manager Project Engineer

5.1.2 Noise and vibration consultation

Community consultation requirements are outlined in the Community Engagement and Stakeholder Management Plan that includes a Community Information Plan developed to meet CoA A14. The Plan identifies the process and tools to liaise with the community to advise them of likely timing and duration of construction activities, including noisy activities.

The Community Engagement and Stakeholder Management Plan also includes a Complaints Management Procedure, which outlines the process for managing, resolving and recording complaints. Any noise or vibration specific complaints will be managed in accordance with this procedure, and with mitigation measures NV3, NV11 and NV12 in Table 11 above.

The Out of Hours Works Procedure included at Appendix 1 of this Plan outlines the process for liaising with relevant agencies to discuss the need to undertake construction activities out of hours. This may include consultation with QCC, OEHL, EPA and DP&E.

6.0 Compliance management

6.1 Roles and responsibilities

The project team's roles and responsibilities are outlined in Section 4.1 of the CEMP. Specific responsibilities for the implementation of environmental controls are detailed in Section 5 of this Plan.

6.2 Training

All personnel working on site will undergo site induction training relating to noise and vibration issues. The induction training will address elements related to noise and vibration management including:

- Normal work hours.
- What activities can and can't take place outside of these working hours.
- The process for seeking approval for out of hours works, including consultation.
- Location of noise sensitive areas.
- The employment of reasonable and feasible noise mitigation measures.
- Roles and responsibilities of the project team related to noise and vibration.

Further details regarding induction and training are outlined in Section 5 of the CEMP.

6.3 Inspections

The Environment Representative will inspect the site regularly to inspect the complaints register and how noise complaints have been addressed.

Requirements and responsibilities in relation to inspections are documented in Section 8.1 of the CEMP.

6.4 Monitoring

6.4.1 Noise monitoring

Noise monitoring will be undertaken should noise complaints be received (refer Table 11, NV11). Noise monitoring will be undertaken at sensitive receivers to determine if the actual construction noise generated exceeds the predicted 'worst case' construction noise management levels identified in Section 4.3 of this Plan.

Where noise levels are found to exceed the predicted worst-case levels, the source of excessive noise will be identified, and any additional feasible and reasonable measures available will be implemented to either reduce noise emissions or reduce the impacts on receivers.

6.4.2 Vibration monitoring

Vibration monitoring may be carried out in response to complaints, exceedances, or for the purpose of refining construction methods or techniques to minimise vibrations (refer to Table 11 NV12).

A Blast Management Plan will be prepared upon completion of geotechnical investigations and detailed design (refer to Table 11, NV9). This Plan will include specific vibration monitoring relating to blasting.

6.5 Auditing

Audits (both internal and external) will be undertaken to assess the effectiveness of environmental controls, compliance with this Plan, CoA and other relevant approvals, licenses and guidelines.

Audit requirements are detailed in Section 8.4 of the CEMP.

6.6 Reporting

Results and outcomes of inspections, monitoring and auditing will be reported internally on a monthly basis. Six-monthly construction compliance reports will be prepared to report on compliance with the IWC Project Approval. Reporting requirements and responsibilities are documented in Section 8.5 of the CEMP.

7.0 Review and improvement

7.1 Non-conformity, corrective and preventative actions

A non-conformance is an action or omission that does not confirm with the requirements of this NVWMP or any legal and other requirements. Any member of the project team or the Environment Representative can identify a non-conformance or opportunity for improvement. Section 8.3 of the CEMP identifies the process for identifying, reporting, recording and reviewing non-conformances. This will ensure continual improvement.

7.2 Management plan update and amendment

The processes described in Section 7 and Section 8 of the CEMP (relating to incidents, inspections, monitoring and auditing) may result in the need to update or revise this Plan. This will occur as needed.

Appendix I

Out of Hours Works Procedure

Distribution

There are no restrictions on the distribution or circulation of this procedure within the Googong IWC Project Stage B Network.

Purpose

This procedure details the process for conducting works outside of the approved hours for construction activities as required by the relevant EPL, Condition of Approval (CoA) C8 and Statement of Commitment (SoC) N1.

