

Coffs Harbour Bypass – Early works

Acoustic Advisor Monthly Report

December 2022

Doc no. 21001-NV-RP-23-0

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Distribution List

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Mick Browne	Transport for NSW
Simon Williams	Environmental Representative
Duncan Thomson	Environmental Representative
Nick Ballard	NSW Department of Planning, Industry and Environment
Hari Corliss	FGJV
CHB Project email	Transport for NSW

Glossary of terms and abbreviation

AA	Independent Acoustic Advisor approved by DPIE
CBAG	Coffs Bypass Action Group
CCC	Community Consultation Committee
CEMP	Construction Environmental Management Plan
CNVMP	Construction Noise and Vibration Management Plan
CoA	Conditions of Approval
CSSI	Critical State Significant Infrastructure
DPE	Department of Planning and Environment
Early works	Works not defined as construction under the CoA
EIS	Environmental Impact Statement
ER	Independent Environmental Representative approved by DPIE
EMS	Environmental Management System
EPA	NSW Environment Protection Authority
EPL	NSW Environment Protection Licence
FGJV	Ferrovial Gamuda Joint Venture (the Contractor)
Incidents	As defined in the Conditions of Approval
OEH	Office of Environment and Heritage
(the) Project	Coffs Harbour Bypass
Proponent	Transport for NSW
Secretary	Secretary of DPIE
SPIR	Submissions and preferred infrastructure report
SSI	State Significant Infrastructure

1. Introduction

1.1 Background

Transport for NSW is the Proponent for the Coffs Harbour Bypass (the Project).

The Project is Critical State Significant Infrastructure (CSSI) and was approved by the NSW Minister for Planning in 2020 (SSI 7666) following preparation of the Environmental Impact Statement (EIS) in 2017 and of a Submissions and Preferred Infrastructure Report (SPIR) by Transport for NSW in response to submissions from government, agencies, organisations and the public.

Transport for NSW is progressing with early works for the project, defined in the Conditions of Approval (CoA) as low impact work, which is completed prior to approval of the Construction Environmental Management Plan (CEMP).

This Acoustic Advisor monthly report relates to the early works.

1.2 Acoustic Advisor

In accordance with CoA A28 of Approval SSI 7666, an independent, suitably qualified and experienced Acoustic Advisor (AA) was engaged for the duration of the Project. John Hutchison was approved in the AA role by the delegate to the Secretary on 1 February 2021 in accordance with CoA A28.

1.3 Environmental Representative

An independent Environmental Representative (ER) was engaged for the Project in accordance with CoA A21. Simon Williams was nominated as the ER, with Duncan Thomson the alternate, and approved by the delegate to the Secretary in July 2021.

As required in CoA A30(g), the ER works closely with the AA on noise and vibration related matters on the Project. Interactions with the AA are summarized in Section 3.10 of this report.

1.4 Scope of monthly report

As required by CoA A30(g)(iv), the AA must prepare and submit a monthly report, providing information on any actions or decisions for which the AA was responsible in the preceding month. Actions and decisions include but are not limited to:

- Communications with the Secretary
- Consideration and recommendations to Transport for NSW on improvements that may be made to avoid or minimise adverse noise and vibration impacts.
- Reviews and, where appropriate, endorsement of all noise and vibration documents required to be prepared under the Conditions of Approval.
- Any actions or decisions relating to regular monitoring of the implementation of noise and vibration documents;
- Any notifications to the Secretary of noise and vibration incidents;
- Any audits or inspections of the project and associated recommendations;
- Any action taken to help resolve conflicts between Transport for NSW and the community;
- Consideration of minor amendments to the CEMP, relevant sub-plans and monitoring programs

2. Summary of construction activities

Early works underway during December, or soon to commence, by TfNSW, Ferrovial Gamuda Joint Venture (FGJV) and Quickway include the following.

- Ongoing utilities relocations including underboring in a variety of locations such as James Small Drive, Bruxner Park Road, Western Utilities Corridor
- Watermain trenching adjacent to the biomass facility off Englands Road (WM1) and to western extent of project corridor (WM2)
- Cutover/splicing of telecommunications in various locations.
- Access track construction (Roberts Hill)
- Ongoing at-house noise treatments

Utility works will continue over the next month and upcoming works also include:

- Trenching and underboring for watermain 1 and 2 in south and western portions of the project
- Dual watermain connection at Old Coast Road
- Underboring works for electrical transmission in Bray Street and Mackays Road (works delayed)
- Underboring around James Small Drive
- Geotechnical investigations by FGJV in a variety of locations
- Completion of clearing adjacent to Handybins

3. AA activity

3.1 Secretary communications

Together with the ER, the AA met with DPE on 14 December to discuss a request by Quickway for high-risk OOHV works, i.e. evening and night periods in addition to 3 per week. The works were of relatively low noise apart from a small period of rock hammering to break up a concrete block. The works were proposed to be undertaken in January 2023.

3.2 Recommendations for improvement

Recommendations on assessment methods and documentation were provided during review, as summarised below. Site inspection conducted in December (see Section 3.8).

3.3 Documentation review

3.3.1 Endorsements of project documentation

No endorsements relating to project documentation during December; however comments on the NVMP had been provided to FGJV and another review of this document is expected late December/early January. In addition, a number of file notes and OOHV permit applications were reviewed and approved in December (see below).

3.3.2 Document reviews

File notes for works during standard hours reviewed and approved in December included:

- LIWA 10 Pine Brush Creek boreholes (12/12)
- LIWA 13 Geotechnical works (1/12)

- LIWA 14 Geotech works (21/12)
- File note 002 Bruxner Road Carpark (5/12)
- Blueberry netting removal (19/12)

3.4 OOHW permit reviews/approvals – low risk

Permit applications for works outside standard hours reviewed and approved in December included the following. These permits are attached as Appendix A for reference. OOH works are generally programmed around one to two weeks after the approval date, pending weather conditions and notification logistics.

- WM01 Swamp Thrust Bore – Generator (15/12)
- OOHW – IBIS Dam pump (15/12)

These works represented low risk of adverse impact due to NML compliance and/or short timeframes with few receivers likely to be affected. All appropriate mitigation measures were to be applied to maintain any impacts at practical minimums.

This application was submitted to DPE for review since it exceeded the definitions of low risk activity in the OOHW Protocol.

3.5 OOHW permit reviews/approvals – community agreement

Due to the works not fitting into the low risk category, community agreement has been sought and achieved for the following activities.

- Extended daytime hours – Gravel access track (21/12) (Reviewed but not yet confirmed to be going ahead – confirming if the work can be pushed back beyond blueberry harvesting at nearby farm).
- Telstra – JSD HDD (12/12)

3.6 OOHW permit reviews/approvals – high risk (DPE approval required)

- OCR Dual watermain (15/12) - This application was submitted to DPE for review since it exceeded the definitions of low risk activity in the OOHW Protocol.

3.7 Emergency works

No emergency works in December

3.8 Document amendments

No amendments to approved documents necessary in December.

3.9 Monitoring of document implementation

3.9.1 CNVMP and associated documents

At this stage, early works are low risk, largely being undertaken during standard hours and outside the framework of the CNVMP, which is yet to be approved. Any OOHW are being carried out under the OOHW Protocol.

Based on inspections, community feedback and feedback from Transport for NSW, low risk works completed in December have been completed in line with the file notes and OOHW applications previously reviewed by the AA for each item of work and have not resulted in any noise or vibration complaints.

3.9.2 At-receiver noise treatments

Transport for NSW is undertaking a program of at-receiver noise treatments (ARNT) to qualifying homes identified within the EIS. The program aims to ensure early mitigation is provided, where possible, prior to construction commencement. The Operational Noise Review (ONR) required under CoA E47 may result in a change in the number of properties and/or the scope of treatment.

Nominally, 605 homes eligible to receive treatment (comprising 440 residential homes, 11 non-residential receivers and 154 unbuilt residential receivers).

To date, tender packages 1, 2 and 3 are complete – consisting of 68 properties. Packages 4, 5 and 6 are underway with 50 of the 89 properties complete. As of the start of December, a total of 118 homes have been treated.

3.10 Incidents

No incidents reported to the AA in December

3.11 Auditing and inspection

Site inspection was undertaken on 14 December.

Sites and works inspected included:

- Rock clearing near the biomass facility – completed without complaint
- Minor ancillary sites at Englands Road
- Ancillary site 1G – earthworks and site levelling underway
- Western utility corridor
- Micro-tunnelling site at Bruxner Park Rd

The team is managing noise with reasonable and feasible measures in place.

3.12 Community complaints and enquiries

No complaints regarding noise were received by the AA in December.

Not included as a complaint but relevant to this section were two queries on at-house noise treatment received by the team and addressed without escalation to the AA..

3.13 Meetings

The AA has been attending weekly meetings with Transport for NSW, FGJV members, DPE representatives, the ER and Project consultation team members. Within these meetings, upcoming works are discussed as well as any complaints related to noise and vibration and the status of document preparation and approval.

The AA also attended a monthly meeting with DPE and the project team for an update.

3.14 Interactions with the ER

The ER and the AA have worked together in reviewing noise and vibration documents and providing comments to Transport for NSW in a coordinated manner. The AA will continue to work with the ER throughout the project.

3.15 Other AA Activities

The AA continues to review Project-related correspondence as and when received, responding accordingly.

4. Closing comments

Appropriate planning and management of noise and vibration impacts has been carried out to date with early works being completed outside the framework of the CEMP. All works appear to be completed in accordance with the CoA and documentation provided for review.

Interaction with FGJV, Transport for NSW and the ER has been positive, and the AA has maintained a good relationship between all parties to achieve best practice proactive noise and vibration management and ongoing compliance with the Conditions of Approval.

With FGJV, Quickway and TfNSW each programming works during standard and outside standard hours, good communication and awareness of all programmed works across the project is being achieved and works are managed consistently across the team.

Documentation reviews have commenced on relevant management plans and will be endorsed in time for construction. There will be a transition period of continuing early works by TfNSW and works completed by the Contractor under the approved CEMP.



Appendix A. Approved OOHW permits for December

CHB Project OOHW application form

Out of hours work approval request form

No:	Notification date:	Approval date:	Project:
009	XX/XX/XXXX		JSD Underbore - Weekend Daytime Working Hours

A. Contact details	Name	Mobile number	Email
TfNSW Environmental Site Representative	Shayne Walker	0467 818 189	shayne.walker@transport.nsw.gov.au
TfNSW Project Manager	Matt Amato	0421 191 916	matt.amato@transport.nsw.gov.au
Contractor Project Manager	Kilian Koen	0473 149 821	kiliank@quickway.com.au
Contractor Project Engineer	Blake Kelly	0437 332 209	blakek@quickway.com.au

B. Details of work: Include a map showing location of work extent and nearest sensitive receivers

Location / chainages:	James Small Drive – Korora School Rd to Norman Hill Dr
NCA/s:	NCA – 25 (East of Pacific Highway) NCA – 26 (East of Pacific Highway)
Description of works – also include a brief description of the sequence of activities:	Works involve underboring along James Small Drive (JSD) from Korora School Road to Norman Hill Drive to install Telstra conduits. As shown in Figure 1, works involve three separate HDD Underbore shots (Shot 1, Shot 2 and Shot 3) with associated removal of drilling fluid at each of the four entry/exit pits (LOC100, LOC105, LOC116 and LOC124). Works will also include the installation 3 manholes (LOC105, LOC116 and LOC124). The works are being undertaken in the school zone, with a lot of work activity required within the active kiss and drop / school bus drop off area immediately out the front of the school. Due to the high safety risk to the public (school children) from the activity being within the active school drop off area, the Project has opted to undertake these works within the school holiday period. Works are required to be undertaken continuously throughout the dates extending outside standard working hours to ensure all works can be completed within the school holiday break. Sequence of works required within and outside of standard hours is generally as follows for each of the Shots: 1. Establishment of Traffic Control 2. Establishment of erosion and sediment controls 3. Locating of existing services / potholing 4. Excavation of entry and exit pits 5. Pilot shot of bore, drilling of bore to full diameter through back reaming. 6. Vacc truck in use progressively to remove any excess slurry and take to Pad 3 slurry treatment bays. (Assessed and approved with OOH 008 to occur over the next 6 months) 7. Pulling conduits back through bore using boring rig. 8. Install Manholes 9. Complete conduit connections into manholes

CHB Project OOHW application form

10. Clean up, reinstatement and demobilise



Figure 1: Snip from Appendix A (Area markup)

Machinery/ plant to be used

LOC105, LOC116 and LOC124

HDD Works

- 1 x 5T Excavator
- 1 x Vacc truck
- 1 x HDD Drill Rig
- 1 x Water cart (when required)

Manhole Installation

- 5T Excavator
- Franna Crane

LOC100

HDD Works

- 1 x 5T excavator
- 1 x Vacc Truck

Traffic control measures required:

Yes – Traffic Control in place to direct traffic. There will also be temporary pedestrian alternative walkways in place as required.

Lighting required:

No lighting required as works will be completed during daylight hours

Proposed dates:

Extended weekend shifts (Saturday and Sunday) on an ongoing basis for during the following dates:

- 03/01/23 to 08/01/23: Shot 1 (Loc100 to Loc105; Cnr Norman Hill Dr to Top of School on JSD) (OOH Sat 07/01 – Sun 08/01)
- 09/01/23 to 15/01/23: Shot 2 (Loc105 to Loc116; Top of School to Cnr Tropic Lodge Pl) (OOH Sat 14/01 – Sun 15/01)
- 16/01/23 to 22/01/23: Shot 3 (Loc116 to Loc124; Cnr Tropic Lodge Pl to South of Korora School Rd) (OOH Sat 21/01 – Sun 22/01)
- 23/01/23 to 29/01/23: Installation of 3 Manholes (Loc105, Loc116 & Loc 124) and Citysmart

CHB Project OOHW application form

	breakout pits to be completed as Drilling completed. (OOH Sat 28/01 – Sun 29/01 and 26/01 Public Holiday). Dates for each activity may be subject to change due to progress / weather (ie shortened duration).	
Proposed times:	Saturdays: 1pm – 6pm (OOSH Day) Sundays: 8am – 6pm (OOSH Day)	
Justification - why does work need to occur outside of standard construction hours? (attach support information as required)	The project has agreed the works are to be undertaken during the school holidays as if works were undertaken within standard working hours during school operational days within the active school zone, they could present a significant risk to the public (parents and school children). The works would also significantly interfere the bus drop off operations, and pedestrian movements. Undertaking works during school holiday periods would minimise disruption to the existing road network and network level of service. Korora Public School has confirmed teachers return on Friday 27 January and all students return Tuesday 31 January. Works need to be completed prior to this time. The justification above is consistent with valid reasons as per Section 3.4 of the OOHW Protocol. Works are required to be undertaken continuously throughout the dates extending outside standard working hours to ensure all works can be completed within the school holiday break. As the existing 'kiss and drop' on the western side of the pacific highway, there is additional pressure on the School Drop off arrangement. If works were not completed during School Holidays and extended within school periods, there would be significant impacts to the drop off operations.	
Select OOHW Category as defined by MCoA E36	Select ☐	(a) for the delivery of materials required by the NSW Police Force or other authority for safety reasons; or
	☐	(b) where it is required in an emergency to avoid injury or the loss of life, to avoid damage or loss of property or to prevent environmental harm; or
	☐	(c) where different construction hours are permitted or required under an EPL in force in respect of the CSSI; or
	☒	(d) work <u>not</u> subject to an EPL that are approved under an Out-of-Hours Work Protocol as required by Condition E40; or
	☐	(e) construction that causes $L_{Aeq(15 \text{ minute})}$ noise levels: (i) no more than 5 dB(A) above the rating background level at any residence in accordance with the <i>Interim Construction Noise Guideline</i> (DECC, 2009), or
	☐	(ii) no more than the 'Noise affected' noise management levels specified in Table 3 of the <i>Interim Construction Noise Guideline</i> (DECC, 2009) at other sensitive land uses, or
	☐	(f) continuous or impulsive vibration values, measured at the most affected residence are no more than the preferred values for human exposure to vibration, specified in Table 2.2 of <i>Assessing Vibration: a technical guideline</i> (DEC, 2006), or

CHB Project OOHW application form

	☐	(g) intermittent vibration values measured at the most affected residence are no more than the preferred values for human exposure to vibration, specified in Table 2.4 of <i>Assessing Vibration: a technical guideline</i> (DEC, 2006); or
	☐	(h) negotiated agreements with directly affected residents and sensitive land uses.

C. Risk assessment

NML (refer Table 3-2 of OOHW protocol)	NCA – 25 OOSH Day: 53dB NCA – 26 OOSH Day: 57dB
Does the works result in highly noise affected levels at any receivers? (above 75dB(A) L_{Aeq} (15 minute))	No
Risk factor category (refer section 4.3 of OOHW protocol):	Other Low High Comments: 4.4.3 (2): OOHW assessed to meet the perception classification of Clearly Audible and above at any one residential receiver do not exceed a maximum of: a. Two consecutive evenings or nights, in a calendar week b. Three evenings or nights in a calendar week c. A maximum of 10 evenings or nights in a calendar month.

D. Details of noise or vibration assessment completed:

Comments: KNOWnoise was used to model predicted noise outputs for the work activities. The works are split over two separate noise catchment areas, and have been assessed against the respective NMLs accordingly.

Refer to **Appendix B** for full list of receivers identified as clearly audible triggering negotiated agreements. Summary of impacts to **nearest sensitive receivers** provided below:

NCA 25 East

LOC105

NML OOSH Day: 53dB

- Activity: HDD Underbore
- Address: Unit 1/40 James Small Drive
- Plant and Equipment: 5T excavator, Vacc Truck, HDD Drill Rig
- Shielding Correction: 5dB (Noise Blankets)
- Predicted SPL: 70dB
- NML Exceedance – OOHW Day: 17dB

- Activity: Installation of Manholes and Pits
- Address: Unit 1/40 James Small Drive
- Plant and Equipment: 5T excavator, Franna Crane
- Shielding Correction: Nil
- Predicted SPL: 63dB
- NML Exceedance – OOHW Day: 10dB

CHB Project OOHW application form

LOC116

NML OOSH Day: 53dB

- Activity: HDD Underbore
- Address: 1 Tropic Lodge Place
- Plant and Equipment: 5T excavator, Vacc Truck, HDD Drill Rig
- Shielding Correction: 5dB (Noise Blankets)
- Predicted SPL: 65dB
- NML Exceedance – OOHW Day: 12dB

- Activity: Installation of Manholes and Pits
- Address: 1 Tropic Lodge Place
- Plant and Equipment: 5T excavator, Franna Crane
- Shielding Correction: Nil
- Predicted SPL: 59dB
- NML Exceedance – OOHW Day: 6dB

LOC124

NML OOSH Day: 53dB

- Activity: HDD Underbore
- Address: 54 James Small Drive
- Plant and Equipment: 5T excavator, Vacc Truck, HDD Drill Rig
- Shielding Correction: 5dB (Noise Blankets)
- Predicted SPL: 65dB
- NML Exceedance – OOHW Day: 12dB

- Activity: Installation of Manholes and Pits
- Address: 54 James Small Drive
- Plant and Equipment: 5T excavator, Franna Crane
- Shielding Correction: Nil
- Predicted SPL: 58dB
- NML Exceedance – OOHW Day: 5dB

NCA 26 East

LOC100

NML OOSH Day: 57dB

- Address: 36 James Small Drive
- Activity: HDD Underbore
- Plant and Equipment: 5T excavator, Vacc Truck,
- Shielding Correction: 5dB (Noise Blankets)
- Predicted SPL: 72dB
- NML Exceedance – OOHW Day: 15dB

CHB Project OOHW application form

E. Proposed mitigation measures, including respite

Comments:

Standard Mitigation measures

- Modifying behavioural practices on site
- Use and siting of plant
- Switching off plant and machinery when not in use
- Use of non-tonal reversing alarms
- Planning noisier work to be carried out earlier in the period.
- Machinery will not be left running unnecessarily.
- Orientating machinery with noisiest elements directed away from receivers wherever possible
- Noise blankets will be installed on ATF panels between the noise source and houses at all times

Additional Mitigation Measure

- Written notification will be provided to residents within 200m of the works
- Verification Monitoring

F. Community consultation

Outline consultation undertaken for the proposed OOHW:

Written notification of the works will be provided to the community (within 200m radius) of the works. The notification will outline reason for the works, diagram of the work area, proposed date of the works and working times, expected noise impacts and mitigation measures in accordance with the Community Consultation Strategy and Section 6.5 of the CHB OOHW Protocol.

Receivers which have been identified as most affected will be notified by door knock to provide further detail as a courtesy measure.

Has respite periods for OOHW been identified with the affected community on a monthly basis and a three-month schedule of likely OOHW provided (refer CoA E39)?

R1 triggered under CNVG. Works do not exceed 3 consecutive evenings as required for R1 .
See community notification letter for proposed works for updates on 3-month schedule of likely OOHW.

Has the outcome of community consultation, the identified respite periods and scheduling of likely OOHW been provided to the ER, AA and Planning Secretary as required?

Works do not trigger consultation on respite offers. Respite R1 met as works do not exceed 3 consecutive evenings.

G. Respite framework

Outline any previous respite within the last month and the status of community agreements (where relevant)?

N/A

Have cumulative impacts from OOHW permitted by an EPL or third-party works been considered during the development of appropriate respite?

Joint Venture Geotech works on Pacific Highway

TfNSW and Quickway have reviewed the noise assessment for OOH works proposed to be undertaken on the Pacific Highway nearby by the JV in January. There is no cumulative impact anticipated during OOHW periods.

1: Daytime **OOHW dates do not** overlap.

- Quickway **OOHW** dates – (Shot 1: 7/1-8/1, Shot 2: 14/1-15/1, Shot 3: 21/01 - 22/01)
- JV **OOHW** dates – (9/1, 10/1, 12/1 and Contingency for 16/1, 17/1 and 19/1)

2: **OOHW times do not overlap** as JV works are occurring during the night period, with Quickway works occurring during the weekend day period.

CHB Project OOHW application form

3: Even though dates or time periods do not overlap, an assessment of exceedances of respective period NML demonstrates there is **no overlap of Clearly Audible receivers** for the works even **at the nearest** Quickway activity as a worst case scenario.



Cumulative Assessment – JV Night OOH / QW Day OOH NMLs

Contractor OOHW Scheduled dates

- JV OOHW – (9/1, 10/1, 12/1 and Contingency for 16/1, 17/1 and 19/1)
- Quickway OOHW #009 - JSD HDD Shot 1: LOC100 to LOC105 (03/01 to 08/01) (**NEAREST ACTIVITY**)

No overlap of Clearly Audible receivers.

Compliance (NML Exceedance)

Compliant	
Noticeable:	0 <= 5dB
Clearly Audible:	5 <= 15dB
Moderately Intrusive:	15 <= 25dB
Highly Intrusive:	>25dB

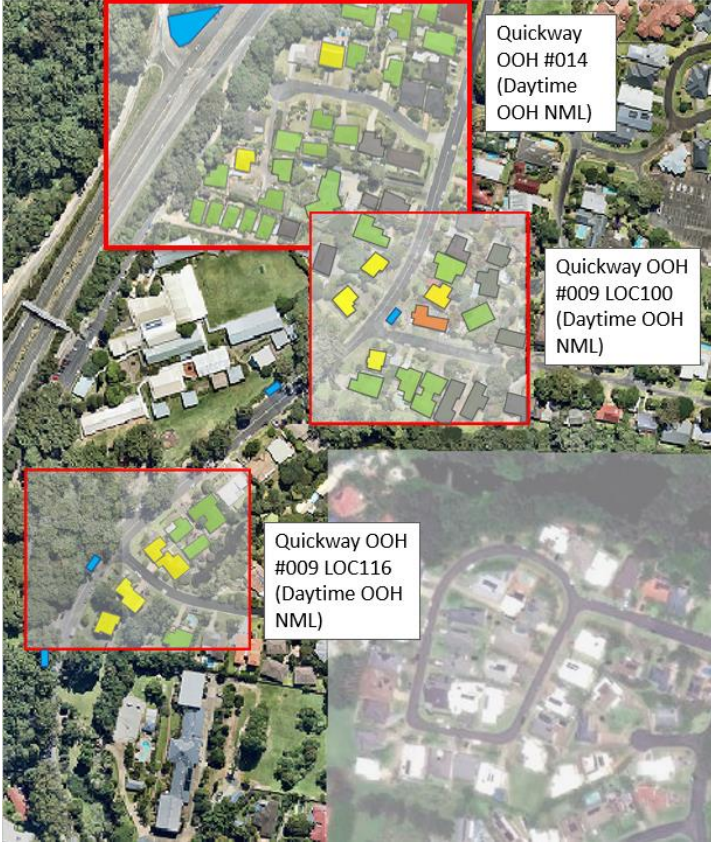
Quickway Critical 24/7 Dual Watermain Connection at OCR

Critical works are scheduled to be undertaken by Quickway on at the intersection of Old Coast Road and the Pacific Highway at any point after 16/01 during a suitable 5 day dry weather window with works occurring 24/7 (ie potentially within Daytime OOHW periods (Sat/Sun)), resulting in simultaneous works occurring at the two sites. Cumulative impacts have been assessed considering and works occurring at both sites simultaneously during daytime OOH periods.

Shot 3 (LOC116 to LOC124) works are scheduled to occur 16/1 – 22/01 (OOHW 21/1 - 22/1). All other HDD work is scheduled to have been completed by this date. As shown below, there are no cumulative impacts anticipated for simultaneous operations during Daytime OOHW period, should that eventuate.

As a worst case scenario, cumulative impacts from the nearest activity on JSD (LOC100) has also been assessed and shows now cumulative impacts.

CHB Project OOHW application form



Cumulative Assessment – Quickway Daytime OOH NML

Quickway OOHW Scheduled dates

- OOHW #014 OCR Dual Main Connection – (16/01 onward).
- OOHW #009 – JSD HDD
 - LOC116 to LOC124 (16/01 to 22/01)
 - LOC100 to LOC 105 (03/01 to 08/01) Note: Assessed as worst case scenario as nearest activity.

No overlap of Clearly Audible receivers during Daytime OOHW

Compliance (NML Exceedance)

Compliant	0 <= 5dB
Noticeable:	5 <= 15dB
Clearly Audible:	15 <= 25dB
Moderately Intrusive:	>25dB
Highly Intrusive:	>25dB

G. Respite framework

Comments:

N/A - None present in subject area.

H. Details of non-residential sensitive receivers (if any) and corresponding NMLs

Comments:

N/A - None present in subject area.

I. Are there any properties at risk of exceeding the screening criteria (CNVG minimum distances for vibration intensive plant) safe working distance for plant) for cosmetic damage?

Comments:

N/A - No vibration generating activities planned.

J. Review / Endorsements

**Transport for NSW
Community Liaison
Representative**

Community notified

Date:

Additional consultation requirements:

Have the works been reviewed and endorsed?

Yes / No

Name:

Signature:

Date:

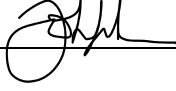
Comments:

**Transport for NSW
Environmental Manager (or
delegate)**

Agreed mitigation measures:

As per section E.

CHB Project OOHW application form

	Have the works been reviewed and endorsed?		Yes / No
	Have the works been approved where neither low nor high risk (predicted to be <NML and below cosmetic damage vibration screening criteria)?		Yes / No
	Name:	Signature:	Date:
	Shayne Walker		
	Comments:		
Project Acoustic Advisor	Agreed mitigation measures:		
	Have the works been reviewed and endorsed?		Yes / No
	Have the works been approved where neither low nor high risk (predicted to be <NML and below cosmetic damage vibration screening criteria)?		Yes / No
	Name:	Signature:	Date:
	John Hutchison		12/12/2022
	Comments:		
Transport for NSW Project Manager	Agreed mitigation measures:		
	Have the works been reviewed and endorsed?		Yes / No
	Have the works been approved where neither low nor high risk (predicted to be <NML and below cosmetic damage vibration screening criteria)?		Yes / No
	Name:	Signature:	Date:
	Comments:		
ER approval (low risk activities)	Are the works approved?		Yes / No
	Name:	Signature:	Date:
	Comments:		
Planning Secretary approval (high risk activities)	Are the works approved?		Yes / No
	Name:	Signature:	Date:
	Comments:		

Appendix A

Works Area Mark-up



Appendix B
Noise Assessments

Construction noise impact assessment

LOC 100 - Daytime OOH

NUR JSD Underbore LOC 100

Proposed works	JSD LOC100		
Proponent	Quickway		
Assessment Date	16/11/2022		
Prepared by	Tom St Vincent Welch	Assessment Id	OOH009

Introduction

This report has been prepared using the construction noise self-assessment platform KNOWnoise: *Minor Works* and presents an assessment of the likely noise impacts related to proposed works associated with the above project. Where possible, these works would be completed during standard construction hours; however, there may be a need to work outside these hours due to technical, community or access limitations. The location of the proposed works is illustrated in Appendix A.

Planned works

A description of the proposed works is as follows.

HDD

Proposed activities and equipment for the works are summarised in Appendix B.

Though subject to change, the works are expected to commence around 03/01/2023 and would be completed by 08/01/2023.

Assessment criteria and mitigation requirements

The Interim Construction Noise Guideline (ICNG) (DECC 2009) describes noise more than the background level as potentially having an adverse impact on sensitive receivers and increasing the likelihood of complaint. During standard construction hours, where construction noise is within 10 dB(A) of the RBL, impacts would be acceptable.

Where construction noise is more than 10 dB(A) above the RBL during standard construction hours, a residential receiver is considered noise affected and the proponent should undertake all reasonable and feasible steps necessary to manage the impact and consult with the affected community.

Above a LAeq, 15 minute noise level of 75 dB(A), a receiver is highly affected, requiring consideration of additional mitigation measures including alternative accommodation in the night period.

Outside standard construction hours, construction noise at a residential receiver more than 5 dB(A) above the RBL is taken to be noise affected.

In addition, annoying noise such as rock hammers, impact piling, or other impulsive noise sources usually result in greater annoyance than continuous construction noise. A 5 dB(A) penalty is applicable to such activities prior to comparison with the NMLs.

Other sensitive land uses, such as schools and offices, typically find noise from construction disruptive when the properties are being used (such as during work and school times). Table 2 presents NMLs from the ICNG for sensitive land uses based on the principle that the characteristic activities for each of these land uses should not be unduly disturbed.

Table 1 Non-residential sensitive land uses noise management levels

Land use	Noise assessment location	NML (L _{Aeq,15min})
Classrooms at schools and other educational institutions	Internal	45
Places of worship		
Active recreation areas (such as sporting activities and activities which generate their own noise or focus for participants)	External	65
Passive recreation areas (contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External	60
Industrial premises	External	75
Office, retail outlets	External	70

As part of planning for out of hours works, standard mitigation measures, as described in the ICNG and CNVG, would be implemented where reasonable and feasible. However, after these measures have been applied, noise and vibration levels may continue to exceed the NMLs.

In this case, additional mitigation measures outlined in the CNVG, which largely focus on engagement with affected sensitive receivers, should be implemented where reasonable and feasible, unless other agreements are in place with the impacted receiver.

Triggers and additional mitigation measures for airborne noise are summarised in Table 2. Further details of specific additional mitigation measures are described in the CNVG.

Table 2 Triggers for additional mitigation measures – Airborne noise (Roads and Maritime 2016)

Predicted airborne LAeq(15min) noise level at receiver			
Perception	dB(A) above RBL	dB(A) above NML	Additional mitigation measures
All hours			
75 dB(A) or greater			N, V, PC, RO
Standard hours: Mon - Fri (7am – 6pm), Sat (8am – 1pm), Sun/Pub Hol (Nil)			
Noticeable	5 to 10	0	-
Clearly audible	10 to 20	< 10	-
Moderately intrusive	20 to 30	10 to 20	N, V
Highly intrusive	> 30	> 20	N, V
OOHW Period 1: Mon – Fri (6pm – 10pm), Sat (7am – 8am & 1pm – 10pm), Sun/Pub Hol (8am – 6pm)			
Noticeable	5 to 10	<5	-
Clearly audible	10 to 20	5 to 15	N, R1, DR
Moderately intrusive	20 to 30	15 to 25	V, N, R1, DR
Highly intrusive	> 30	>25	V, IB, N, R1, DR, PC, SN
OOHW Period 2: Mon – Fri (10pm – 7am), Sat (10pm – 8am), Sun/Pub Hol (6pm – 7am)			
Noticeable	5 to 10	<5	N
Clearly audible	10 to 20	5 to 15	V, N, R2, DR
Moderately intrusive	20 to 30	15 to 25	V, IB, N, PC, SN, R2, DR
Highly intrusive	> 30	>25	AA, V, IB, N, PC, SN, R2, DR

Notes:

PC = Phone calls

V = verification

IB = Individual briefings

N= Notification

AA = Alternative accommodation

SN = Specific notifications

RO = Respite offer

R1 = Respite period 1

R2 = Respite period 2

DR = Duration respite

Perception = relates to levels above RBL

NML = Noise management level

HA = Highly affected

Existing environment and noise management levels

The proposed works would be undertaken in a predominantly Suburban/ Urban, characterised as:

Areas with low density transportation.

Typically local traffic, light vehicles, intermittent traffic flow

Background noise levels adopted for the project area and associated noise management levels (NMLs) are summarised in Table 3. NMLs have been established in line with the ICNG.

Table 3 Construction NMLs

Land use	Suburban/ Urban		Using custom background noise data?		Yes
Criterion	Day	Weekend Day	Evening	Night	Sleep
RBL	52	52	46	37	
NML	62	57	51	42	65

Sleep disturbance

The ICNG recommends where construction works are planned to extend over more than two consecutive nights, the maximum noise level should be considered for the purposes of establishing the likelihood of sleep disturbance. The Road Noise Policy suggests that maximum internal noise levels below 50-55 dB(A) are unlikely to awaken people from sleep and one or two noise events per night, with maximum internal noise levels of 65-70 dB(A) are not likely to affect health and wellbeing significantly.

Based on this, a sleep awakening criterion of 55 dB(A) (internal) is typically adopted for works. Given that noise attenuation of 10 dB(A) is typically provided by an open window, a sleep awakening criterion of L_Amax 65 dB(A) (external) has been applied to residential bedroom façades. This is consistent with the sleep disturbance threshold described in Appendix E of the CNVG.

Vibration

Effects of vibration from construction may be segregated into:

- Human exposure – disturbance to building occupants: vibration in which the occupants or users of the building are inconvenienced or possibly disturbed.
- Effects on building contents – vibration where the building contents may be affected.
- Effects on building structures – vibration in which the integrity of the building or structure itself may be prejudiced.

Vibration criteria relating to human comfort applicable to this project are taken from the DEC (2006) document Assessing Vibration – A Technical Guideline for intermittent vibration – such as from drilling, compacting or activities that would result in continuous vibration if operated continuously. Intermittent vibration is assessed as a vibration dose value (VDV) and relates to the level of vibration over time (cumulative over the night or day period). VDV's that may result in adverse comment from receivers are summarised in Table 4.

Table 4 Summary of vibration dose values which might result in adverse comment

Time	Low probability of adverse comment (m/s ^{1.75})	Adverse comment possible (m/s ^{1.75})	Adverse comment probable (m/s ^{1.75})
Day (6am to 10pm)	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Night (10pm to 6am)	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Guidance for the consideration of potential building damage from construction vibration is in line with BS 7385-1 *Evaluation and measurement for vibration in buildings - Guide for measurement of vibration and evaluation of their effects on buildings*. These guideline values are presented in Table 5.

Table 5 Building damage vibration guidelines (BS 7385-1)

Type of building	Guideline values for vibration (PPV mm/s)		
	4Hz to 15Hz	15Hz to 40Hz	40Hz and above
Reinforced or framed structures / Industrial and heavy commercial buildings	50		
Un-reinforced or light framed structures / Residential or light commercial type buildings	15 - 20	20 - 50	50

For heritage structures, criteria are in line with the German Standard *DIN 4150-3: Structural Vibration- effects of vibration on structures*, as summarised in Table 6.

Table 6 Guideline values for vibration velocity to be used when evaluating the effects of short-term vibration on heritage structures (DIN 4150-3).

Type of building	Guideline values for vibration (PPV mm/s)			
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz	Vibration at horizontal plane of highest floor at all frequencies
Structures that, because of their sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	3	3 to 8	8 to 10	8

The safe working distances presented in Table 7 are indicative and will vary depending on the item of plant and local geotechnical conditions. The cosmetic damage thresholds apply to typical buildings under typical geotechnical conditions and vibration monitoring is recommended at specific sites. Where structures are more sensitive, such as heritage items, more stringent conditions are applicable and should be considered individually.

In relation to human response, the safe working distances relate to continuous vibration. For most construction activities, vibration emissions are intermittent and higher vibration levels over shorter periods are acceptable. Additional assessment should be undertaken where the human response criteria are exceeded.

Table 7 Safe working distances for vibration intensive plant

Plant item	Rating/description	Safe working distance	
		Cosmetic damage (BS 7385-1)	Human response (DECCW)
Vibratory roller	<50 kN (typically 1-2 t)	5 m	15 m to 20 m
	<100 kN (typically 2-4 t)	6 m	20 m
	<200 kN (typically 4-6 t)	12 m	40 m
	<300 kN (typically 7-13 t)	15 m	100 m
	>300 kN (typically 13-18 t)	20 m	100 m
	>300 kN (> 18 t)	25 m	100 m
Small hydraulic hammer	300 kg – 5 to 12 t excavator	2 m	7 m
Medium hydraulic hammer	900 kg – 12 to 18t excavator	7 m	23 m
Large hydraulic hammer	1600 kg – 18 to 34 t excavator	22 m	73 m
Vibratory pile driver	Sheet piles	2 m to 20 m	20 m
Pile boring	≤800 mm	2 m	n/a
Jackhammer	Hand held	1 m	Avoid contact with structure

Assessment methodology

Based on the nominated works area (illustrated in Appendix A), proposed equipment and the minimum distance from the works to each sensitive receiver, noise levels were calculated based on CONCAWE (1981) *Propagation of noise from petroleum and petrochemical complexes to neighboring communities*.

This method considers geometric spreading, atmospheric absorption, ground effects and is valid for meteorological conditions of a gentle breeze from source to receiver and stable atmosphere (temperature inversion).

KNOWnoise: Minor works is a 2-Dimensional assessment platform and does not consider terrain effects (e.g. hills, valleys) or the presence of solid structures such as homes or noise barriers. This will result in a conservative prediction, suitable for the project being assessed.

Considering the nature of the works and the type of surrounding land uses, sensitive receivers up to a radius of 300 metres from the works have been included in the assessment.

Sound power levels and predicted noise levels depend on the number of plant items operating at any one time and their precise location relative to a sensitive receiver. Equipment was assumed to be working at the worst-case location relative to each receiver and represents a worst-case assessment. Where the activity is further away from receivers or less equipment is used the predicted levels will decrease.

Sound power levels for plant and equipment expected to be used for each activity has been estimated based on guidance in the following standards and guidelines as well as typical measured noise levels for specific equipment.

- “ Australian Standard AS2436-2010: Guide to noise and vibration control on construction, demolition and maintenance sites
- “ Construction Noise and Vibration Strategy 7TP-ST-157/2.0 (CNVS), (TfNSW, 2018)
- “ Construction Noise and Vibration Guideline (CNVG) (Roads and Maritime Services, 2016)
- “ British Standard 5228-1:2009 Code of practice for noise and vibration control on construction and open sites
- “ United Kingdom Department for Environment, Food and Rural Affairs (DEFRA) Noise database for prediction of noise on construction and open sites

Construction noise sources and associated sound power levels are listed in Appendix B. The maximum predicted LAeq noise level within the work area was identified for each receiver.

Predicted noise levels

Detailed predicted noise levels for each potentially affected receiver are presented Appendix C.

A summary of predicted noise levels in comparison with ICNG assessment criteria for the Weekend day period is presented in Table 8.

Table 8 Summary of predicted noise levels with comparison against ICNG criteria for the Weekend day period.

Criterion	Predicted number of receivers
Maximum cumulative predicted L _{Aeq} , 15 minute noise level	72 dB(A)
Number of highly noise affected receivers (>75 dB)	0
1 – 10 dB above NML	6
10 – 20 dB above NML	2
20+ dB above NML	0

In line with CNVG impact classes, up to 0 receivers are predicted to be classified as Highly Impacted during the Weekend day period. A summary of the number of receivers in each class is presented in Table 9.

Table 9 Summary of predicted noise levels with comparison against CNVG criteria

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 <= 5 dB above NML	6
Clearly Audible	5 <= 15 dB above NML	4
Moderately Intrusive	15 <= 25 dB above NML	1
Highly Intrusive	> 25 dB above NML	0

Predicted impact classes for the Weekend day period are illustrated graphically in Appendix C. Each identified receiver in the study area has been coloured to highlight the predicted level of impact.

Sleep disturbance

In the event works are planned for more than two consecutive nights, up to 4 are expected to exceed the sleep awakening criteria. Where any exceedances if the awakening criteria are predicted, additional care should be taken and mitigation measures implemented in the with the CNVG.

Predicted vibration impacts

The level of vibration impact on sensitive receivers (buildings and human comfort) will largely depend on the type of machinery in use and the distance from source to receiver.

Based on the proposed work locations and selected equipment, the following level of vibration impact is expected. A summary of vibration impacts is provided for each sensitive receiver in Appendix C.

Impact classification	Number of potentially affected receivers
Human comfort	0
Cosmetic damage	0
Heritage structure	0

Proposed noise mitigation measures

The safeguards and controls listed in Table 10 will be implemented where reasonable and feasible with the intention of achieving the project noise criteria and to maintain noise impacts at a practical minimum.

Table 10 Safeguards and controls

Action	Description
Community consultation or notification	Notify the affected community. The notification will detail work activities, dates and hours, impacts and mitigation measures, indication of work schedule over the night time period, any operational noise benefits from the works (where applicable) and contact telephone number. Notification should be a minimum of 7 calendar days prior to the start of works. For projects other than maintenance works more advanced consultation or notification may be required.
Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction would at least include: - all project specific and relevant standard noise and vibration mitigation measures - relevant licence and approval conditions - permissible hours of work - any limitations on high noise generating activities - location of nearest sensitive receivers - construction employee parking areas - designated loading/unloading areas and procedures site opening/closing times (including deliveries) environmental incident procedures
Behaviour	No swearing or unnecessary shouting or loud stereos/radios on site. Limit compression braking at night in residential areas. No dropping of materials from height, throwing of metal items and slamming of doors.
Verification	Where indicated in Appendix C, a noise verification program would be undertaken for the duration of the works.
Construction hours	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels should be scheduled during less sensitive time periods.
Respite for out-of-hours works	Respite would be scheduled as indicated in Appendix C and described in the CNVG.
Equipment selection	Use quieter construction methods where feasible and reasonable. Ensure plant including the silencer is well maintained. Plant noise levels will have an operating noise emission level compliant with Appendix F of the CNVG
Use and siting of plant	The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers.

Action	Description
Plan worksites and activities to minimise noise and vibration.	Locate compounds away from sensitive receivers and discourage access from local roads. Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site. Where additional activities or plant may only result in a marginal noise increase and speed up works, consider limiting duration of impact by concentrating noisy activities at one location and move to another as quickly as possible. Very noise activities should be scheduled for normal working hours. If the work can not be undertaken during the day, it should be completed before 11:00pm. Where practicable, work should be scheduled to avoid major student examination periods when students are studying for examinations such as before or during Higher School Certificate and at the end of higher education semesters.
Non-tonal reverse alarms	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work.
Shield stationary noise sources such as pumps, generators, and compressors	These should be enclosed or shielded where reasonable and feasible.
Implement any project specific mitigation measures	
1	None

Appendix A Project location and predicted level of impact



Appendix B Proposed activities and equipment

JSD LOC100

Equipment	Quantity	Usage	Reduction	SWL
Excavator (06 tonne)	1	10 %	5	79
Vacc truck	1	40 %	5	103

Activity Sound Power Level: 103

Appendix C Detailed noise predicted for each receiver and activity

Assessment: JSD LOC100				Weekend day	Results summary		
NCA	ID	Address	Land use	NML	Cumulative Predicted LAeq, 15 minute noise level	Exceedance of NML, dB	Impact classification
NCA 1	764500	2 NORMAN HILL DRIVE KORORA	RES	57	61	4	Noticable
NCA 1	764493	38 JAMES SMALL DRIVE KORORA	RES	57	67	10	Clearly Audible
NCA 1	764456	33 JAMES SMALL DRIVE KORORA	RES	57	64	7	Clearly Audible
NCA 1	764448	32 JAMES SMALL DRIVE KORORA	RES	57	60	3	Noticable
NCA 1	764446	31 JAMES SMALL DRIVE KORORA	RES	57	57	0	Noticable
NCA 1	764444	39 JAMES SMALL DRIVE KORORA	RES	57	65	8	Clearly Audible
NCA 1	764434	2A NORMAN HILL DRIVE KORORA	RES	57	58	1	Noticable
NCA 1	764432	34 JAMES SMALL DRIVE KORORA	RES	57	66	9	Clearly Audible
NCA 1	764431	36 JAMES SMALL DRIVE KORORA	RES	57	72	15	Moderately Intrusive
NCA 1	764422	5 CAVENDISH PLACE KORORA	RES	57	58	1	Noticable
NCA 1	764399	38A JAMES SMALL DRIVE KORORA	RES	57	60	3	Noticable

Construction noise impact assessment

LOC 105 - Weekend Day

NUR JSD LOC 105			
Proposed works	JSD Telstra Underbore LOC105		
Proponent	Quickway		
Assessment Date	16/11/2022		
Prepared by	Tom St Vincent Welch	Assessment Id	OOH009

Introduction

This report has been prepared using the construction noise self-assessment platform KNOWnoise: *Minor Works* and presents an assessment of the likely noise impacts related to proposed works associated with the above project. Where possible, these works would be completed during standard construction hours; however, there may be a need to work outside these hours due to technical, community or access limitations. The location of the proposed works is illustrated in Appendix A.