Induction/training

Where required, project personnel will be made aware of this procedure as required through toolbox talks.

Scope

This procedure is applicable to any proposed out of hours construction activities conducted by the contractor or sub-contractors. Standard construction hours, other than for blasting and high noise activities, are:

- 7:00 am to 6:00 pm, Mondays to Fridays.
- 8:00 am to 1:00 pm on Saturdays.
- At no time on Sundays or public holidays.

This procedure does not apply where:

- The delivery of materials is required by police or other authorities for safety reasons.
- The work is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm.

Procedure for inaudible out of hours work

Subject to approval by the Environment Manager, work can proceed out of standard construction hours where:

- The works do not cause construction noise to be audible at any sensitive receiver.
- A request to the Environment Manager to conduct inaudible works should be accompanied by:
 - Details of the nature and justification for activities to be conducted during the varied construction hours.
 - A qualitative noise impact assessment of predicted noise impacts at sensitive receivers.
 - Details of any proposed noise monitoring during the out of hours work.
 - Details of notification to sensitive receivers.

Complaints

Any complaints received as a result of the nominated inaudible out of hours works are to be managed in accordance with the Complaints Management Procedure, which is an appendix to the Community Engagement and Stakeholder Management Plan. Details of noise complaints will be managed as a Category two incident as per Section 7.2 of the Construction Environmental Management Plan (CEMP).

Procedure for audible out of hours work

Out of hours noise assessment

Where (audible) out of hours work is proposed, an out of hours work (OOHW) assessment will be prepared by the Environment Manager in consultation with GTPL. As part of the preparation of the OOHW assessment, the Environment Manager and GTPL will consult with the Environmental Representative and the EPA (refer below for details on consultation requirements).

The OOHW assessment will include:

- Details of the nature and justification for activities to be conducted during the varied construction hours.
- A noise impact assessment of predicted noise levels at each sensitive receiver.
- Details of any additional proposed noise monitoring.
- Evidence that appropriate consultation has been undertaken.
- Evidence that all reasonable and feasible noise mitigation measures have been put in place.

Environment Protection Authority

The Environment Manager and GTPL will consult with EPA on the proposed variation in construction times. Consultation will include but not be limited to details on predicted noise impacts at sensitive receivers and reasonable and feasible noise mitigation measures that the contractor will put in place to limit impacts.

Note that the conditions of EPL 20188 held by GTPL for construction and testing activities does not permit construction work outside standard working hours. As part of any OOHW application, GTPL may also need to also submit an application to amend its EPL to allow for changes to the licence conditions to allow for construction works outside standard hours. This would be confirmed with the EPA during consultation.

Consideration of community impacts

The contractor will review the proposed work program and where reasonable and feasible prescribe mitigation measures to minimise impacts to the community.

DP&E and EPA approval

GTPL would submit the OOHW assessment to the EPA and Department of Planning and **Environment Infrastructure** (DP&E) for approval. Such an approval would also likely require an amendment to construction EPL (20188) GTPL would be responsible for submitting a variation to the construction EPL, as advised by the EPA.

Issue of notification to the community

Once approved by DP&E and EPA, the contractor will issue a letterbox notification to affected properties at least 48 hours prior to the commencement of the proposed out of hours works, advising of the start date and expected duration of the out of hours activities (in accordance with Condition of Approval C8). The notification must also include details of the community information line (1800 838 438), project email address (iwc@googong.net) for lodging complaints.

Where the activity is deemed as having a significant affect on sensitive receivers, doorknocking and/or distribution of individual letters to affected properties should also be undertaken at least 48 hours in advance of the proposed works.

Works approval

Following completion of the appropriate community notifications, as confirmed by the Environment Manager and details provided to GTPL, the work as described in the OOHW assessment and approved by the Director-General DP&E+ can proceed out of standard construction hours.

Complaints

Any complaints received as a result of the works are to be managed in accordance with the Complaints Management Procedure, which is an appendix of the Community Engagement and Stakeholder Management Plan.