Planned works

A description of the proposed works is as follows.

Underbore at LOC 105

Proposed activities and equipment for the works are summarised in Appendix B.

Though subject to change, the works are expected to commence around 03/01/2023 and would be completed by 08/01/2023.

Assessment criteria and mitigation requirements

The Interim Construction Noise Guideline (ICNG) (DECC 2009) describes noise more than the background level as potentially having an adverse impact on sensitive receivers and increasing the likelihood of complaint. During standard construction hours, where construction noise is within 10 dB(A) of the RBL, impacts would be acceptable.

Where construction noise is more than 10 dB(A) above the RBL during standard construction hours, a residential receiver is considered noise affected and the proponent should undertake all reasonable and feasible steps necessary to manage the impact and consult with the affected community.

Above a LAeq, 15 minute noise level of 75 dB(A), a receiver is highly affected, requiring consideration of additional mitigation measures including alternative accommodation in the night period.

Outside standard construction hours, construction noise at a residential receiver more than 5 dB(A) above the RBL is taken to be noise affected.

In addition, annoying noise such as rock hammers, impact piling, or other impulsive noise sources usually result in greater annoyance than continuous construction noise. A 5 dB(A) penalty is applicable to such activities prior to comparison with the NMLs.

Other sensitive land uses, such as schools and offices, typically find noise from construction disruptive when the properties are being used (such as during work and school times). Table 2 presents NMLs from the ICNG for sensitive land uses based on the principle that the characteristic activities for each of these land uses should not be unduly disturbed.

Table 1 Non-residential sensitive land uses noise management levels

Land use	Noise assessment location	NML (L _{Aeq,15min})
Classrooms at schools and other educational institutions	Internal	45
Places of worship		
Active recreation areas (such as sporting activities and activities which generate their own noise or focus for participants)	External	65
Passive recreation areas (contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External	60
Industrial premises	External	75
Office, retail outlets	External	70

As part of planning for out of hours works, standard mitigation measures, as described in the ICNG and CNVG, would be implemented where reasonable and feasible. However, after these measures have been applied, noise and vibration levels may continue to exceed the NMLs.

In this case, additional mitigation measures outlined in the CNVG, which largely focus on engagement with affected sensitive receivers, should be implemented where reasonable and feasible, unless other agreements are in place with the impacted receiver.

Triggers and additional mitigation measures for airborne noise are summarised in Table 2. Further details of specific additional mitigation measures are described in the CNVG.

Table 2 Triggers for additional mitigation measures – Airborne noise (Roads and Maritime 2016)

Predicted airborne LAeq(15min) noise level at receiver			
Perception	dB(A) above RBL	dB(A) above NML	Additional mitigation measures
All hours			
75 dB(A) or greater			N, V, PC, RO
Standard hours: Mon - Fri (7am – 6pm), Sat (8am – 1pm), Sun/Pub Hol (Nil)			
Noticeable	5 to 10	0	-
Clearly audible	10 to 20	< 10	-
Moderately intrusive	20 to 30	10 to 20	N, V
Highly intrusive	> 30	> 20	N, V
OOHW Period 1: Mon – Fri (6pm – 10pm), Sat (7am – 8am & 1pm – 10pm), Sun/Pub Hol (8am – 6pm)			
Noticeable	5 to 10	<5	-
Clearly audible	10 to 20	5 to 15	N, R1, DR
Moderately intrusive	20 to 30	15 to 25	V, N, R1, DR
Highly intrusive	> 30	>25	V, IB, N, R1, DR, PC, SN
OOHW Period 2: Mon – Fri (10pm – 7am), Sat (10pm – 8am), Sun/Pub Hol (6pm – 7am)			
Noticeable	5 to 10	<5	N
Clearly audible	10 to 20	5 to 15	V, N, R2, DR
Moderately intrusive	20 to 30	15 to 25	V, IB, N, PC, SN, R2, DR
Highly intrusive	> 30	>25	AA, V, IB, N, PC, SN, R2, DR

Notes:

PC = Phone calls

V = verification

IB = Individual briefings

N= Notification

AA = Alternative accommodation

SN = Specific notifications

RO = Respite offer

R1 = Respite period 1

R2 = Respite period 2

DR = Duration respite

Perception = relates to levels above RBL

NML = Noise management level

HA = Highly affected

Existing environment and noise management levels

The proposed works would be undertaken in a predominantly Suburban/ Urban, characterised as:

Areas with low density transportation.

Typically local traffic, light vehicles, intermittent traffic flow

Background noise levels adopted for the project area and associated noise management levels (NMLs) are summarised in Table 3. NMLs have been established in line with the ICNG.

Table 3 Construction NMLs

Land use	Suburban/ Urban		Using custom background noise data?		Yes
Criterion	Day	Weekend Day	Evening	Night	Sleep
RBL	48	48	40	34	
NML	58	53	45	39	65

Sleep disturbance

The ICNG recommends where construction works are planned to extend over more than two consecutive nights, the maximum noise level should be considered for the purposes of establishing the likelihood of sleep disturbance. The Road Noise Policy suggests that maximum internal noise levels below 50-55 dB(A) are unlikely to awaken people from sleep and one or two noise events per night, with maximum internal noise levels of 65-70 dB(A) are not likely to affect health and wellbeing significantly.

Based on this, a sleep awakening criterion of 55 dB(A) (internal) is typically adopted for works. Given that noise attenuation of 10 dB(A) is typically provided by an open window, a sleep awakening criterion of L_{Amax} 65 dB(A) (external) has been applied to residential bedroom façades. This is consistent with the sleep disturbance threshold described in Appendix E of the CNVG.

Vibration

Effects of vibration from construction may be segregated into:

- Human exposure – disturbance to building occupants: vibration in which the occupants or users of the building are inconvenienced or possibly disturbed.
- Effects on building contents – vibration where the building contents may be affected.
- Effects on building structures – vibration in which the integrity of the building or structure itself may be prejudiced.

Vibration criteria relating to human comfort applicable to this project are taken from the DEC (2006) document Assessing Vibration – A Technical Guideline for intermittent vibration – such as from drilling, compacting or activities that would result in continuous vibration if operated continuously. Intermittent vibration is assessed as a vibration dose value (VDV) and relates to the level of vibration over time (cumulative over the night or day period). VDV values that may result in adverse comment from receivers are summarised in Table 4.

Table 4 Summary of vibration dose values which might result in adverse comment

Time	Low probability of adverse comment (m/s ^{1.75})	Adverse comment possible (m/s ^{1.75})	Adverse comment probable (m/s ^{1.75})
Day (6am to 10pm)	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Night (10pm to 6am)	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Guidance for the consideration of potential building damage from construction vibration is in line with BS 7385-1 *Evaluation and measurement for vibration in buildings - Guide for measurement of vibration and evaluation of their effects on buildings*. These guideline values are presented in Table 5.

Table 5 Building damage vibration guidelines (BS 7385-1)

Type of building	Guideline values for vibration (PPV mm/s)		
	4Hz to 15Hz	15Hz to 40Hz	40Hz and above
Reinforced or framed structures / Industrial and heavy commercial buildings	50		
Un-reinforced or light framed structures / Residential or light commercial type buildings	15 - 20	20 - 50	50

For heritage structures, criteria are in line with the German Standard *DIN 4150-3: Structural Vibration- effects of vibration on structures*, as summarised in Table 6.

Table 6 Guideline values for vibration velocity to be used when evaluating the effects of short-term vibration on heritage structures (DIN 4150-3).

Type of building	Guideline values for vibration (PPV mm/s)			
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz	Vibration at horizontal plane of highest floor at all frequencies
Structures that, because of their sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	3	3 to 8	8 to 10	8

The safe working distances presented in Table 7 are indicative and will vary depending on the item of plant and local geotechnical conditions. The cosmetic damage thresholds apply to typical buildings under typical geotechnical conditions and vibration monitoring is recommended at specific sites. Where structures are more sensitive, such as heritage items, more stringent conditions are applicable and should be considered individually.

In relation to human response, the safe working distances relate to continuous vibration. For most construction activities, vibration emissions are intermittent and higher vibration levels over shorter periods are acceptable. Additional assessment should be undertaken where the human response criteria are exceeded.

Table 7 Safe working distances for vibration intensive plant

Plant item	Rating/description	Safe working distance	
		Cosmetic damage (BS 7385-1)	Human response (DECCW)
Vibratory roller	<50 kN (typically 1-2 t)	5 m	15 m to 20 m
	<100 kN (typically 2-4 t)	6 m	20 m
	<200 kN (typically 4-6 t)	12 m	40 m
	<300 kN (typically 7-13 t)	15 m	100 m
	>300 kN (typically 13-18 t)	20 m	100 m
	>300 kN (> 18 t)	25 m	100 m
Small hydraulic hammer	300 kg – 5 to 12 t excavator	2 m	7 m
Medium hydraulic hammer	900 kg – 12 to 18t excavator	7 m	23 m
Large hydraulic hammer	1600 kg – 18 to 34 t excavator	22 m	73 m
Vibratory pile driver	Sheet piles	2 m to 20 m	20 m
Pile boring	≤800 mm	2 m	n/a
Jackhammer	Hand held	1 m	Avoid contact with structure

Assessment methodology

Based on the nominated works area (illustrated in Appendix A), proposed equipment and the minimum distance from the works to each sensitive receiver, noise levels were calculated based on CONCAWE (1981) *Propagation of noise from petroleum and petrochemical complexes to neighboring communities*.

This method considers geometric spreading, atmospheric absorption, ground effects and is valid for meteorological conditions of a gentle breeze from source to receiver and stable atmosphere (temperature inversion).

KNOWnoise: Minor works is a 2-Dimensional assessment platform and does not consider terrain effects (e.g. hills, valleys) or the presence of solid structures such as homes or noise barriers. This will result in a conservative prediction, suitable for the project being assessed.

Considering the nature of the works and the type of surrounding land uses, sensitive receivers up to a radius of 300 metres from the works have been included in the assessment.

Sound power levels and predicted noise levels depend on the number of plant items operating at any one time and their precise location relative to a sensitive receiver. Equipment was assumed to be working at the worst-case location relative to each receiver and represents a worst-case assessment. Where the activity is further away from receivers or less equipment is used the predicted levels will decrease.

Sound power levels for plant and equipment expected to be used for each activity has been estimated based on guidance in the following standards and guidelines as well as typical measured noise levels for specific equipment.

- “ Australian Standard AS2436-2010: Guide to noise and vibration control on construction, demolition and maintenance sites
- “ Construction Noise and Vibration Strategy 7TP-ST-157/2.0 (CNVS), (TfNSW, 2018)
- “ Construction Noise and Vibration Guideline (CNVG) (Roads and Maritime Services, 2016)
- “ British Standard 5228-1:2009 Code of practice for noise and vibration control on construction and open sites
- “ United Kingdom Department for Environment, Food and Rural Affairs (DEFRA) Noise database for prediction of noise on construction and open sites

Construction noise sources and associated sound power levels are listed in Appendix B. The maximum predicted LAeq noise level within the work area was identified for each receiver.

Predicted noise levels

Detailed predicted noise levels for each potentially affected receiver are presented Appendix C.

A summary of predicted noise levels in comparison with ICNG assessment criteria for the Weekend day period is presented in Table 8.

Table 8 Summary of predicted noise levels with comparison against ICNG criteria for the Weekend day period.

Criterion	Predicted number of receivers
Maximum cumulative predicted L _{Aeq} , 15 minute noise level	70 dB(A)
Number of highly noise affected receivers (>75 dB)	0
1 – 10 dB above NML	11
10 – 20 dB above NML	3
20+ dB above NML	0

In line with CNVG impact classes, up to 0 receivers are predicted to be classified as Highly Impacted during the Weekend day period. A summary of the number of receivers in each class is presented in Table 9.

Table 9 Summary of predicted noise levels with comparison against CNVG criteria

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 <= 5 dB above NML	10
Clearly Audible	5 <= 15 dB above NML	5
Moderately Intrusive	15 <= 25 dB above NML	1
Highly Intrusive	> 25 dB above NML	0

Predicted impact classes for the Weekend day period are illustrated graphically in Appendix C. Each identified receiver in the study area has been coloured to highlight the predicted level of impact.

Sleep disturbance

In the event works are planned for more than two consecutive nights, up to 1 are expected to exceed the sleep awakening criteria. Where any exceedances if the awakening criteria are predicted, additional care should be taken and mitigation measures implemented in the with the CNVG.

Predicted vibration impacts

The level of vibration impact on sensitive receivers (buildings and human comfort) will largely depend on the type of machinery in use and the distance from source to receiver.

Based on the proposed work locations and selected equipment, the following level of vibration impact is expected. A summary of vibration impacts is provided for each sensitive receiver in Appendix C.

Impact classification	Number of potentially affected receivers
Human comfort	0
Cosmetic damage	0
Heritage structure	0

Proposed noise mitigation measures

The safeguards and controls listed in Table 10 will be implemented where reasonable and feasible with the intention of achieving the project noise criteria and to maintain noise impacts at a practical minimum.

Table 10 Safeguards and controls

Action	Description
Community consultation or notification	Notify the affected community. The notification will detail work activities, dates and hours, impacts and mitigation measures, indication of work schedule over the night time period, any operational noise benefits from the works (where applicable) and contact telephone number. Notification should be a minimum of 7 calendar days prior to the start of works. For projects other than maintenance works more advanced consultation or notification may be required.
Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction would at least include: - all project specific and relevant standard noise and vibration mitigation measures - relevant licence and approval conditions - permissible hours of work - any limitations on high noise generating activities - location of nearest sensitive receivers - construction employee parking areas - designated loading/unloading areas and procedures site opening/closing times (including deliveries) environmental incident procedures
Behaviour	No swearing or unnecessary shouting or loud stereos/radios on site. Limit compression braking at night in residential areas. No dropping of materials from height, throwing of metal items and slamming of doors.
Verification	Where indicated in Appendix C, a noise verification program would be undertaken for the duration of the works.
Construction hours	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels should be scheduled during less sensitive time periods.
Respite for out-of-hours works	Respite would be scheduled as indicated in Appendix C and described in the CNVG.
Equipment selection	Use quieter construction methods where feasible and reasonable. Ensure plant including the silencer is well maintained. Plant noise levels will have an operating noise emission level compliant with Appendix F of the CNVG
Use and siting of plant	The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers.

Action	Description
Plan worksites and activities to minimise noise and vibration.	Locate compounds away from sensitive receivers and discourage access from local roads. Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site. Where additional activities or plant may only result in a marginal noise increase and speed up works, consider limiting duration of impact by concentrating noisy activities at one location and move to another as quickly as possible. Very noise activities should be scheduled for normal working hours. If the work can not be undertaken during the day, it should be completed before 11:00pm. Where practicable, work should be scheduled to avoid major student examination periods when students are studying for examinations such as before or during Higher School Certificate and at the end of higher education semesters.
Non-tonal reverse alarms	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work.
Shield stationary noise sources such as pumps, generators, and compressors	These should be enclosed or shielded where reasonable and feasible.
Implement any project specific mitigation measures	
1	None

Appendix A Project location and predicted level of impact



Appendix B Proposed activities and equipment

HDD Underbore LOC105

Equipment	Quantity	Usage	Reduction	SWL
Excavator (06 tonne)	1	10 %	5	79
Horizontal direction drill	1	50 %	5	95
Vacc truck	1	50 %	5	104

Activity Sound Power Level: 105

Appendix C Detailed noise predicted for each receiver and activity

Assessment: JSD Telstra Underbore LOC105				Weekend day	Results summary		
NCA	ID	Address	Land use	NML	Cumulative Predicted LAeq, 15 minute noise level	Exceedance of NML, dB	Impact classification
NCA 1	764360	UNIT 5/ 10-12 TROPIC LODGE PLACE KORORA	RES	53	55	2	Noticable
NCA 1	764349	2 NORMAN HILL DRIVE KORORA	RES	53	55	2	Noticable
NCA 1	764346	UNIT 1/ 40 JAMES SMALL DRIVE KORORA	RES	53	63	10	Clearly Audible
NCA 1	764345	46 JAMES SMALL DRIVE KORORA	RES	53	56	3	Noticable
NCA 1	764342	38 JAMES SMALL DRIVE KORORA	RES	53	59	6	Clearly Audible
NCA 1	764340	UNIT 5/ 10-12 TROPIC LODGE PLACE KORORA	RES	53	54	1	Noticable
NCA 1	764339	UNIT 5/ 10-12 TROPIC LODGE PLACE KORORA	RES	53	57	4	Noticable
NCA 1	764338	UNIT 5/ 10-12 TROPIC LODGE PLACE KORORA	RES	53	55	2	Noticable
NCA 1	764325	UNIT 14/ 10-12 TROPIC LODGE PLACE KORORA	RES	53	56	3	Noticable
NCA 1	764307	37 JAMES SMALL DRIVE KORORA	RES	53	54	1	Noticable
NCA 1	764296	39 JAMES SMALL DRIVE KORORA	RES	53	57	4	Noticable
NCA 1	764276	2A NORMAN HILL DRIVE KORORA	RES	53	53	0	Noticable
NCA 1	764275	44 JAMES SMALL DRIVE KORORA	RES	53	59	6	Clearly Audible
NCA 1	764252	38A JAMES SMALL DRIVE KORORA	RES	53	63	10	Clearly Audible
NCA 1	764249	UNIT 1/ 40 JAMES SMALL DRIVE KORORA	RES	53	70	17	Moderately Intrusive
NCA 1	764248	42 JAMES SMALL DRIVE KORORA	RES	53	63	10	Clearly Audible

Construction noise impact assessment

Excavation and Manhole Installation - Daytime

OOHW

NUR JSD LOC 105

Proposed works	JSD Telstra Underbore LOC105		
Proponent	Quickway		
Assessment Date	16/11/2022		
Prepared by	Tom St Vincent Welch	Assessment Id	OOH009

Introduction

This report has been prepared using the construction noise self-assessment platform KNOWnoise: *Minor Works* and presents an assessment of the likely noise impacts related to proposed works associated with the above project. Where possible, these works would be completed during standard construction hours; however, there may be a need to work outside these hours due to technical, community or access limitations. The location of the proposed works is illustrated in Appendix A.

Planned works

A description of the proposed works is as follows.

Underbore at LOC 105

Proposed activities and equipment for the works are summarised in Appendix B.

Though subject to change, the works are expected to commence around 23/01/2023 and would be completed by 29/01/2023.

Assessment criteria and mitigation requirements

The Interim Construction Noise Guideline (ICNG) (DECC 2009) describes noise more than the background level as potentially having an adverse impact on sensitive receivers and increasing the likelihood of complaint. During standard construction hours, where construction noise is within 10 dB(A) of the RBL, impacts would be acceptable.

Where construction noise is more than 10 dB(A) above the RBL during standard construction hours, a residential receiver is considered noise affected and the proponent should undertake all reasonable and feasible steps necessary to manage the impact and consult with the affected community.

Above a LAeq, 15 minute noise level of 75 dB(A), a receiver is highly affected, requiring consideration of additional mitigation measures including alternative accommodation in the night period.

Outside standard construction hours, construction noise at a residential receiver more than 5 dB(A) above the RBL is taken to be noise affected.

In addition, annoying noise such as rock hammers, impact piling, or other impulsive noise sources usually result in greater annoyance than continuous construction noise. A 5 dB(A) penalty is applicable to such activities prior to comparison with the NMLs.

Other sensitive land uses, such as schools and offices, typically find noise from construction disruptive when the properties are being used (such as during work and school times). Table 2 presents NMLs from the ICNG for sensitive land uses based on the principle that the characteristic activities for each of these land uses should not be unduly disturbed.

Table 1 Non-residential sensitive land uses noise management levels

Land use	Noise assessment location	NML (L _{Aeq,15min})
Classrooms at schools and other educational institutions	Internal	45
Places of worship		
Active recreation areas (such as sporting activities and activities which generate their own noise or focus for participants)	External	65
Passive recreation areas (contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External	60
Industrial premises	External	75
Office, retail outlets	External	70

As part of planning for out of hours works, standard mitigation measures, as described in the ICNG and CNVG, would be implemented where reasonable and feasible. However, after these measures have been applied, noise and vibration levels may continue to exceed the NMLs.

In this case, additional mitigation measures outlined in the CNVG, which largely focus on engagement with affected sensitive receivers, should be implemented where reasonable and feasible, unless other agreements are in place with the impacted receiver.

Triggers and additional mitigation measures for airborne noise are summarised in Table 2. Further details of specific additional mitigation measures are described in the CNVG.

Table 2 Triggers for additional mitigation measures – Airborne noise (Roads and Maritime 2016)

Predicted airborne LAeq(15min) noise level at receiver			
Perception	dB(A) above RBL	dB(A) above NML	Additional mitigation measures
All hours			
75 dB(A) or greater			N, V, PC, RO
Standard hours: Mon - Fri (7am – 6pm), Sat (8am – 1pm), Sun/Pub Hol (Nil)			
Noticeable	5 to 10	0	-
Clearly audible	10 to 20	< 10	-
Moderately intrusive	20 to 30	10 to 20	N, V
Highly intrusive	> 30	> 20	N, V
OOHW Period 1: Mon – Fri (6pm – 10pm), Sat (7am – 8am & 1pm – 10pm), Sun/Pub Hol (8am – 6pm)			
Noticeable	5 to 10	<5	-
Clearly audible	10 to 20	5 to 15	N, R1, DR
Moderately intrusive	20 to 30	15 to 25	V, N, R1, DR
Highly intrusive	> 30	>25	V, IB, N, R1, DR, PC, SN
OOHW Period 2: Mon – Fri (10pm – 7am), Sat (10pm – 8am), Sun/Pub Hol (6pm – 7am)			
Noticeable	5 to 10	<5	N
Clearly audible	10 to 20	5 to 15	V, N, R2, DR
Moderately intrusive	20 to 30	15 to 25	V, IB, N, PC, SN, R2, DR
Highly intrusive	> 30	>25	AA, V, IB, N, PC, SN, R2, DR

Notes:

PC = Phone calls

V = verification

IB = Individual briefings

N= Notification

AA = Alternative accommodation

SN = Specific notifications

RO = Respite offer

R1 = Respite period 1

R2 = Respite period 2

DR = Duration respite

Perception = relates to levels above RBL

NML = Noise management level

HA = Highly affected

Existing environment and noise management levels

The proposed works would be undertaken in a predominantly Suburban/ Urban, characterised as:

Areas with low density transportation.

Typically local traffic, light vehicles, intermittent traffic flow

Background noise levels adopted for the project area and associated noise management levels (NMLs) are summarised in Table 3. NMLs have been established in line with the ICNG.

Table 3 Construction NMLs

Land use	Suburban/ Urban		Using custom background noise data?		Yes
Criterion	Day	Weekend Day	Evening	Night	Sleep
RBL	48	48	40	34	
NML	58	53	45	39	65

Sleep disturbance

The ICNG recommends where construction works are planned to extend over more than two consecutive nights, the maximum noise level should be considered for the purposes of establishing the likelihood of sleep disturbance. The Road Noise Policy suggests that maximum internal noise levels below 50-55 dB(A) are unlikely to awaken people from sleep and one or two noise events per night, with maximum internal noise levels of 65-70 dB(A) are not likely to affect health and wellbeing significantly.

Based on this, a sleep awakening criterion of 55 dB(A) (internal) is typically adopted for works. Given that noise attenuation of 10 dB(A) is typically provided by an open window, a sleep awakening criterion of L_{Amax} 65 dB(A) (external) has been applied to residential bedroom façades. This is consistent with the sleep disturbance threshold described in Appendix E of the CNVG.

Vibration

Effects of vibration from construction may be segregated into:

- Human exposure – disturbance to building occupants: vibration in which the occupants or users of the building are inconvenienced or possibly disturbed.
- Effects on building contents – vibration where the building contents may be affected.
- Effects on building structures – vibration in which the integrity of the building or structure itself may be prejudiced.

Vibration criteria relating to human comfort applicable to this project are taken from the DEC (2006) document Assessing Vibration – A Technical Guideline for intermittent vibration – such as from drilling, compacting or activities that would result in continuous vibration if operated continuously. Intermittent vibration is assessed as a vibration dose value (VDV) and relates to the level of vibration over time (cumulative over the night or day period). VDV's that may result in adverse comment from receivers are summarised in Table 4.

Table 4 Summary of vibration dose values which might result in adverse comment

Time	Low probability of adverse comment (m/s ^{1.75})	Adverse comment possible (m/s ^{1.75})	Adverse comment probable (m/s ^{1.75})
Day (6am to 10pm)	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Night (10pm to 6am)	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Guidance for the consideration of potential building damage from construction vibration is in line with BS 7385-1 *Evaluation and measurement for vibration in buildings - Guide for measurement of vibration and evaluation of their effects on buildings*. These guideline values are presented in Table 5.

Table 5 Building damage vibration guidelines (BS 7385-1)

Type of building	Guideline values for vibration (PPV mm/s)		
	4Hz to 15Hz	15Hz to 40Hz	40Hz and above
Reinforced or framed structures / Industrial and heavy commercial buildings	50		
Un-reinforced or light framed structures / Residential or light commercial type buildings	15 - 20	20 - 50	50

For heritage structures, criteria are in line with the German Standard *DIN 4150-3: Structural Vibration- effects of vibration on structures*, as summarised in Table 6.

Table 6 Guideline values for vibration velocity to be used when evaluating the effects of short-term vibration on heritage structures (DIN 4150-3).

Type of building	Guideline values for vibration (PPV mm/s)			
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz	Vibration at horizontal plane of highest floor at all frequencies
Structures that, because of their sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	3	3 to 8	8 to 10	8

The safe working distances presented in Table 7 are indicative and will vary depending on the item of plant and local geotechnical conditions. The cosmetic damage thresholds apply to typical buildings under typical geotechnical conditions and vibration monitoring is recommended at specific sites. Where structures are more sensitive, such as heritage items, more stringent conditions are applicable and should be considered individually.

In relation to human response, the safe working distances relate to continuous vibration. For most construction activities, vibration emissions are intermittent and higher vibration levels over shorter periods are acceptable. Additional assessment should be undertaken where the human response criteria are exceeded.

Table 7 Safe working distances for vibration intensive plant

Plant item	Rating/description	Safe working distance	
		Cosmetic damage (BS 7385-1)	Human response (DECCW)
Vibratory roller	<50 kN (typically 1-2 t)	5 m	15 m to 20 m
	<100 kN (typically 2-4 t)	6 m	20 m
	<200 kN (typically 4-6 t)	12 m	40 m
	<300 kN (typically 7-13 t)	15 m	100 m
	>300 kN (typically 13-18 t)	20 m	100 m
	>300 kN (> 18 t)	25 m	100 m
Small hydraulic hammer	300 kg – 5 to 12 t excavator	2 m	7 m
Medium hydraulic hammer	900 kg – 12 to 18t excavator	7 m	23 m
Large hydraulic hammer	1600 kg – 18 to 34 t excavator	22 m	73 m
Vibratory pile driver	Sheet piles	2 m to 20 m	20 m
Pile boring	≤800 mm	2 m	n/a
Jackhammer	Hand held	1 m	Avoid contact with structure

Assessment methodology

Based on the nominated works area (illustrated in Appendix A), proposed equipment and the minimum distance from the works to each sensitive receiver, noise levels were calculated based on CONCAWE (1981) *Propagation of noise from petroleum and petrochemical complexes to neighboring communities*.

This method considers geometric spreading, atmospheric absorption, ground effects and is valid for meteorological conditions of a gentle breeze from source to receiver and stable atmosphere (temperature inversion).

KNOWnoise: Minor works is a 2-Dimensional assessment platform and does not consider terrain effects (e.g. hills, valleys) or the presence of solid structures such as homes or noise barriers. This will result in a conservative prediction, suitable for the project being assessed.

Considering the nature of the works and the type of surrounding land uses, sensitive receivers up to a radius of 300 metres from the works have been included in the assessment.

Sound power levels and predicted noise levels depend on the number of plant items operating at any one time and their precise location relative to a sensitive receiver. Equipment was assumed to be working at the worst-case location relative to each receiver and represents a worst-case assessment. Where the activity is further away from receivers or less equipment is used the predicted levels will decrease.

Sound power levels for plant and equipment expected to be used for each activity has been estimated based on guidance in the following standards and guidelines as well as typical measured noise levels for specific equipment.

- “ Australian Standard AS2436-2010: Guide to noise and vibration control on construction, demolition and maintenance sites
- “ Construction Noise and Vibration Strategy 7TP-ST-157/2.0 (CNVS), (TfNSW, 2018)
- “ Construction Noise and Vibration Guideline (CNVG) (Roads and Maritime Services, 2016)
- “ British Standard 5228-1:2009 Code of practice for noise and vibration control on construction and open sites
- “ United Kingdom Department for Environment, Food and Rural Affairs (DEFRA) Noise database for prediction of noise on construction and open sites

Construction noise sources and associated sound power levels are listed in Appendix B. The maximum predicted LAeq noise level within the work area was identified for each receiver.

Predicted noise levels

Detailed predicted noise levels for each potentially affected receiver are presented Appendix C.

A summary of predicted noise levels in comparison with ICNG assessment criteria for the Weekend day period is presented in Table 8.

Table 8 Summary of predicted noise levels with comparison against ICNG criteria for the Weekend day period.

Criterion	Predicted number of receivers
Maximum cumulative predicted L _{Aeq} , 15 minute noise level	63 dB(A)
Number of highly noise affected receivers (>75 dB)	0
1 – 10 dB above NML	4
10 – 20 dB above NML	0
20+ dB above NML	0

In line with CNVG impact classes, up to 0 receivers are predicted to be classified as Highly Impacted during the Weekend day period. A summary of the number of receivers in each class is presented in Table 9.

Table 9 Summary of predicted noise levels with comparison against CNVG criteria

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 <= 5 dB above NML	3
Clearly Audible	5 <= 15 dB above NML	1
Moderately Intrusive	15 <= 25 dB above NML	0
Highly Intrusive	> 25 dB above NML	0

Predicted impact classes for the Weekend day period are illustrated graphically in Appendix C. Each identified receiver in the study area has been coloured to highlight the predicted level of impact.

Sleep disturbance

In the event works are planned for more than two consecutive nights, up to 0 are expected to exceed the sleep awakening criteria. Where any exceedances if the awakening criteria are predicted, additional care should be taken and mitigation measures implemented in the with the CNVG.

Predicted vibration impacts

The level of vibration impact on sensitive receivers (buildings and human comfort) will largely depend on the type of machinery in use and the distance from source to receiver.

Based on the proposed work locations and selected equipment, the following level of vibration impact is expected. A summary of vibration impacts is provided for each sensitive receiver in Appendix C.

Impact classification	Number of potentially affected receivers
Human comfort	0
Cosmetic damage	0
Heritage structure	0

Proposed noise mitigation measures

The safeguards and controls listed in Table 10 will be implemented where reasonable and feasible with the intention of achieving the project noise criteria and to maintain noise impacts at a practical minimum.

Table 10 Safeguards and controls

Action	Description
Community consultation or notification	Notify the affected community. The notification will detail work activities, dates and hours, impacts and mitigation measures, indication of work schedule over the night time period, any operational noise benefits from the works (where applicable) and contact telephone number. Notification should be a minimum of 7 calendar days prior to the start of works. For projects other than maintenance works more advanced consultation or notification may be required.
Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction would at least include: - all project specific and relevant standard noise and vibration mitigation measures - relevant licence and approval conditions - permissible hours of work - any limitations on high noise generating activities - location of nearest sensitive receivers - construction employee parking areas - designated loading/unloading areas and procedures site opening/closing times (including deliveries) environmental incident procedures
Behaviour	No swearing or unnecessary shouting or loud stereos/radios on site. Limit compression braking at night in residential areas. No dropping of materials from height, throwing of metal items and slamming of doors.
Verification	Where indicated in Appendix C, a noise verification program would be undertaken for the duration of the works.
Construction hours	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels should be scheduled during less sensitive time periods.
Respite for out-of-hours works	Respite would be scheduled as indicated in Appendix C and described in the CNVG.
Equipment selection	Use quieter construction methods where feasible and reasonable. Ensure plant including the silencer is well maintained. Plant noise levels will have an operating noise emission level compliant with Appendix F of the CNVG
Use and siting of plant	The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers.

Action	Description
Plan worksites and activities to minimise noise and vibration.	Locate compounds away from sensitive receivers and discourage access from local roads. Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site. Where additional activities or plant may only result in a marginal noise increase and speed up works, consider limiting duration of impact by concentrating noisy activities at one location and move to another as quickly as possible. Very noise activities should be scheduled for normal working hours. If the work can not be undertaken during the day, it should be completed before 11:00pm. Where practicable, work should be scheduled to avoid major student examination periods when students are studying for examinations such as before or during Higher School Certificate and at the end of higher education semesters.
Non-tonal reverse alarms	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work.
Shield stationary noise sources such as pumps, generators, and compressors	These should be enclosed or shielded where reasonable and feasible.
Implement any project specific mitigation measures	
1	None

Appendix A Project location and predicted level of impact



Appendix B Proposed activities and equipment

Excavation for pits and manholes

Equipment	Quantity	Usage	Reduction	SWL
Excavator (06 tonne)	1	80 %	0	93
Franna Crane	1	60 %	0	96

Activity Sound Power Level: 98

Appendix C Detailed noise predicted for each receiver and activity

Assessment: JSD Telstra Underbore LOC105				Weekend day	Results summary		
NCA	ID	Address	Land use	NML	Cumulative Predicted LAeq, 15 minute noise level	Exceedance of NML, dB	Impact classification
NCA 1	764346	UNIT 1/ 40 JAMES SMALL DRIVE KORORA	RES	53	56	3	Noticable
NCA 1	764252	38A JAMES SMALL DRIVE KORORA	RES	53	56	3	Noticable
NCA 1	764249	UNIT 1/ 40 JAMES SMALL DRIVE KORORA	RES	53	63	10	Clearly Audible
NCA 1	764248	42 JAMES SMALL DRIVE KORORA	RES	53	56	3	Noticable

Construction noise impact assessment

Daytime OOH - LOC116

NUR

Proposed works JSD Telstra Underbore
Proponent Quickway

Assessment Date 08/11/2022

Prepared by Tom St Vincent Welch

Assessment Id OOHW009

Introduction

This report has been prepared using the construction noise self-assessment platform KNOWnoise: *Minor Works* and presents an assessment of the likely noise impacts related to proposed works associated with the above project. Where possible, these works would be completed during standard construction hours; however, there may be a need to work outside these hours due to technical, community or access limitations. The location of the proposed works is illustrated in Appendix A.

Planned works

A description of the proposed works is as follows.

Underbore for Telstra work on James Small Drive

Proposed activities and equipment for the works are summarised in Appendix B.

Though subject to change, the works are expected to commence around 16/01/2023 and would be completed by 22/01/2023.

Assessment criteria and mitigation requirements

The Interim Construction Noise Guideline (ICNG) (DECC 2009) describes noise more than the background level as potentially having an adverse impact on sensitive receivers and increasing the likelihood of complaint. During standard construction hours, where construction noise is within 10 dB(A) of the RBL, impacts would be acceptable.

Where construction noise is more than 10 dB(A) above the RBL during standard construction hours, a residential receiver is considered noise affected and the proponent should undertake all reasonable and feasible steps necessary to manage the impact and consult with the affected community.

Above a LAeq, 15 minute noise level of 75 dB(A), a receiver is highly affected, requiring consideration of additional mitigation measures including alternative accommodation in the night period.

Outside standard construction hours, construction noise at a residential receiver more than 5 dB(A) above the RBL is taken to be noise affected.

In addition, annoying noise such as rock hammers, impact piling, or other impulsive noise sources usually result in greater annoyance than continuous construction noise. A 5 dB(A) penalty is applicable to such activities prior to comparison with the NMLs.

Other sensitive land uses, such as schools and offices, typically find noise from construction disruptive when the properties are being used (such as during work and school times). Table 2 presents NMLs from the ICNG for sensitive land uses based on the principle that the characteristic activities for each of these land uses should not be unduly disturbed.

Table 1 Non-residential sensitive land uses noise management levels

Land use	Noise assessment location	NML (L _{Aeq,15min})
Classrooms at schools and other educational institutions	Internal	45
Places of worship		
Active recreation areas (such as sporting activities and activities which generate their own noise or focus for participants)	External	65
Passive recreation areas (contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External	60
Industrial premises	External	75
Office, retail outlets	External	70

As part of planning for out of hours works, standard mitigation measures, as described in the ICNG and CNVG, would be implemented where reasonable and feasible. However, after these measures have been applied, noise and vibration levels may continue to exceed the NMLs.

In this case, additional mitigation measures outlined in the CNVG, which largely focus on engagement with affected sensitive receivers, should be implemented where reasonable and feasible, unless other agreements are in place with the impacted receiver.

Triggers and additional mitigation measures for airborne noise are summarised in Table 2. Further details of specific additional mitigation measures are described in the CNVG.

Table 2 Triggers for additional mitigation measures – Airborne noise (Roads and Maritime 2016)

Predicted airborne LAeq(15min) noise level at receiver			
Perception	dB(A) above RBL	dB(A) above NML	Additional mitigation measures
All hours			
75 dB(A) or greater			N, V, PC, RO
Standard hours: Mon - Fri (7am – 6pm), Sat (8am – 1pm), Sun/Pub Hol (Nil)			
Noticeable	5 to 10	0	-
Clearly audible	10 to 20	< 10	-
Moderately intrusive	20 to 30	10 to 20	N, V
Highly intrusive	> 30	> 20	N, V
OOHW Period 1: Mon – Fri (6pm – 10pm), Sat (7am – 8am & 1pm – 10pm), Sun/Pub Hol (8am – 6pm)			
Noticeable	5 to 10	<5	-
Clearly audible	10 to 20	5 to 15	N, R1, DR
Moderately intrusive	20 to 30	15 to 25	V, N, R1, DR
Highly intrusive	> 30	>25	V, IB, N, R1, DR, PC, SN
OOHW Period 2: Mon – Fri (10pm – 7am), Sat (10pm – 8am), Sun/Pub Hol (6pm – 7am)			
Noticeable	5 to 10	<5	N
Clearly audible	10 to 20	5 to 15	V, N, R2, DR
Moderately intrusive	20 to 30	15 to 25	V, IB, N, PC, SN, R2, DR
Highly intrusive	> 30	>25	AA, V, IB, N, PC, SN, R2, DR

Notes:

PC = Phone calls

V = verification

IB = Individual briefings

N= Notification

AA = Alternative accommodation

SN = Specific notifications

RO = Respite offer

R1 = Respite period 1

R2 = Respite period 2

DR = Duration respite

Perception = relates to levels above RBL

NML = Noise management level

HA = Highly affected

Existing environment and noise management levels

The proposed works would be undertaken in a predominantly Suburban/ Urban, characterised as:

Areas with low density transportation.

Typically local traffic, light vehicles, intermittent traffic flow

Background noise levels adopted for the project area and associated noise management levels (NMLs) are summarised in Table 3. NMLs have been established in line with the ICNG.

Table 3 Construction NMLs

Land use	Suburban/ Urban		Using custom background noise data?		Yes
Criterion	Day	Weekend Day	Evening	Night	Sleep
RBL	48	48	40	34	
NML	58	53	45	39	65

Sleep disturbance

The ICNG recommends where construction works are planned to extend over more than two consecutive nights, the maximum noise level should be considered for the purposes of establishing the likelihood of sleep disturbance. The Road Noise Policy suggests that maximum internal noise levels below 50-55 dB(A) are unlikely to awaken people from sleep and one or two noise events per night, with maximum internal noise levels of 65-70 dB(A) are not likely to affect health and wellbeing significantly.

Based on this, a sleep awakening criterion of 55 dB(A) (internal) is typically adopted for works. Given that noise attenuation of 10 dB(A) is typically provided by an open window, a sleep awakening criterion of L_{Amax} 65 dB(A) (external) has been applied to residential bedroom façades. This is consistent with the sleep disturbance threshold described in Appendix E of the CNVG.

Assessment methodology

Based on the nominated works area (illustrated in Appendix A), proposed equipment and the minimum distance from the works to each sensitive receiver, noise levels were calculated based on CONCAWE (1981) *Propagation of noise from petroleum and petrochemical complexes to neighboring communities*.

This method considers geometric spreading, atmospheric absorption, ground effects and is valid for meteorological conditions of a gentle breeze from source to receiver and stable atmosphere (temperature inversion).

KNOWnoise: Minor works is a 2-Dimensional assessment platform and does not consider terrain effects (e.g. hills, valleys) or the presence of solid structures such as homes or noise barriers. This will result in a conservative prediction, suitable for the project being assessed.

Considering the nature of the works and the type of surrounding land uses, sensitive receivers up to a radius of 300 metres from the works have been included in the assessment.

Sound power levels and predicted noise levels depend on the number of plant items operating at any one time and their precise location relative to a sensitive receiver. Equipment was assumed to be working at the worst-case location relative to each receiver and represents a worst-case assessment. Where the activity is further away from receivers or less equipment is used the predicted levels will decrease.

Sound power levels for plant and equipment expected to be used for each activity has been estimated based on guidance in the following standards and guidelines as well as typical measured noise levels for specific equipment.

- “ Australian Standard AS2436-2010: Guide to noise and vibration control on construction, demolition and maintenance sites
- “ Construction Noise and Vibration Strategy 7TP-ST-157/2.0 (CNVS), (TfNSW, 2018)
- “ Construction Noise and Vibration Guideline (CNVG) (Roads and Maritime Services, 2016)
- “ British Standard 5228-1:2009 Code of practice for noise and vibration control on construction and open sites

“ United Kingdom Department for Environment, Food and Rural Affairs (DEFRA) Noise database for prediction of noise on construction and open sites

Construction noise sources and associated sound power levels are listed in Appendix B. The maximum predicted LAeq noise level within the work area was identified for each receiver.

Predicted noise levels

Detailed predicted noise levels for each potentially affected receiver are presented Appendix C.

A summary of predicted noise levels in comparison with ICNG assessment criteria for the Weekend day period is presented in Table 4.

Table 4 Summary of predicted noise levels with comparison against ICNG criteria for the Weekend day period.

Criterion	Predicted number of receivers
Maximum cumulative predicted L _{Aeq, 15 minute} noise level	65 dB(A)
Number of highly noise affected receivers (>75 dB)	0
1 – 10 dB above NML	5
10 – 20 dB above NML	2
20+ dB above NML	0

For works outside standard hours, up to 0 receivers are predicted to be classified as Highly Impacted during the Weekend day period. A summary of the number of receivers in each class is presented in Table 5.

Table 5 Summary of predicted noise levels with comparison against CNVG criteria

Impact class	Predicted noise level	Predicted number of receivers
Noticeable	1 – 5 dB above NML	4
Clearly audible	5 – 15 dB above NML	4
Moderately impacted	15 – 25 dB above NML	0
Highly Impacted	> 25 dB above NML	0

Predicted impact classes for the Weekend day period are illustrated graphically in Appendix C. Each identified receiver in the study area has been coloured to highlight the predicted level of impact.

Sleep disturbance

In the event works are planned for more than two consecutive nights, up to 1 are expected to exceed the sleep awakening criteria. Where any exceedances if the awakening criteria are predicted, additional care should be taken and mitigation measures implemented in the with the CNVG.

Proposed noise mitigation measures

The safeguards and controls listed in Table 6 will be implemented where reasonable and feasible with the intention of achieving the project noise criteria and to maintain noise impacts at a practical minimum.

Table 6 Safeguards and controls

Action	Description
Community consultation or notification	Notify the affected community. The notification will detail work activities, dates and hours, impacts and mitigation measures, indication of work schedule over the night time period, any operational noise benefits from the works (where applicable) and contact telephone number. Notification should be a minimum of 7 calendar days prior to the start of works. For projects other than maintenance works more advanced consultation or notification may be required.
Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction would at least include: • all project specific and relevant standard noise and vibration mitigation measures • relevant licence and approval conditions • permissible hours of work • any limitations on high noise generating activities • location of nearest sensitive receivers • construction employee parking areas • designated loading/unloading areas and procedures site opening/closing times (including deliveries) environmental incident procedures
Behaviour	No swearing or unnecessary shouting or loud stereos/radios on site. Limit compression braking at night in residential areas. No dropping of materials from height, throwing of metal items and slamming of doors.
Verification	Where indicated in Appendix C, a noise verification program would be undertaken for the duration of the works.
Construction hours	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels should be scheduled during less sensitive time periods.
Respite for out-of-hours works	Respite would be scheduled as indicated in Appendix C and described in the CNVG.
Equipment selection	Use quieter construction methods where feasible and reasonable. Ensure plant including the silencer is well maintained. Plant noise levels will have an operating noise emission level compliant with Appendix F of the CNVG
Use and siting of plant	The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers.

Action	Description
Plan worksites and activities to minimise noise and vibration.	Locate compounds away from sensitive receivers and discourage access from local roads. Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site. Where additional activities or plant may only result in a marginal noise increase and speed up works, consider limiting duration of impact by concentrating noisy activities at one location and move to another as quickly as possible. Very noise activities should be scheduled for normal working hours. If the work can not be undertaken during the day, it should be completed before 11:00pm. Where practicable, work should be scheduled to avoid major student examination periods when students are studying for examinations such as before or during Higher School Certificate and at the end of higher education semesters.
Non-tonal reverse alarms	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work.
Shield stationary noise sources such as pumps, generators, and compressors	These should be enclosed or shielded where reasonable and feasible.
Implement any project specific mitigation measures	
1	None

Appendix A Project location and predicted level of impact



Appendix B Proposed activities and equipment

HDD Underbore (Shot 3)

Equipment	Quantity	Usage	Reduction	SWL
Excavator (06 tonne)	1	10 %	5	79
Horizontal direction drill	1	50 %	5	95
Vacc truck	1	50 %	5	104

Activity Sound Power Level: 105

Appendix C Detailed noise predicted for each receiver and activity

Assessment: JSD Telstra Underbore				Weekend day	Results summary		
NCA	ID	Address	Land use	NML	Cumulative Predicted LAeq, 15 minute noise level	Exceedance of NML, dB	Impact classification
NCA 1	763897	54 JAMES SMALL DRIVE KORORA	RES	53	64	11	Clearly Audible
NCA 1	763875	UNIT 1/ 50 JAMES SMALL DRIVE KORORA	RES	53	57	4	Noticable
NCA 1	763870	UNIT 2/ 50 JAMES SMALL DRIVE KORORA	RES	53	55	2	Noticable
NCA 1	763848	3 TROPIC LODGE PLACE KORORA	RES	53	55	2	Noticable
NCA 1	763847	1 TROPIC LODGE PLACE KORORA	RES	53	65	12	Clearly Audible
NCA 1	763839	48A JAMES SMALL DRIVE KORORA	RES	53	53	0	Noticable
NCA 1	763830	50A JAMES SMALL DRIVE KORORA	RES	53	58	5	Clearly Audible
NCA 1	763829	50A JAMES SMALL DRIVE KORORA	RES	53	62	9	Clearly Audible

Construction noise impact assessment

Excavation and Manhole Installation - Daytime

OOHW

NUR JSD LOC 116

Proposed works	JSD Telstra Underbore		
Proponent	Quickway		
Assessment Date	08/11/2022		
Prepared by	Tom St Vincent Welch	Assessment Id	OOHW009

Introduction

This report has been prepared using the construction noise self-assessment platform KNOWnoise: *Minor Works* and presents an assessment of the likely noise impacts related to proposed works associated with the above project. Where possible, these works would be completed during standard construction hours; however, there may be a need to work outside these hours due to technical, community or access limitations. The location of the proposed works is illustrated in Appendix A.

Planned works

A description of the proposed works is as follows.

Underbore for Telstra work on James Small Drive

Proposed activities and equipment for the works are summarised in Appendix B.

Though subject to change, the works are expected to commence around 23/01/2023 and would be completed by 29/01/2023.

Assessment criteria and mitigation requirements

The Interim Construction Noise Guideline (ICNG) (DECC 2009) describes noise more than the background level as potentially having an adverse impact on sensitive receivers and increasing the likelihood of complaint. During standard construction hours, where construction noise is within 10 dB(A) of the RBL, impacts would be acceptable.

Where construction noise is more than 10 dB(A) above the RBL during standard construction hours, a residential receiver is considered noise affected and the proponent should undertake all reasonable and feasible steps necessary to manage the impact and consult with the affected community.

Above a LAeq, 15 minute noise level of 75 dB(A), a receiver is highly affected, requiring consideration of additional mitigation measures including alternative accommodation in the night period.

Outside standard construction hours, construction noise at a residential receiver more than 5 dB(A) above the RBL is taken to be noise affected.

In addition, annoying noise such as rock hammers, impact piling, or other impulsive noise sources usually result in greater annoyance than continuous construction noise. A 5 dB(A) penalty is applicable to such activities prior to comparison with the NMLs.

Other sensitive land uses, such as schools and offices, typically find noise from construction disruptive when the properties are being used (such as during work and school times). Table 2 presents NMLs from the ICNG for sensitive land uses based on the principle that the characteristic activities for each of these land uses should not be unduly disturbed.

Table 1 Non-residential sensitive land uses noise management levels

Land use	Noise assessment location	NML (L _{Aeq,15min})
Classrooms at schools and other educational institutions	Internal	45
Places of worship		
Active recreation areas (such as sporting activities and activities which generate their own noise or focus for participants)	External	65
Passive recreation areas (contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External	60
Industrial premises	External	75
Office, retail outlets	External	70

As part of planning for out of hours works, standard mitigation measures, as described in the ICNG and CNVG, would be implemented where reasonable and feasible. However, after these measures have been applied, noise and vibration levels may continue to exceed the NMLs.

In this case, additional mitigation measures outlined in the CNVG, which largely focus on engagement with affected sensitive receivers, should be implemented where reasonable and feasible, unless other agreements are in place with the impacted receiver.

Triggers and additional mitigation measures for airborne noise are summarised in Table 2. Further details of specific additional mitigation measures are described in the CNVG.

Table 2 Triggers for additional mitigation measures – Airborne noise (Roads and Maritime 2016)

Predicted airborne L _{Aeq} (15min) noise level at receiver			
Perception	dB(A) above RBL	dB(A) above NML	Additional mitigation measures
All hours			
75 dB(A) or greater			N, V, PC, RO
Standard hours: Mon - Fri (7am – 6pm), Sat (8am – 1pm), Sun/Pub Hol (Nil)			
Noticeable	5 to 10	0	-
Clearly audible	10 to 20	< 10	-
Moderately intrusive	20 to 30	10 to 20	N, V
Highly intrusive	> 30	> 20	N, V
OOHW Period 1: Mon – Fri (6pm – 10pm), Sat (7am – 8am & 1pm – 10pm), Sun/Pub Hol (8am – 6pm)			
Noticeable	5 to 10	<5	-
Clearly audible	10 to 20	5 to 15	N, R1, DR
Moderately intrusive	20 to 30	15 to 25	V, N, R1, DR
Highly intrusive	> 30	>25	V, IB, N, R1, DR, PC, SN
OOHW Period 2: Mon – Fri (10pm – 7am), Sat (10pm – 8am), Sun/Pub Hol (6pm – 7am)			
Noticeable	5 to 10	<5	N
Clearly audible	10 to 20	5 to 15	V, N, R2, DR
Moderately intrusive	20 to 30	15 to 25	V, IB, N, PC, SN, R2, DR
Highly intrusive	> 30	>25	AA, V, IB, N, PC, SN, R2, DR

Notes:

PC = Phone calls

V = verification

IB = Individual briefings

N= Notification

AA = Alternative accommodation

SN = Specific notifications

RO = Respite offer

R1 = Respite period 1

R2 = Respite period 2

DR = Duration respite

Perception = relates to levels above RBL

NML = Noise management level

HA = Highly affected

Existing environment and noise management levels

The proposed works would be undertaken in a predominantly Suburban/ Urban, characterised as:

Areas with low density transportation.

Typically local traffic, light vehicles, intermittent traffic flow

Background noise levels adopted for the project area and associated noise management levels (NMLs) are summarised in Table 3. NMLs have been established in line with the ICNG.

Table 3 Construction NMLs

Land use	Suburban/ Urban		Using custom background noise data?		Yes
Criterion	Day	Weekend Day	Evening	Night	Sleep
RBL	48	48	40	34	
NML	58	53	45	39	65

Sleep disturbance

The ICNG recommends where construction works are planned to extend over more than two consecutive nights, the maximum noise level should be considered for the purposes of establishing the likelihood of sleep disturbance. The Road Noise Policy suggests that maximum internal noise levels below 50-55 dB(A) are unlikely to awaken people from sleep and one or two noise events per night, with maximum internal noise levels of 65-70 dB(A) are not likely to affect health and wellbeing significantly.

Based on this, a sleep awakening criterion of 55 dB(A) (internal) is typically adopted for works. Given that noise attenuation of 10 dB(A) is typically provided by an open window, a sleep awakening criterion of L_{Amax} 65 dB(A) (external) has been applied to residential bedroom façades. This is consistent with the sleep disturbance threshold described in Appendix E of the CNVG.

Assessment methodology

Based on the nominated works area (illustrated in Appendix A), proposed equipment and the minimum distance from the works to each sensitive receiver, noise levels were calculated based on CONCAWE (1981) *Propagation of noise from petroleum and petrochemical complexes to neighboring communities*.

This method considers geometric spreading, atmospheric absorption, ground effects and is valid for meteorological conditions of a gentle breeze from source to receiver and stable atmosphere (temperature inversion).

KNOWnoise: Minor works is a 2-Dimensional assessment platform and does not consider terrain effects (e.g. hills, valleys) or the presence of solid structures such as homes or noise barriers. This will result in a conservative prediction, suitable for the project being assessed.

Considering the nature of the works and the type of surrounding land uses, sensitive receivers up to a radius of 300 metres from the works have been included in the assessment.

Sound power levels and predicted noise levels depend on the number of plant items operating at any one time and their precise location relative to a sensitive receiver. Equipment was assumed to be working at the worst-case location relative to each receiver and represents a worst-case assessment. Where the activity is further away from receivers or less equipment is used the predicted levels will decrease.

Sound power levels for plant and equipment expected to be used for each activity has been estimated based on guidance in the following standards and guidelines as well as typical measured noise levels for specific equipment.

- “ Australian Standard AS2436-2010: Guide to noise and vibration control on construction, demolition and maintenance sites
- “ Construction Noise and Vibration Strategy 7TP-ST-157/2.0 (CNVS), (TfNSW, 2018)
- “ Construction Noise and Vibration Guideline (CNVG) (Roads and Maritime Services, 2016)
- “ British Standard 5228-1:2009 Code of practice for noise and vibration control on construction and open sites

“ United Kingdom Department for Environment, Food and Rural Affairs (DEFRA) Noise database for prediction of noise on construction and open sites

Construction noise sources and associated sound power levels are listed in Appendix B. The maximum predicted LAeq noise level within the work area was identified for each receiver.

Predicted noise levels

Detailed predicted noise levels for each potentially affected receiver are presented Appendix C.

A summary of predicted noise levels in comparison with ICNG assessment criteria for the Weekend day period is presented in Table 4.

Table 4 Summary of predicted noise levels with comparison against ICNG criteria for the Weekend day period.

Criterion	Predicted number of receivers
Maximum cumulative predicted L _{Aeq, 15 minute} noise level	59 dB(A)
Number of highly noise affected receivers (>75 dB)	0
1 – 10 dB above NML	3
10 – 20 dB above NML	0
20+ dB above NML	0

For works outside standard hours, up to 0 receivers are predicted to be classified as Highly Impacted during the Weekend day period. A summary of the number of receivers in each class is presented in Table 5.

Table 5 Summary of predicted noise levels with comparison against CNVG criteria

Impact class	Predicted noise level	Predicted number of receivers
Noticeable	1 – 5 dB above NML	2
Clearly audible	5 – 15 dB above NML	1
Moderately impacted	15 – 25 dB above NML	0
Highly Impacted	> 25 dB above NML	0

Predicted impact classes for the Weekend day period are illustrated graphically in Appendix C. Each identified receiver in the study area has been coloured to highlight the predicted level of impact.

Sleep disturbance

In the event works are planned for more than two consecutive nights, up to 0 are expected to exceed the sleep awakening criteria. Where any exceedances if the awakening criteria are predicted, additional care should be taken and mitigation measures implemented in the with the CNVG.

Proposed noise mitigation measures

The safeguards and controls listed in Table 6 will be implemented where reasonable and feasible with the intention of achieving the project noise criteria and to maintain noise impacts at a practical minimum.

Table 6 Safeguards and controls

Action	Description
Community consultation or notification	Notify the affected community. The notification will detail work activities, dates and hours, impacts and mitigation measures, indication of work schedule over the night time period, any operational noise benefits from the works (where applicable) and contact telephone number. Notification should be a minimum of 7 calendar days prior to the start of works. For projects other than maintenance works more advanced consultation or notification may be required.
Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction would at least include: • all project specific and relevant standard noise and vibration mitigation measures • relevant licence and approval conditions • permissible hours of work • any limitations on high noise generating activities • location of nearest sensitive receivers • construction employee parking areas • designated loading/unloading areas and procedures site opening/closing times (including deliveries) environmental incident procedures
Behaviour	No swearing or unnecessary shouting or loud stereos/radios on site. Limit compression braking at night in residential areas. No dropping of materials from height, throwing of metal items and slamming of doors.
Verification	Where indicated in Appendix C, a noise verification program would be undertaken for the duration of the works.
Construction hours	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels should be scheduled during less sensitive time periods.
Respite for out-of-hours works	Respite would be scheduled as indicated in Appendix C and described in the CNVG.
Equipment selection	Use quieter construction methods where feasible and reasonable. Ensure plant including the silencer is well maintained. Plant noise levels will have an operating noise emission level compliant with Appendix F of the CNVG
Use and siting of plant	The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers.

Action	Description
Plan worksites and activities to minimise noise and vibration.	Locate compounds away from sensitive receivers and discourage access from local roads. Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site. Where additional activities or plant may only result in a marginal noise increase and speed up works, consider limiting duration of impact by concentrating noisy activities at one location and move to another as quickly as possible. Very noise activities should be scheduled for normal working hours. If the work can not be undertaken during the day, it should be completed before 11:00pm. Where practicable, work should be scheduled to avoid major student examination periods when students are studying for examinations such as before or during Higher School Certificate and at the end of higher education semesters.
Non-tonal reverse alarms	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work.
Shield stationary noise sources such as pumps, generators, and compressors	These should be enclosed or shielded where reasonable and feasible.
Implement any project specific mitigation measures	
1	None

Appendix A Project location and predicted level of impact



Appendix B Proposed activities and equipment

Excavation for pits and manholes

Equipment	Quantity	Usage	Reduction	SWL
Excavator (06 tonne)	1	80 %	0	93
Franna Crane	1	60 %	0	96

Activity Sound Power Level: 98

Appendix C Detailed noise predicted for each receiver and activity

Assessment: JSD Telstra Underbore				Weekend day	Results summary		
NCA	ID	Address	Land use	NML	Cumulative Predicted LAeq, 15 minute noise level	Exceedance of NML, dB	Impact classification
NCA 1	763897	54 JAMES SMALL DRIVE KORORA	RES	53	57	4	Noticable
NCA 1	763847	1 TROPIC LODGE PLACE KORORA	RES	53	59	6	Clearly Audible
NCA 1	763829	50A JAMES SMALL DRIVE KORORA	RES	53	55	2	Noticable

Construction noise impact assessment

LOC124 - Daytime OOH

JSD LOC124			
Proposed works	JSD Telstra Underbore LOC124		
Proponent	Quickway		
Assessment Date	16/11/2022		
Prepared by	Tom St Vincent Welch	Assessment Id	OOHW009

Introduction

This report has been prepared using the construction noise self-assessment platform KNOWnoise: *Minor Works* and presents an assessment of the likely noise impacts related to proposed works associated with the above project. Where possible, these works would be completed during standard construction hours; however, there may be a need to work outside these hours due to technical, community or access limitations. The location of the proposed works is illustrated in Appendix A.

Planned works

A description of the proposed works is as follows.

Underbore at LOC124

Proposed activities and equipment for the works are summarised in Appendix B.

Though subject to change, the works are expected to commence around 16/01/2023 and would be completed by 22/01/2023.

Assessment criteria and mitigation requirements

The Interim Construction Noise Guideline (ICNG) (DECC 2009) describes noise more than the background level as potentially having an adverse impact on sensitive receivers and increasing the likelihood of complaint. During standard construction hours, where construction noise is within 10 dB(A) of the RBL, impacts would be acceptable.

Where construction noise is more than 10 dB(A) above the RBL during standard construction hours, a residential receiver is considered noise affected and the proponent should undertake all reasonable and feasible steps necessary to manage the impact and consult with the affected community.

Above a LAeq, 15 minute noise level of 75 dB(A), a receiver is highly affected, requiring consideration of additional mitigation measures including alternative accommodation in the night period.

Outside standard construction hours, construction noise at a residential receiver more than 5 dB(A) above the RBL is taken to be noise affected.

In addition, annoying noise such as rock hammers, impact piling, or other impulsive noise sources usually result in greater annoyance than continuous construction noise. A 5 dB(A) penalty is applicable to such activities prior to comparison with the NMLs.

Other sensitive land uses, such as schools and offices, typically find noise from construction disruptive when the properties are being used (such as during work and school times). Table 2 presents NMLs from the ICNG for sensitive land uses based on the principle that the characteristic activities for each of these land uses should not be unduly disturbed.

Table 1 Non-residential sensitive land uses noise management levels

Land use	Noise assessment location	NML (L _{Aeq,15min})
Classrooms at schools and other educational institutions	Internal	45
Places of worship		
Active recreation areas (such as sporting activities and activities which generate their own noise or focus for participants)	External	65
Passive recreation areas (contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External	60
Industrial premises	External	75
Office, retail outlets	External	70

As part of planning for out of hours works, standard mitigation measures, as described in the ICNG and CNVG, would be implemented where reasonable and feasible. However, after these measures have been applied, noise and vibration levels may continue to exceed the NMLs.

In this case, additional mitigation measures outlined in the CNVG, which largely focus on engagement with affected sensitive receivers, should be implemented where reasonable and feasible, unless other agreements are in place with the impacted receiver.

Triggers and additional mitigation measures for airborne noise are summarised in Table 2. Further details of specific additional mitigation measures are described in the CNVG.

Table 2 Triggers for additional mitigation measures – Airborne noise (Roads and Maritime 2016)

Predicted airborne L _{Aeq} (15min) noise level at receiver			
Perception	dB(A) above RBL	dB(A) above NML	Additional mitigation measures
All hours			
75 dB(A) or greater			N, V, PC, RO
Standard hours: Mon - Fri (7am – 6pm), Sat (8am – 1pm), Sun/Pub Hol (Nil)			
Noticeable	5 to 10	0	-
Clearly audible	10 to 20	< 10	-
Moderately intrusive	20 to 30	10 to 20	N, V
Highly intrusive	> 30	> 20	N, V
OOHW Period 1: Mon – Fri (6pm – 10pm), Sat (7am – 8am & 1pm – 10pm), Sun/Pub Hol (8am – 6pm)			
Noticeable	5 to 10	<5	-
Clearly audible	10 to 20	5 to 15	N, R1, DR
Moderately intrusive	20 to 30	15 to 25	V, N, R1, DR
Highly intrusive	> 30	>25	V, IB, N, R1, DR, PC, SN
OOHW Period 2: Mon – Fri (10pm – 7am), Sat (10pm – 8am), Sun/Pub Hol (6pm – 7am)			
Noticeable	5 to 10	<5	N
Clearly audible	10 to 20	5 to 15	V, N, R2, DR
Moderately intrusive	20 to 30	15 to 25	V, IB, N, PC, SN, R2, DR
Highly intrusive	> 30	>25	AA, V, IB, N, PC, SN, R2, DR

Notes:

PC = Phone calls

V = verification

IB = Individual briefings

N= Notification

AA = Alternative accommodation

SN = Specific notifications

RO = Respite offer

R1 = Respite period 1

R2 = Respite period 2

DR = Duration respite

Perception = relates to levels above RBL

NML = Noise management level

HA = Highly affected

Existing environment and noise management levels

The proposed works would be undertaken in a predominantly Suburban/ Urban, characterised as:

Areas with low density transportation.

Typically local traffic, light vehicles, intermittent traffic flow

Background noise levels adopted for the project area and associated noise management levels (NMLs) are summarised in Table 3. NMLs have been established in line with the ICNG.

Table 3 Construction NMLs

Land use	Suburban/ Urban		Using custom background noise data?		Yes
Criterion	Day	Weekend Day	Evening	Night	Sleep
RBL	48	48	40	34	
NML	58	53	45	39	65

Sleep disturbance

The ICNG recommends where construction works are planned to extend over more than two consecutive nights, the maximum noise level should be considered for the purposes of establishing the likelihood of sleep disturbance. The Road Noise Policy suggests that maximum internal noise levels below 50-55 dB(A) are unlikely to awaken people from sleep and one or two noise events per night, with maximum internal noise levels of 65-70 dB(A) are not likely to affect health and wellbeing significantly.

Based on this, a sleep awakening criterion of 55 dB(A) (internal) is typically adopted for works. Given that noise attenuation of 10 dB(A) is typically provided by an open window, a sleep awakening criterion of L_Amax 65 dB(A) (external) has been applied to residential bedroom façades. This is consistent with the sleep disturbance threshold described in Appendix E of the CNVG.

Vibration

Effects of vibration from construction may be segregated into:

- Human exposure – disturbance to building occupants: vibration in which the occupants or users of the building are inconvenienced or possibly disturbed.
- Effects on building contents – vibration where the building contents may be affected.
- Effects on building structures – vibration in which the integrity of the building or structure itself may be prejudiced.

Vibration criteria relating to human comfort applicable to this project are taken from the DEC (2006) document Assessing Vibration – A Technical Guideline for intermittent vibration – such as from drilling, compacting or activities that would result in continuous vibration if operated continuously. Intermittent vibration is assessed as a vibration dose value (VDV) and relates to the level of vibration over time (cumulative over the night or day period). VDV values that may result in adverse comment from receivers are summarised in Table 4.

Table 4 Summary of vibration dose values which might result in adverse comment

Time	Low probability of adverse comment (m/s ^{1.75})	Adverse comment possible (m/s ^{1.75})	Adverse comment probable (m/s ^{1.75})
Day (6am to 10pm)	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Night (10pm to 6am)	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Guidance for the consideration of potential building damage from construction vibration is in line with BS 7385-1 *Evaluation and measurement for vibration in buildings - Guide for measurement of vibration and evaluation of their effects on buildings*. These guideline values are presented in Table 5.

Table 5 Building damage vibration guidelines (BS 7385-1)

Type of building	Guideline values for vibration (PPV mm/s)		
	4Hz to 15Hz	15Hz to 40Hz	40Hz and above
Reinforced or framed structures / Industrial and heavy commercial buildings	50		
Un-reinforced or light framed structures / Residential or light commercial type buildings	15 - 20	20 - 50	50

For heritage structures, criteria are in line with the German Standard *DIN 4150-3: Structural Vibration- effects of vibration on structures*, as summarised in Table 6.

Table 6 Guideline values for vibration velocity to be used when evaluating the effects of short-term vibration on heritage structures (DIN 4150-3).

Type of building	Guideline values for vibration (PPV mm/s)			
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz	Vibration at horizontal plane of highest floor at all frequencies
Structures that, because of their sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	3	3 to 8	8 to 10	8

The safe working distances presented in Table 7 are indicative and will vary depending on the item of plant and local geotechnical conditions. The cosmetic damage thresholds apply to typical buildings under typical geotechnical conditions and vibration monitoring is recommended at specific sites. Where structures are more sensitive, such as heritage items, more stringent conditions are applicable and should be considered individually.

In relation to human response, the safe working distances relate to continuous vibration. For most construction activities, vibration emissions are intermittent and higher vibration levels over shorter periods are acceptable. Additional assessment should be undertaken where the human response criteria are exceeded.

Table 7 Safe working distances for vibration intensive plant

Plant item	Rating/description	Safe working distance	
		Cosmetic damage (BS 7385-1)	Human response (DECCW)
Vibratory roller	<50 kN (typically 1-2 t)	5 m	15 m to 20 m
	<100 kN (typically 2-4 t)	6 m	20 m
	<200 kN (typically 4-6 t)	12 m	40 m
	<300 kN (typically 7-13 t)	15 m	100 m
	>300 kN (typically 13-18 t)	20 m	100 m
	>300 kN (> 18 t)	25 m	100 m
Small hydraulic hammer	300 kg – 5 to 12 t excavator	2 m	7 m
Medium hydraulic hammer	900 kg – 12 to 18t excavator	7 m	23 m
Large hydraulic hammer	1600 kg – 18 to 34 t excavator	22 m	73 m
Vibratory pile driver	Sheet piles	2 m to 20 m	20 m
Pile boring	≤800 mm	2 m	n/a
Jackhammer	Hand held	1 m	Avoid contact with structure

Assessment methodology

Based on the nominated works area (illustrated in Appendix A), proposed equipment and the minimum distance from the works to each sensitive receiver, noise levels were calculated based on CONCAWE (1981) *Propagation of noise from petroleum and petrochemical complexes to neighboring communities*.

This method considers geometric spreading, atmospheric absorption, ground effects and is valid for meteorological conditions of a gentle breeze from source to receiver and stable atmosphere (temperature inversion).

KNOWnoise: Minor works is a 2-Dimensional assessment platform and does not consider terrain effects (e.g. hills, valleys) or the presence of solid structures such as homes or noise barriers. This will result in a conservative prediction, suitable for the project being assessed.

Considering the nature of the works and the type of surrounding land uses, sensitive receivers up to a radius of 300 metres from the works have been included in the assessment.

Sound power levels and predicted noise levels depend on the number of plant items operating at any one time and their precise location relative to a sensitive receiver. Equipment was assumed to be working at the worst-case location relative to each receiver and represents a worst-case assessment. Where the activity is further away from receivers or less equipment is used the predicted levels will decrease.

Sound power levels for plant and equipment expected to be used for each activity has been estimated based on guidance in the following standards and guidelines as well as typical measured noise levels for specific equipment.

- “ Australian Standard AS2436-2010: Guide to noise and vibration control on construction, demolition and maintenance sites
- “ Construction Noise and Vibration Strategy 7TP-ST-157/2.0 (CNVS), (TfNSW, 2018)
- “ Construction Noise and Vibration Guideline (CNVG) (Roads and Maritime Services, 2016)
- “ British Standard 5228-1:2009 Code of practice for noise and vibration control on construction and open sites
- “ United Kingdom Department for Environment, Food and Rural Affairs (DEFRA) Noise database for prediction of noise on construction and open sites

Construction noise sources and associated sound power levels are listed in Appendix B. The maximum predicted LAeq noise level within the work area was identified for each receiver.

Predicted noise levels

Detailed predicted noise levels for each potentially affected receiver are presented Appendix C.

A summary of predicted noise levels in comparison with ICNG assessment criteria for the Weekend day period is presented in Table 8.

Table 8 Summary of predicted noise levels with comparison against ICNG criteria for the Weekend day period.

Criterion	Predicted number of receivers
Maximum cumulative predicted L _{Aeq} , 15 minute noise level	65 dB(A)
Number of highly noise affected receivers (>75 dB)	0
1 – 10 dB above NML	2
10 – 20 dB above NML	1
20+ dB above NML	0

In line with CNVG impact classes, up to 0 receivers are predicted to be classified as Highly Impacted during the Weekend day period. A summary of the number of receivers in each class is presented in Table 9.

Table 9 Summary of predicted noise levels with comparison against CNVG criteria

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 <= 5 dB above NML	1
Clearly Audible	5 <= 15 dB above NML	2
Moderately Intrusive	15 <= 25 dB above NML	0
Highly Intrusive	> 25 dB above NML	0

Predicted impact classes for the Weekend day period are illustrated graphically in Appendix C. Each identified receiver in the study area has been coloured to highlight the predicted level of impact.

Sleep disturbance

In the event works are planned for more than two consecutive nights, up to 0 are expected to exceed the sleep awakening criteria. Where any exceedances if the awakening criteria are predicted, additional care should be taken and mitigation measures implemented in the with the CNVG.

Predicted vibration impacts

The level of vibration impact on sensitive receivers (buildings and human comfort) will largely depend on the type of machinery in use and the distance from source to receiver.

Based on the proposed work locations and selected equipment, the following level of vibration impact is expected. A summary of vibration impacts is provided for each sensitive receiver in Appendix C.

Impact classification	Number of potentially affected receivers
Human comfort	0
Cosmetic damage	0
Heritage structure	0

Proposed noise mitigation measures

The safeguards and controls listed in Table 10 will be implemented where reasonable and feasible with the intention of achieving the project noise criteria and to maintain noise impacts at a practical minimum.

Table 10 Safeguards and controls

Action	Description
Community consultation or notification	Notify the affected community. The notification will detail work activities, dates and hours, impacts and mitigation measures, indication of work schedule over the night time period, any operational noise benefits from the works (where applicable) and contact telephone number. Notification should be a minimum of 7 calendar days prior to the start of works. For projects other than maintenance works more advanced consultation or notification may be required.
Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction would at least include: - all project specific and relevant standard noise and vibration mitigation measures - relevant licence and approval conditions - permissible hours of work - any limitations on high noise generating activities - location of nearest sensitive receivers - construction employee parking areas - designated loading/unloading areas and procedures site opening/closing times (including deliveries) environmental incident procedures
Behaviour	No swearing or unnecessary shouting or loud stereos/radios on site. Limit compression braking at night in residential areas. No dropping of materials from height, throwing of metal items and slamming of doors.
Verification	Where indicated in Appendix C, a noise verification program would be undertaken for the duration of the works.
Construction hours	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels should be scheduled during less sensitive time periods.
Respite for out-of-hours works	Respite would be scheduled as indicated in Appendix C and described in the CNVG.
Equipment selection	Use quieter construction methods where feasible and reasonable. Ensure plant including the silencer is well maintained. Plant noise levels will have an operating noise emission level compliant with Appendix F of the CNVG
Use and siting of plant	The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers.

Action	Description
Plan worksites and activities to minimise noise and vibration.	Locate compounds away from sensitive receivers and discourage access from local roads. Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site. Where additional activities or plant may only result in a marginal noise increase and speed up works, consider limiting duration of impact by concentrating noisy activities at one location and move to another as quickly as possible. Very noise activities should be scheduled for normal working hours. If the work can not be undertaken during the day, it should be completed before 11:00pm. Where practicable, work should be scheduled to avoid major student examination periods when students are studying for examinations such as before or during Higher School Certificate and at the end of higher education semesters.
Non-tonal reverse alarms	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work.
Shield stationary noise sources such as pumps, generators, and compressors	These should be enclosed or shielded where reasonable and feasible.
Implement any project specific mitigation measures	
1	None

Appendix A Project location and predicted level of impact



Appendix B Proposed activities and equipment

HDD Underbore LOC124

Equipment	Quantity	Usage	Reduction	SWL
Excavator (06 tonne)	1	10 %	5	79
Horizontal direction drill	1	50 %	5	95
Vacc truck	1	50 %	5	104

Activity Sound Power Level: 105

Appendix C Detailed noise predicted for each receiver and activity

Assessment: JSD Telstra Underbore LOC124				Weekend day	Results summary		
NCA	ID	Address	Land use	NML	Cumulative Predicted LAeq, 15 minute noise level	Exceedance of NML, dB	Impact classification
NCA 1	764216	54 JAMES SMALL DRIVE KORORA	RES	53	65	12	Clearly Audible
NCA 1	764175	3 TROPIC LODGE PLACE KORORA	RES	53	54	1	Noticable
NCA 1	764174	1 TROPIC LODGE PLACE KORORA	RES	53	58	5	Clearly Audible

Construction noise impact assessment

Excavation and manhole installation - Daytime OOHW

JSD LOC124

Proposed works JSD Telstra Underbore LOC124
Proponent Quickway

Assessment Date 16/11/2022

Prepared by Tom St Vincent Welch

Assessment Id OOHW009

Introduction

This report has been prepared using the construction noise self-assessment platform KNOWnoise: *Minor Works* and presents an assessment of the likely noise impacts related to proposed works associated with the above project. Where possible, these works would be completed during standard construction hours; however, there may be a need to work outside these hours due to technical, community or access limitations. The location of the proposed works is illustrated in Appendix A.

Planned works

A description of the proposed works is as follows.

Underbore at LOC124

Proposed activities and equipment for the works are summarised in Appendix B.

Though subject to change, the works are expected to commence around 16/01/2023 and would be completed by 22/01/2023.

Assessment criteria and mitigation requirements

The Interim Construction Noise Guideline (ICNG) (DECC 2009) describes noise more than the background level as potentially having an adverse impact on sensitive receivers and increasing the likelihood of complaint. During standard construction hours, where construction noise is within 10 dB(A) of the RBL, impacts would be acceptable.

Where construction noise is more than 10 dB(A) above the RBL during standard construction hours, a residential receiver is considered noise affected and the proponent should undertake all reasonable and feasible steps necessary to manage the impact and consult with the affected community.

Above a LAeq, 15 minute noise level of 75 dB(A), a receiver is highly affected, requiring consideration of additional mitigation measures including alternative accommodation in the night period.

Outside standard construction hours, construction noise at a residential receiver more than 5 dB(A) above the RBL is taken to be noise affected.

In addition, annoying noise such as rock hammers, impact piling, or other impulsive noise sources usually result in greater annoyance than continuous construction noise. A 5 dB(A) penalty is applicable to such activities prior to comparison with the NMLs.

Other sensitive land uses, such as schools and offices, typically find noise from construction disruptive when the properties are being used (such as during work and school times). Table 2 presents NMLs from the ICNG for sensitive land uses based on the principle that the characteristic activities for each of these land uses should not be unduly disturbed.

Table 1 Non-residential sensitive land uses noise management levels

Land use	Noise assessment location	NML (L _{Aeq,15min})
Classrooms at schools and other educational institutions	Internal	45
Places of worship		
Active recreation areas (such as sporting activities and activities which generate their own noise or focus for participants)	External	65
Passive recreation areas (contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External	60
Industrial premises	External	75
Office, retail outlets	External	70

As part of planning for out of hours works, standard mitigation measures, as described in the ICNG and CNVG, would be implemented where reasonable and feasible. However, after these measures have been applied, noise and vibration levels may continue to exceed the NMLs.

In this case, additional mitigation measures outlined in the CNVG, which largely focus on engagement with affected sensitive receivers, should be implemented where reasonable and feasible, unless other agreements are in place with the impacted receiver.

Triggers and additional mitigation measures for airborne noise are summarised in Table 2. Further details of specific additional mitigation measures are described in the CNVG.

Table 2 Triggers for additional mitigation measures – Airborne noise (Roads and Maritime 2016)

Predicted airborne LAeq(15min) noise level at receiver			
Perception	dB(A) above RBL	dB(A) above NML	Additional mitigation measures
All hours			
75 dB(A) or greater			N, V, PC, RO
Standard hours: Mon - Fri (7am – 6pm), Sat (8am – 1pm), Sun/Pub Hol (Nil)			
Noticeable	5 to 10	0	-
Clearly audible	10 to 20	< 10	-
Moderately intrusive	20 to 30	10 to 20	N, V
Highly intrusive	> 30	> 20	N, V
OOHW Period 1: Mon – Fri (6pm – 10pm), Sat (7am – 8am & 1pm – 10pm), Sun/Pub Hol (8am – 6pm)			
Noticeable	5 to 10	<5	-
Clearly audible	10 to 20	5 to 15	N, R1, DR
Moderately intrusive	20 to 30	15 to 25	V, N, R1, DR
Highly intrusive	> 30	>25	V, IB, N, R1, DR, PC, SN
OOHW Period 2: Mon – Fri (10pm – 7am), Sat (10pm – 8am), Sun/Pub Hol (6pm – 7am)			
Noticeable	5 to 10	<5	N
Clearly audible	10 to 20	5 to 15	V, N, R2, DR
Moderately intrusive	20 to 30	15 to 25	V, IB, N, PC, SN, R2, DR
Highly intrusive	> 30	>25	AA, V, IB, N, PC, SN, R2, DR

Notes:

PC = Phone calls

V = verification

IB = Individual briefings

N= Notification

AA = Alternative accommodation

SN = Specific notifications

RO = Respite offer

R1 = Respite period 1

R2 = Respite period 2

DR = Duration respite

Perception = relates to levels above RBL

NML = Noise management level

HA = Highly affected

Existing environment and noise management levels

The proposed works would be undertaken in a predominantly Suburban/ Urban, characterised as:

Areas with low density transportation.

Typically local traffic, light vehicles, intermittent traffic flow

Background noise levels adopted for the project area and associated noise management levels (NMLs) are summarised in Table 3. NMLs have been established in line with the ICNG.

Table 3 Construction NMLs

Land use	Suburban/ Urban		Using custom background noise data?		Yes
Criterion	Day	Weekend Day	Evening	Night	Sleep
RBL	48	48	40	34	
NML	58	53	45	39	65

Sleep disturbance

The ICNG recommends where construction works are planned to extend over more than two consecutive nights, the maximum noise level should be considered for the purposes of establishing the likelihood of sleep disturbance. The Road Noise Policy suggests that maximum internal noise levels below 50-55 dB(A) are unlikely to awaken people from sleep and one or two noise events per night, with maximum internal noise levels of 65-70 dB(A) are not likely to affect health and wellbeing significantly.

Based on this, a sleep awakening criterion of 55 dB(A) (internal) is typically adopted for works. Given that noise attenuation of 10 dB(A) is typically provided by an open window, a sleep awakening criterion of L_{Amax} 65 dB(A) (external) has been applied to residential bedroom façades. This is consistent with the sleep disturbance threshold described in Appendix E of the CNVG.

Vibration

Effects of vibration from construction may be segregated into:

- Human exposure – disturbance to building occupants: vibration in which the occupants or users of the building are inconvenienced or possibly disturbed.
- Effects on building contents – vibration where the building contents may be affected.
- Effects on building structures – vibration in which the integrity of the building or structure itself may be prejudiced.

Vibration criteria relating to human comfort applicable to this project are taken from the DEC (2006) document Assessing Vibration – A Technical Guideline for intermittent vibration – such as from drilling, compacting or activities that would result in continuous vibration if operated continuously. Intermittent vibration is assessed as a vibration dose value (VDV) and relates to the level of vibration over time (cumulative over the night or day period). VDV's that may result in adverse comment from receivers are summarised in Table 4.

Table 4 Summary of vibration dose values which might result in adverse comment

Time	Low probability of adverse comment (m/s ^{1.75})	Adverse comment possible (m/s ^{1.75})	Adverse comment probable (m/s ^{1.75})
Day (6am to 10pm)	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Night (10pm to 6am)	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Guidance for the consideration of potential building damage from construction vibration is in line with BS 7385-1 *Evaluation and measurement for vibration in buildings - Guide for measurement of vibration and evaluation of their effects on buildings*. These guideline values are presented in Table 5.

Table 5 Building damage vibration guidelines (BS 7385-1)

Type of building	Guideline values for vibration (PPV mm/s)		
	4Hz to 15Hz	15Hz to 40Hz	40Hz and above
Reinforced or framed structures / Industrial and heavy commercial buildings	50		
Un-reinforced or light framed structures / Residential or light commercial type buildings	15 - 20	20 - 50	50

For heritage structures, criteria are in line with the German Standard *DIN 4150-3: Structural Vibration- effects of vibration on structures*, as summarised in Table 6.

Table 6 Guideline values for vibration velocity to be used when evaluating the effects of short-term vibration on heritage structures (DIN 4150-3).

Type of building	Guideline values for vibration (PPV mm/s)			
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz	Vibration at horizontal plane of highest floor at all frequencies
Structures that, because of their sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	3	3 to 8	8 to 10	8

The safe working distances presented in Table 7 are indicative and will vary depending on the item of plant and local geotechnical conditions. The cosmetic damage thresholds apply to typical buildings under typical geotechnical conditions and vibration monitoring is recommended at specific sites. Where structures are more sensitive, such as heritage items, more stringent conditions are applicable and should be considered individually.

In relation to human response, the safe working distances relate to continuous vibration. For most construction activities, vibration emissions are intermittent and higher vibration levels over shorter periods are acceptable. Additional assessment should be undertaken where the human response criteria are exceeded.

Table 7 Safe working distances for vibration intensive plant

Plant item	Rating/description	Safe working distance	
		Cosmetic damage (BS 7385-1)	Human response (DECCW)
Vibratory roller	<50 kN (typically 1-2 t)	5 m	15 m to 20 m
	<100 kN (typically 2-4 t)	6 m	20 m
	<200 kN (typically 4-6 t)	12 m	40 m
	<300 kN (typically 7-13 t)	15 m	100 m
	>300 kN (typically 13-18 t)	20 m	100 m
	>300 kN (> 18 t)	25 m	100 m
Small hydraulic hammer	300 kg – 5 to 12 t excavator	2 m	7 m
Medium hydraulic hammer	900 kg – 12 to 18t excavator	7 m	23 m
Large hydraulic hammer	1600 kg – 18 to 34 t excavator	22 m	73 m
Vibratory pile driver	Sheet piles	2 m to 20 m	20 m
Pile boring	≤800 mm	2 m	n/a
Jackhammer	Hand held	1 m	Avoid contact with structure

Assessment methodology

Based on the nominated works area (illustrated in Appendix A), proposed equipment and the minimum distance from the works to each sensitive receiver, noise levels were calculated based on CONCAWE (1981) *Propagation of noise from petroleum and petrochemical complexes to neighboring communities*.

This method considers geometric spreading, atmospheric absorption, ground effects and is valid for meteorological conditions of a gentle breeze from source to receiver and stable atmosphere (temperature inversion).

KNOWnoise: Minor works is a 2-Dimensional assessment platform and does not consider terrain effects (e.g. hills, valleys) or the presence of solid structures such as homes or noise barriers. This will result in a conservative prediction, suitable for the project being assessed.

Considering the nature of the works and the type of surrounding land uses, sensitive receivers up to a radius of 300 metres from the works have been included in the assessment.

Sound power levels and predicted noise levels depend on the number of plant items operating at any one time and their precise location relative to a sensitive receiver. Equipment was assumed to be working at the worst-case location relative to each receiver and represents a worst-case assessment. Where the activity is further away from receivers or less equipment is used the predicted levels will decrease.

Sound power levels for plant and equipment expected to be used for each activity has been estimated based on guidance in the following standards and guidelines as well as typical measured noise levels for specific equipment.

- “ Australian Standard AS2436-2010: Guide to noise and vibration control on construction, demolition and maintenance sites
- “ Construction Noise and Vibration Strategy 7TP-ST-157/2.0 (CNVS), (TfNSW, 2018)
- “ Construction Noise and Vibration Guideline (CNVG) (Roads and Maritime Services, 2016)
- “ British Standard 5228-1:2009 Code of practice for noise and vibration control on construction and open sites
- “ United Kingdom Department for Environment, Food and Rural Affairs (DEFRA) Noise database for prediction of noise on construction and open sites

Construction noise sources and associated sound power levels are listed in Appendix B. The maximum predicted LAeq noise level within the work area was identified for each receiver.

Predicted noise levels

Detailed predicted noise levels for each potentially affected receiver are presented Appendix C.

A summary of predicted noise levels in comparison with ICNG assessment criteria for the Weekend day period is presented in Table 8.

Table 8 Summary of predicted noise levels with comparison against ICNG criteria for the Weekend day period.

Criterion	Predicted number of receivers
Maximum cumulative predicted L _{Aeq} , 15 minute noise level	58 dB(A)
Number of highly noise affected receivers (>75 dB)	0
1 – 10 dB above NML	1
10 – 20 dB above NML	0
20+ dB above NML	0

In line with CNVG impact classes, up to 0 receivers are predicted to be classified as Highly Impacted during the Weekend day period. A summary of the number of receivers in each class is presented in Table 9.

Table 9 Summary of predicted noise levels with comparison against CNVG criteria

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 <= 5 dB above NML	1
Clearly Audible	5 <= 15 dB above NML	0
Moderately Intrusive	15 <= 25 dB above NML	0
Highly Intrusive	> 25 dB above NML	0

Predicted impact classes for the Weekend day period are illustrated graphically in Appendix C. Each identified receiver in the study area has been coloured to highlight the predicted level of impact.

Sleep disturbance

In the event works are planned for more than two consecutive nights, up to 0 are expected to exceed the sleep awakening criteria. Where any exceedances if the awakening criteria are predicted, additional care should be taken and mitigation measures implemented in the with the CNVG.

Predicted vibration impacts

The level of vibration impact on sensitive receivers (buildings and human comfort) will largely depend on the type of machinery in use and the distance from source to receiver.

Based on the proposed work locations and selected equipment, the following level of vibration impact is expected. A summary of vibration impacts is provided for each sensitive receiver in Appendix C.

Impact classification	Number of potentially affected receivers
Human comfort	0
Cosmetic damage	0
Heritage structure	0

Proposed noise mitigation measures

The safeguards and controls listed in Table 10 will be implemented where reasonable and feasible with the intention of achieving the project noise criteria and to maintain noise impacts at a practical minimum.

Table 10 Safeguards and controls

Action	Description
Community consultation or notification	Notify the affected community. The notification will detail work activities, dates and hours, impacts and mitigation measures, indication of work schedule over the night time period, any operational noise benefits from the works (where applicable) and contact telephone number. Notification should be a minimum of 7 calendar days prior to the start of works. For projects other than maintenance works more advanced consultation or notification may be required.
Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction would at least include: - all project specific and relevant standard noise and vibration mitigation measures - relevant licence and approval conditions - permissible hours of work - any limitations on high noise generating activities - location of nearest sensitive receivers - construction employee parking areas - designated loading/unloading areas and procedures site opening/closing times (including deliveries) environmental incident procedures
Behaviour	No swearing or unnecessary shouting or loud stereos/radios on site. Limit compression braking at night in residential areas. No dropping of materials from height, throwing of metal items and slamming of doors.
Verification	Where indicated in Appendix C, a noise verification program would be undertaken for the duration of the works.
Construction hours	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels should be scheduled during less sensitive time periods.
Respite for out-of-hours works	Respite would be scheduled as indicated in Appendix C and described in the CNVG.
Equipment selection	Use quieter construction methods where feasible and reasonable. Ensure plant including the silencer is well maintained. Plant noise levels will have an operating noise emission level compliant with Appendix F of the CNVG
Use and siting of plant	The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers.

Action	Description
Plan worksites and activities to minimise noise and vibration.	Locate compounds away from sensitive receivers and discourage access from local roads. Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site. Where additional activities or plant may only result in a marginal noise increase and speed up works, consider limiting duration of impact by concentrating noisy activities at one location and move to another as quickly as possible. Very noise activities should be scheduled for normal working hours. If the work can not be undertaken during the day, it should be completed before 11:00pm. Where practicable, work should be scheduled to avoid major student examination periods when students are studying for examinations such as before or during Higher School Certificate and at the end of higher education semesters.
Non-tonal reverse alarms	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work.
Shield stationary noise sources such as pumps, generators, and compressors	These should be enclosed or shielded where reasonable and feasible.
Implement any project specific mitigation measures	
1	None

Appendix A Project location and predicted level of impact



Appendix B Proposed activities and equipment

Excavation for and installation of Manholes

Equipment	Quantity	Usage	Reduction	SWL
Excavator (06 tonne)	1	80 %	0	93
Franna Crane	1	60 %	0	96

Activity Sound Power Level: 98

Appendix C Detailed noise predicted for each receiver and activity

Assessment: JSD Telstra Underbore LOC124				Weekend day	Results summary		
NCA	ID	Address	Land use	NML	Cumulative Predicted LAeq, 15 minute noise level	Exceedance of NML, dB	Impact classification
NCA 1	764216	54 JAMES SMALL DRIVE KORORA	RES	53	58	5	Noticable

Appendix C

Draft Community Notification



December 2022

Out of Hours Work on the Coffs Harbour bypass project – northern utilities

Notification of upcoming out of hours work on James Small Drive

Quickway has been engaged to continue low impact work on the Coffs Harbour bypass project. As part of the utility relocations, horizontal drilling (Underbore) for telecommunication services is due to commence on the western side on James Small Drive from Korora School Road to Norman Hill Drive at Korora.

Underbore activity will commence from **Tuesday 3 January** until **Sunday 29 January 2023**. Work will occur 7 days a week from **Monday to Friday** between **7am and 6pm** and on **Saturdays and Sundays** between **8am and 6pm**, weather and work progress permitting.

This work will continue outside the approved construction hours to ensure the work is completed over the school holiday period and to minimise disruption to Kororo Public School, school bus route and traffic.

This work will involve service investigation, excavation of footpaths, entry and exit pits and horizontal drilling, with the drilling rig set up in three locations over the course of the work. Telecommunication pipes and cables will be fed through the horizontal bore and on completion, man holes will be installed at excavation pit locations.

Work will involve machinery including a drill rig, franna crane, vacuum truck, excavators, tipper trucks and water carts. Where required, traffic control and temporary parking restrictions will be in place on James Small Drive and surrounding local streets. Driveway access will be maintained at all times, however pedestrians and cyclists will experience a change in footpath conditions. Traffic control will be in place to escort footpath users to ensure their safety.

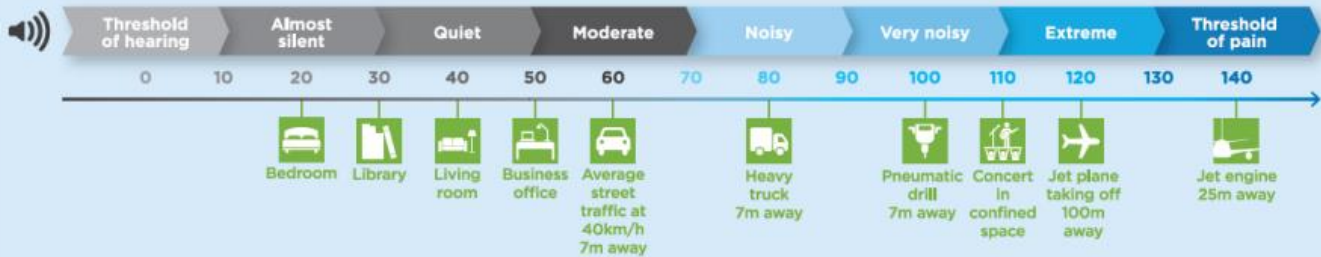
How could this work impact you?

All efforts will be made to minimise dust, noise and added disruption to the surrounding community and environment while this work is being carried out. We are committed to mitigating construction impacts on the surrounding residents by:

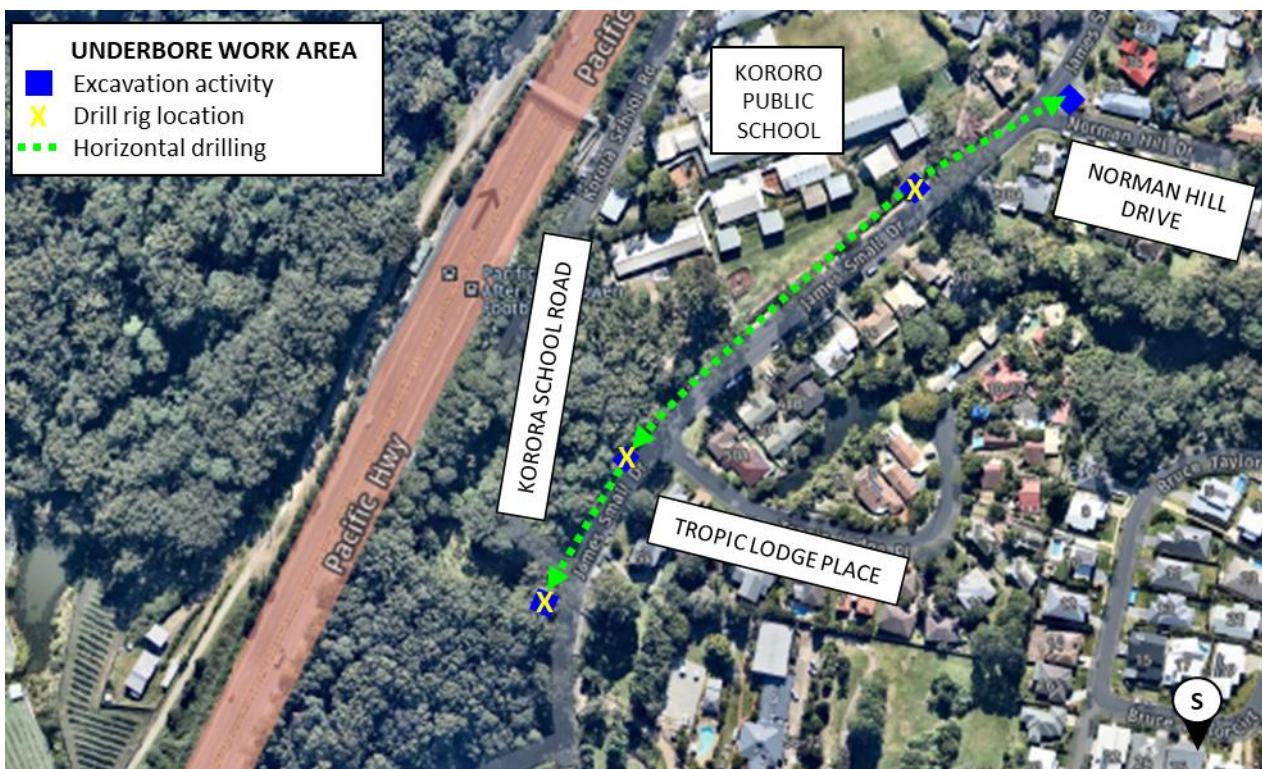
- consulting with directly impacted residents ahead of the work starting and during works
- work involving machinery will occur in stages to minimise noise levels
- turning off vehicles when not in use
- using non-tonal reversing beepers and instructing workers to keep noise to a minimum
- verification monitoring of generated noise levels
- orientating machinery with the noisiest elements directed away from receivers wherever possible
- using noise blankets and other barriers to reduce noise impacts where possible

The predicted noise levels are expected to be moderate in nature, as illustrated in the image below.

Sound levels in decibels (approximate)



Location of work



Looking ahead

Over the next three months, additional out of hours work is anticipated for the following:

- Additional underboring and trenching activities adjacent to and under the Pacific Highway and local roads, including Old Coast Road, James Small Drive, Bruxner Park Road, and Charlesworth Bay Road, periodically until June 2023
- Vegetation clearing adjacent to the eastern side of the Pacific Highway and local roads near Charlesworth Bay Road throughout December 2022 and January 2023
- Geotechnical investigations in the median and shoulder of the Pacific Highway near Pine Brush Creek in January 2023 will require lane closures.

Unexpected circumstances may initiate the need for additional out of hours work to occur outside of the above timeframes. In all events, Transport for NSW will provide written notification before the work commences. In addition, directly impacted residents will be contacted and advised of the likely impact and what we are doing to minimise disruption during the work.

Contact

If you have any questions or would like more information, please contact our project team:

1800 550 621

coffsharbourbypass@transport.nsw.gov.au

pacifichighway.nsw.gov.au/coffsharbourbypass

Translating and interpreting service



If you need help understanding this information, please contact the Translating and Interpreting Service on **13 14 50** and ask them to call us on **1800 550 621**.

CHB Project OOHW application form

Out of hours work approval request form

No:	Notification date:	Approval date:	Project:
014	XX/XX/XXXX		Old Coast Road Dual Watermain Connection

A. Contact details	Name	Mobile number	Email
TfNSW Environmental Site Representative	Shayne Walker	0467 818 189	shayne.walker@transport.nsw.gov.au
TfNSW Project Manager	Matt Amato	0421 191 916	matt.amato@transport.nsw.gov.au
Contractor Project Manager	Kilian Koen	0473 149 821	kiliank@quickway.com.au
Contractor Project Engineer	Joshua Maltese	0488 662 264	joshuam@quickway.com.au

B. Details of work: Include a map showing location of work extent and nearest sensitive receivers

Location / chainages:	Intersection of the Pacific Highway and Old Coast Road, Korora
NCA/s:	NCA – 23 (West Side – Pad 4) NCA – 26 (East side – Opposite Old Coast Rd) NCA – 27 (West side – West of Old Coast Rd) NCA – 28 (East side – Opal Boulevard Nth)
Description of works – also include a brief description of the sequence of activities:	As part of the Coffs Harbour Bypass Northern Utilities Relocation works, new potable water and recycled water mains are being installed outside of the footprint of the future motorway alignment. These dual watermain pipes need to be connected to the existing watermain pipes. The northern connection is to occur just north of the intersection of Old Coast Road and the Pacific Highway. The recycled watermain being relocated conveys recycled effluent water from the sewage treatment plant at Woolgoolga to the north, to Coffs Harbour to the south in the event the capacity of Woolgoolga reservoir has exceeded capacity from rainfall. Originally the works were programmed to occur over a 10 day daytime works program. Coffs City Council has advised the Project (TfNSW) that this work involving complete disconnection must occur within a window of no more than 5 days. The Woolgoolga reservoir has a capacity for an average 5-day rainfall event, after which it would result in recycled effluent water discharging to the environment causing pollution, with high likelihood of significant fines from the EPA. Due to the duration of works required (10 working days), in order to complete the works within the 5 day duration restriction, this critical work must be carried out over continuous 24 hour shifts over five days (4 night) during a forecast fine weather window. Work will involve trenching in proximity to the connection, disconnection of existing recycled watermain services, removal of an existing concrete anchor block, installation of new pipes, pouring of a new concrete anchor block and reconnection to the existing service. Sequence of works required within and outside of standard hours at any time over the 5 day long 24 hour works program is generally as follows: 1. Establishment of Traffic Control 2. Establishment of erosion and sediment controls and noise blankets

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3. Locating of existing services / potholing using NDD techniques with a Vacc Truck
4. Draining existing recycled watermain to existing adjacent sewerage infrastructure in the CHCC Compound adjacent to Opal Cove Boulevard. (Figure 3)
5. Excavation in proximity to the connection, existing pipes and anchor block. Excavated material will be hauled to Pad 4.
6. Cutting existing pipes either side of the anchor block (4 x cuts – Approx. 30 mins each), and with contingency for additional cuts if needed allow removal of pipe sections in the way of the new water main alignment.
7. Breaking out existing concrete anchor block using 2 excavators with rock hammers (Duration for up to 1 x 8 hour period). This activity will be undertaken during standard daytime hours only.
8. Removing all anchor block and pipe material from within the footprint of the new alignment
9. Excavating new trench to design depth and removing spoil.
10. Progressively cut new pipes to length as measured and install into the trench (Up to 16 cuts – Approx. 30 mins each).
11. Form, reinforce and pour new anchor block and other associated concrete works.
12. Connect new watermain line to the existing line at the connection point.
13. Backfill trenches and associated excavations
14. Clean up, reinstatement and demobilise

Works will include the occasional use of Pad 4 for servicing of the works including but not limited to picking up and dumping of materials as required. Access will be via the existing access track through the berry farm as shown in Figure 2.

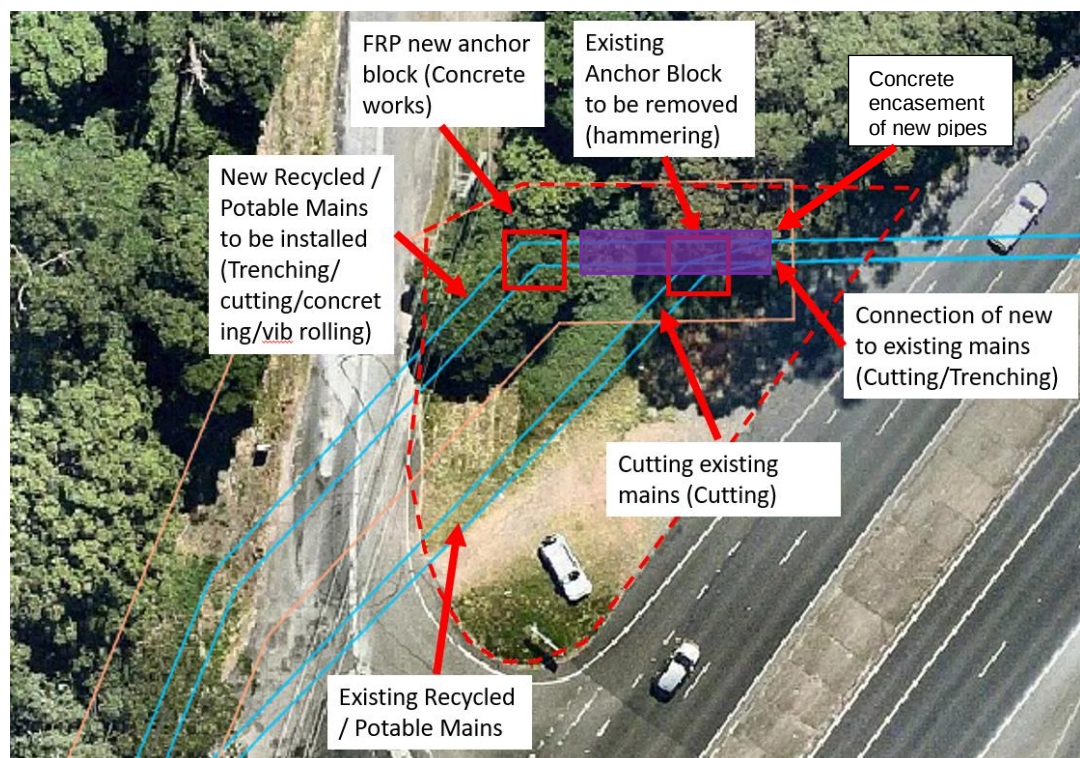


Figure 1: Summary of Activities at connection site

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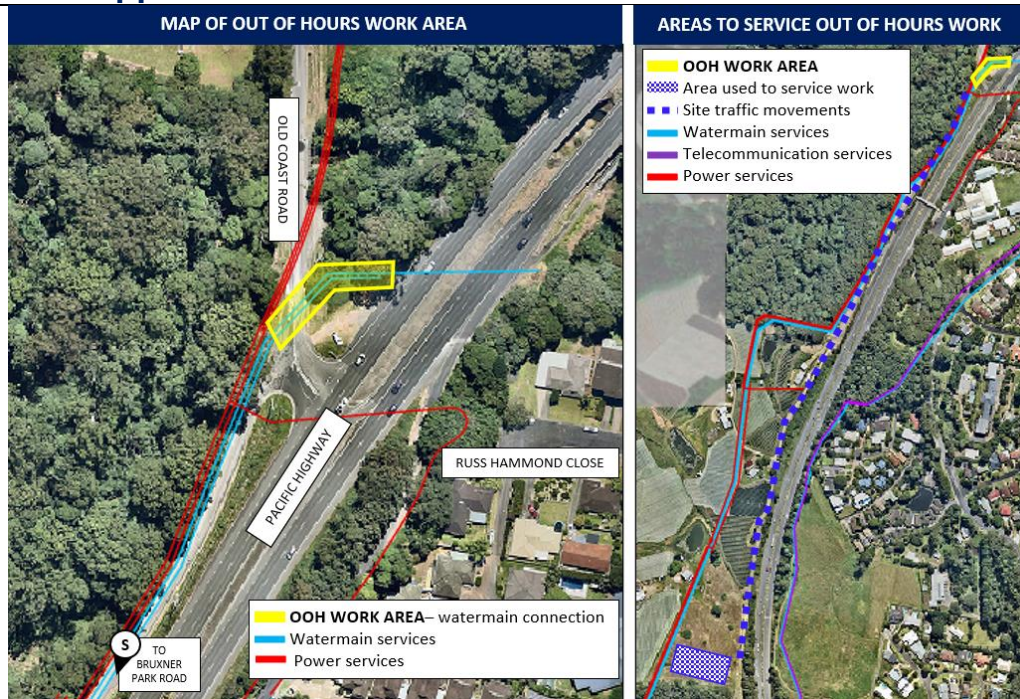


Figure 2: Location of connection works and access route to Pad 4

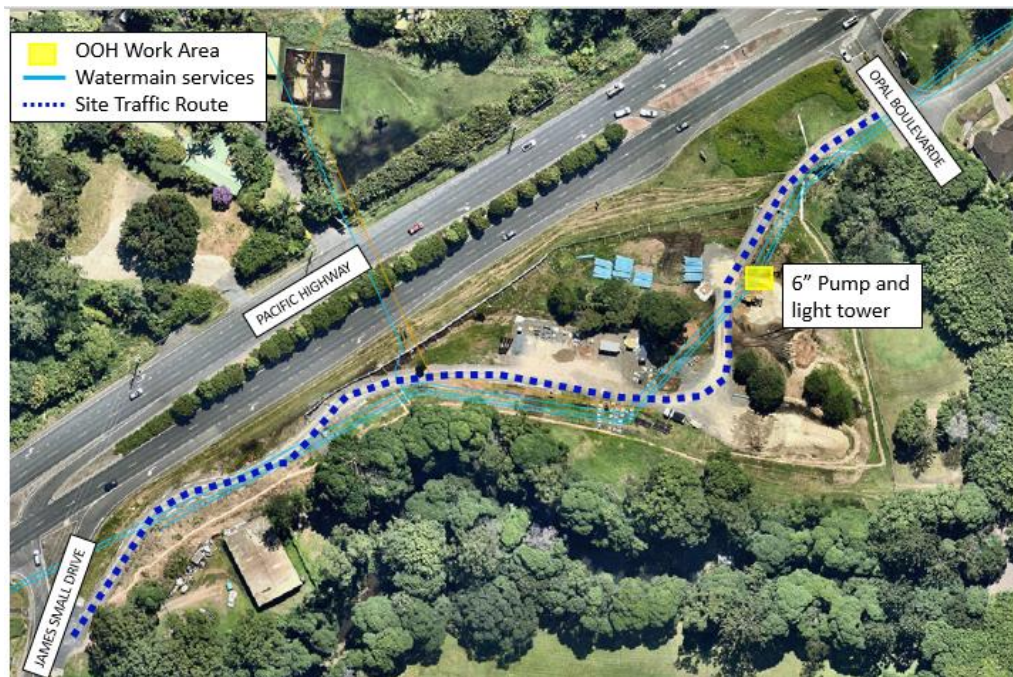


Figure 3: Location of dewatering site

Old Coast Road Watermain Connection Main Activities

Draining of existing watermain to sewer at Opal Cove CHCC compound

- 1 x 6" Pump (89dB)
- 1 x Light Tower (93dB)

Excavation, lifting pipes and backfilling

- 1 x Bogie (95dB)
- 2 x 23T Excavators (100dB)
- 3 x Light Towers (93dB)

Cutting pipes

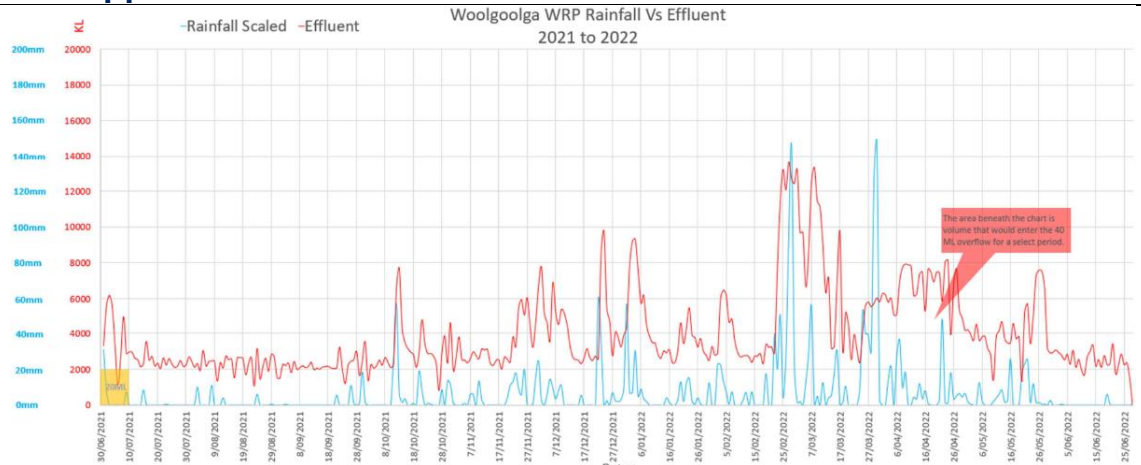
- 1 x Demolition Saw (113dB)
- 3 x Light Towers (93dB)

**Machinery/ plant
to be used**

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	Breaking out existing anchor block - 2 x 23T excavators with 1,000kg hammers (113dB) - 3 x Light Towers (93dB) Concreting Works - 1 x Concrete Truck / Agitator (93dB) - 1 x Concrete Vibrator (95dB) - 1 x 23T Excavator (96dB) - 1 x 4" Grinder (83dB) - 3 x Light Towers (93dB) Vibration Rolling during backfilling - 1 x 10T Vibratory Roller (101dB) - 3 x Light Towers (93dB) Vacc Truck Use (As/If required) - 1 x Vacc Truck (105dB) - 3 x Light Towers (93dB) <u>Use of Pad 4 for Servicing Works</u> - 1 x Tipper Truck (101dB) - 1 x 23T excavator (99dB) - 2 x Light towers (93dB)
Traffic control measures required:	Yes – Traffic Control in place to direct traffic.
Lighting required:	Yes lighting will be required during Night works. Lights will be arranged to minimise light spill into the adjacent environment and residential areas.
Proposed dates:	Dates are subject to Coffs Harbour City Council instructing works to proceed based on their assessment of the weather forecast identifying a clear 5-day window with no rain predicted. Works will be completed over up to 6 days / 5 nights (inc. 1 day/night contingency if dry weather) with the first available date for commencement being after the 16/01/23. Dates and durations will be subject to weather.
Proposed times:	Monday to Friday: 24 hours / day Saturdays: 24 hours / day Sundays: 24 hours / day
Justification - why does work need to occur outside of standard construction hours? (attach support information as required)	The recycled watermain being relocated conveys recycled effluent water from the sewage treatment plant at Woolgoolga to the north, to the Coffs Harbour Deep Sea Release facility to the south in the event the capacity of Woolgoolga reservoir has exceeded capacity from rainfall and general effluent capture. Originally the works were programmed to occur over a 10 day daytime works program. Coffs City Council has advised the Project (TfNSW) that this work involving complete disconnection must occur within a window of no more than 5 consecutive 24hour periods. The Woolgoolga reservoir is highly sensitive to rainfall events and in combination with daily effluent discharge presents a significant risk of exceeding the reservoirs capacity during a planned outage period. This exceedance would result in recycled effluent water discharging to the environment causing pollution, with high likelihood of significant fines from the EPA.

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Due to the duration of works required (10 working days), in order to complete the works within the 5 day duration restriction, this critical work must be carried out over continuous 24 hour shifts over five days (4 night) during a forecast fine weather window. This work involves a critical point of no return once the existing main has been made redundant. Therefore, justifying the requirement for consecutive working periods to ensure that the critical Coffs City infrastructure is returned to service as soon as possible

Significant scope reduction inclusive of the removal of concrete encasement works has been completed to reduce the duration of outage, although there is no alternative way that this work can be completed within the 5 day restricted period within standard working hours only. These works are being completed over this continuous period to prevent potential discharge of recycled effluent to the environment and subsequent fines to CHCC, and to minimise the duration of disruption to the existing council infrastructure.

This justification aligns with those permissible in Section 3.4 of the Coffs Harbour Bypass OOHW Protocol.

This OOHW application is consistent with the requirements of REMM LUP04, which states:

The following strategy for managing utilities will be implemented prior to construction in consultation with the relevant utility providers:

- Further detailed utility investigations (revised 'Dial before you Dig' queries and/or potholing will be carried to confirm location of buried services)
- Detailed utility design be undertaken in accordance with the relevant utility providers requirements

Relocation or protection work will be undertaken in a manner that minimises environmental impacts and addresses the relevant utility service providers requirements and construction methods.

Select OOHW Category as defined by MCoA E36

Select

☐

(a) for the delivery of materials required by the NSW Police Force or other authority for safety reasons; or

☐

(b) where it is required in an emergency to avoid injury or the loss of life, to avoid damage or loss of property or to prevent environmental harm; or

☐

(c) where different construction hours are permitted or required under an EPL in force in respect of the CSSI; or

☒

(d) work not subject to an EPL that are approved under an **Out-of-Hours Work Protocol** as required by **Condition E40**; or

☐

(e) construction that causes $L_{Aeq}(15 \text{ minute})$ noise levels:

- (i) no more than 5 dB(A) above the rating background level at any residence in accordance with the *Interim Construction Noise Guideline* (DECC, 2009), or

CHB Project OOHW application form

	☐	(ii) no more than the 'Noise affected' noise management levels specified in Table 3 of the <i>Interim Construction Noise Guideline</i> (DECC, 2009) at other sensitive land uses, or
	☐	(f) continuous or impulsive vibration values, measured at the most affected residence are no more than the preferred values for human exposure to vibration, specified in Table 2.2 of <i>Assessing Vibration: a technical guideline</i> (DEC, 2006), or
	☐	(g) intermittent vibration values measured at the most affected residence are no more than the preferred values for human exposure to vibration, specified in Table 2.4 of <i>Assessing Vibration: a technical guideline</i> (DEC, 2006); or
	☐	(h) negotiated agreements with directly affected residents and sensitive land uses.

C. Risk assessment

NML (refer Table 3-2 of OOHW protocol)	NCA – 23 (West Side – Pad 4) OOSH Day: 48dB OOSH Evening: 43dB OOSH Night: 39dB		
	NCA – 26 (East side – Opposite Old Coast Rd) OOSH Day: 57dB OOSH Evening: 51dB OOSH Night: 42dB		
	NCA – 27 (West side – West of Old Coast Rd) OOSH Day: 61dB OOSH Evening: 52dB OOSH Night: 43dB		
	NCA – 28 (East side – Opal Boulevard Nth) OOSH Day: 65dB OOSH Evening: 55dB OOSH Night: 47dB		
Does the works result in highly noise affected levels at any receivers? (above 75dB(A) L_{Aeq} (15 minute))	No		
Risk factor category (refer section 4.3 of OOHW protocol):	Other	Low	High
	Comments: In accordance with Section 4.4.4 of the OOH Protocol, OOHW are considered high risk when the duration limitations outlined in Section 4.4.3 cannot be achieved. As a result of the works, the requirements of 4.4.3 cannot be achieved. This is described below: As described in Section 4.4.3 of the OOH Protocol, for OOHW to be classified as Low risk if it must meet one of the following requirements: (1) OOHW assessed to meet the perception classification of Noticeable; OR (2) OOHW assessed to meet the perception classification of Clearly Audible and above at any one residential receiver for a maximum of: a. Two consecutive evenings or nights, in a calendar week b. Three evenings or nights in a calendar week c. A maximum of 10 evenings or nights in a calendar month.		

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	OR - (3) Where negotiated agreements with directly affected residents and sensitive land uses have agreed to the OOHW and mitigation measures proposed. (1) Works louder than noticeable. - <u>Does not comply.</u> (2) Predicted noise levels extend over 24 hours/day over a 5 day period, and exceed the perception classification of Clearly Audible over all OOH Periods. 117 Residents exceeding Clearly Audible during any given 15 minute period where concrete breaking or saw cutting is occurring. - <u>Does not comply with 2a or 2b</u> (3) Due to the number of residents classified as directly affected (i.e. those exceeding clearly audible), it is highly unlikely to achieve agreement with all residents, nor maintain these agreements for the duration of the works. - <u>Does not comply</u>
--	--

D. Details of noise or vibration assessment completed:

Comments: KNOWnoise noise modelling software was used to model predicted noise outputs for the work activities. It is noted that predictions are based on a representative 15 minute period (LAeq15) throughout the works period, and that durations for each of the activities varies. Durations of each of the main contributing noise sources are described below:

Due to the uncertainty of the timing of the shutdown (at CHCC discretion for the works to commence), these works may occur at any time during day or night, so have been assessed against compliance with night time Noise Management Levels (NMLs) at the most affected Noise Catchment Area.

Refer to **Appendix C** for full list of receivers identified as exceeding clearly audible during each of the activities and distribution maps as Appendix A. Summary of the extent of impacts to residents are provided below:

Draining of existing watermain to sewer at Opal Cove CHCC compound

NCA Assessed (Period): NCA 28 (Night)

Duration: Up to 16 hours continuous

Perception Classification (number of receivers):

- Noticeable = 0
- Clearly Audible = 0
- Moderately Intrusive = 0
- Highly Intrusive = 0

Excavation, lifting pipes and backfilling

NCA Assessed (Period): NCA 26 (Night)

Duration: Up to 10 hours for bulk excavation. Up to 6 hours to lift pipes (as required)

Perception Classification (number of receivers):

- Noticeable = 19
- Clearly Audible = 18
- Moderately Intrusive = 0
- Highly Intrusive = 0

Cutting Pipes

NCA Assessed (Period): NCA 26 (Night)

Duration: Up to 16 cuts, with generally 30 minutes each (4 cuts initially prior to anchor block removal. Approximately 12 cuts during pipe installation as required during installation)

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Perception Classification (number of receivers):

- Noticeable = 270
- Clearly Audible = 94
- Moderately Intrusive = 23
- Highly Intrusive = 0

Breaking out existing anchor block

NCA Assessed (Period): NCA 26 (Daytime)

Duration: 1 x 8 hour period during the day

Perception Classification (number of receivers):

- Noticeable = 0
- Clearly Audible = 3
- Moderately Intrusive = 0
- Highly Intrusive = 0

Concreting Works (FRP)

NCA Assessed (Period): NCA 26 (Night)

Duration: Main pours – 2 x 6 hour periods. Various small pours throughout.

Perception Classification (number of receivers):

- Noticeable = 24
- Clearly Audible = 7
- Moderately Intrusive = 0
- Highly Intrusive = 0

Vibration Rolling during backfilling

NCA Assessed (Period): NCA 26 (Night)

Duration: Post shutdown. Up to 6 hours as required.

Perception Classification (number of receivers):

- Noticeable = 20
- Clearly Audible = 17
- Moderately Intrusive = 0
- Highly Intrusive = 0

Vacc. Truck Use

NCA Assessed (Period): NCA 26 (Night)

Duration: As/if required to remove water from excavations. Short infrequent durations anticipated.

Perception Classification (number of receivers):

- Noticeable = 34
- Clearly Audible = 33
- Moderately Intrusive = 0
- Highly Intrusive = 0

Accessing Pad 4 for servicing of works

NCA Assessed (Period): NCA 23 (Night)

Duration: As/if required to remove water from excavations. 5 minute durations for each use of the pad.

Perception Classification (number of receivers):

- Noticeable = 2

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- Clearly Audible = 0
- Moderately Intrusive = 0
- Highly Intrusive = 0

E. Proposed mitigation measures, including respite

Comments:

Standard Mitigation measures

- Modifying behavioural practices on site
- Use and siting of plant
- Switching off plant and machinery when not in use
- Use of non-tonal reversing alarms
- Planning noisier work to be carried out earlier in the period.
- Machinery will not be left running unnecessarily.
- Orientating machinery with noisiest elements directed away from receivers wherever possible

Additional Mitigation Measure

- Notification of upcoming work – to be issued to all eligible receivers December 2022, subject to approval.
- Notification of work to commence at least 24 hours prior to works – to be issued to all eligible receivers from Monday 16 January (proposed at this stage) 2023
- Specific notifications to those triggered in noise assessment
- Individual briefing to those triggered in noise assessment
- Phone calls to those triggered in noise assessment (Where details are available)
- Ministerial briefing note
- Verification Monitoring
- Noise blankets will be installed on ATF panels between the noise source and houses
- Concrete Hammering will be scheduled to occur during daytime hours only to reduce impacts on adjacent receivers.
- Other noisier works such as saw cutting will be scheduled within daytime hours or earlier parts of the where reasonable and feasible. Feasibility will be determined on site based on the timing of the activity commencing, status of progress, and whether undertaking this will result in the overall works program extending past timeframe restrictions.
- Note: It is proposed that works will **NOT** implement 3 hours on 1 hours off respite during daytime concrete hammering in accordance with MCoA E38. Hammering will be completed in one continuous period to complete the once off noisy activity as quickly as possible during the day to reduce overall duration of impacts to the residents, and to minimise risk of works extending to within evening and night time areas and beyond CHCC time restrictions.
- It is noted that during daytime hours, hammering is only predicted to exceed NML at 3 residents, who will be individually briefed on the works to be undertaken. Exceedances are minor (1dB).

F. Community consultation

Outline consultation undertaken for the proposed OOHW:

No consultation triggered. Two stage written notification of the works will be provided to receivers as described in Section E above. The notification will outline reason for the works, diagram of the work area, proposed date of the works and working times, expected noise impacts and mitigation measures in accordance with the Community Consultation Strategy and Section 6.5 of the CHB OOHW Protocol.

Receivers which have been identified as most affected will be notified by door knock to provide further detail as required based on predicted noise levels against CNVG criteria.

Has respite periods for OOHW been identified with the affected community on a monthly basis and a three-month schedule of likely OOHW provided (refer CoA E39)?

3 month look ahead provided within notification provided to the community in preparation for the works.

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Has the outcome of community consultation, the identified respite periods and scheduling of likely OOHW been provided to the ER, AA and Planning Secretary as required?

No consultation occurring. Notification only.

G. Respite framework

Outline any previous respite within the last month and the status of community agreements (where relevant)?

No respite triggered in the past month. Negotiated agreements sought for works at the intersection of Old Coast Road and the Pacific Highway for works which occurred 12/12/22-13/12/22. No other works triggering respite have occurred since these dates.

Have cumulative impacts from OOHW permitted by an EPL or third-party works been considered during the development of appropriate respite?

Joint Venture (JV) Geotech works on Pacific Highway (Nights)

TfNSW and Quickway have reviewed the noise assessment for Geotech investigation OOH works proposed to be undertaken on the Pacific Highway nearby by the JV in January. There is no cumulative impact anticipated during OOHW periods, subject to JV works occurring on dates they have scheduled.

Scheduled OOHW dates **do not** overlap.

- Quickway Night OOHW dates – at any point for 5 days from 16/01 subject to good weather.
- JV Night OOHW dates – (09/01, 10/01, 12/01 and Contingency shifts for 16/01, 17/01 and 19/01).

In the event works are occurring on the same night (simultaneous with JV contingency dates), the works being undertaken by the JV do not add to, or increase the number of receivers triggering clearly audible or above, as Quickway's predicted noise levels are higher. All residents will be notified by the Project of both packages of works.

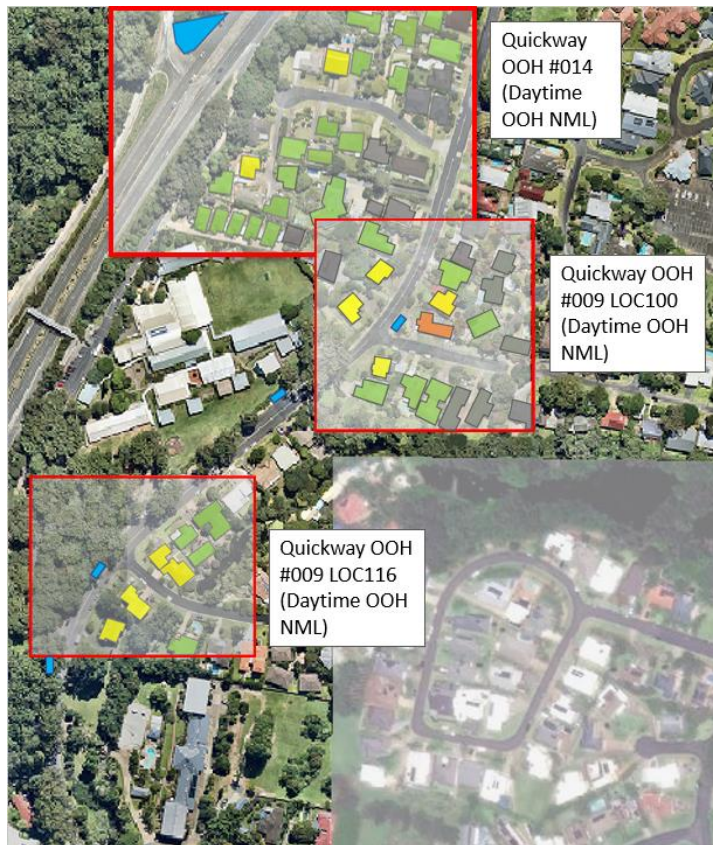
OOH #009 - Quickway Telstra Underbore on James Small Drive (Daytime OOH)

Critical works are scheduled to be undertaken by Quickway on James Small Drive during within **Daytime OOHW** periods (Sat/Sun) in January to avoid impacts to the adjacent school. Subject to timing of the works described in this permit, there is potentially simultaneous works occurring at the two sites, noting the overlap would **only be within Daytime OOHW (Sat/Sun)**. Cumulative impacts have been assessed considering and works occurring at both sites simultaneously during daytime OOH periods.

HDD Shot 3 (LOC116 to LOC124) on James Small Drive is scheduled to occur 16/1 – 22/01 (OOHW 21/1 - 22/1). All other HDD work is scheduled to have been completed by this date. As shown below, there are no cumulative impacts anticipated for simultaneous operations during Daytime OOHW period, should that eventuate.

As a worst case scenario, cumulative impacts from the nearest under bore activity on JSD (LOC100) has also been assessed and shows no cumulative impacts are predicted.

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Cumulative Assessment – Quickway Daytime OOH NML

Quickway OOHW Scheduled dates

- OOHW #014 OCR Dual Main Connection – (16/01 onward).
- OOHW #009 – JSD HDD
 - LOC116 to LOC124 (16/01 to 22/01)
 - LOC100 to LOC 105 (03/01 to 08/01) Note: Assessed as worst case scenario as nearest activity.

No overlap of Clearly Audible receivers during Daytime OOHW

Compliance (NML Exceedance)

Compliant	0 <= 5dB
Noticeable:	5 <= 15dB
Clearly Audible:	15 <= 25dB
Moderately Intrusive:	>25dB
Highly Intrusive:	>25dB

G. Respite framework

Comments:

N/A - None present in subject area.

H. Details of non-residential sensitive receivers (if any) and corresponding NMLs

Comments:

N/A - None present in subject area.

I. Are there any properties at risk of exceeding the screening criteria (CNVG minimum distances for vibration intensive plant) safe working distance for plant) for cosmetic damage?

Comments:

N/A – Vibration works are outside safe working distances for cosmetic damage.

J. Review / Endorsements

Transport for NSW Community Liaison Representative

Community notified

Date:

Additional consultation requirements:

Have the works been reviewed and endorsed?

Yes / No

Name:

Signature:

Date:

Tammy Hosking

15/12/22

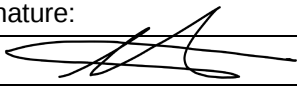
Comments:

Transport for NSW Environmental Manager (or delegate)

Agreed mitigation measures:

As per section E.

CHB Project OOHW application form

	Have the works been reviewed and endorsed?		Yes / No
	Have the works been approved where neither low nor high risk (predicted to be <NML and below cosmetic damage vibration screening criteria)?		Yes / No
	Name:	Signature:	Date:
	Shayne Walker	<i>SWalker</i>	15/12/22
	Comments:		
Project Acoustic Advisor	Agreed mitigation measures:		
	Have the works been reviewed and endorsed?		Yes / No
	Have the works been approved where neither low nor high risk (predicted to be <NML and below cosmetic damage vibration screening criteria)?		Yes / No
	Name:	Signature:	Date:
	Comments:		
Transport for NSW Project Manager	Agreed mitigation measures:		
	Have the works been reviewed and endorsed?		Yes / No
	Have the works been approved where neither low nor high risk (predicted to be <NML and below cosmetic damage vibration screening criteria)?		Yes / No
	Name:	Signature:	Date:
	Matthew Amato		15/12/2022
	Comments:		
ER approval (low risk activities)	Are the works approved?		Yes / No
	Name:	Signature:	Date:
	Comments:		
Planning Secretary approval (high risk activities)	Are the works approved?		Yes / No
	Name:	Signature:	Date:
	Comments:		

Appendix A

Noise impact distribution maps

Dewatering (Night)

Plant and Equipment

- 1 x 6" pump (89dB)
- 3 x Light Towers (93dB)

NCA Assessed (NML Period)

- NCA 28 (Night)

Duration

- Up to 16 hours (continuous)

Perception Classification (number of receivers)

- Noticeable = 0
- Clearly Audible = 0
- Moderately Intrusive = 0
- Highly Intrusive = 0



Excavation / Pipe Lifting (Night)

Plant and Equipment

- 1 x Bogie (95dB)
- 2 x 23T Excavators (100dB)
- 3 x Light Towers (93dB)

NCA Assessed (NML Period)

- NCA 26 (Night)

Duration

- Up to 10 hours for bulk excavation. Up to 6 hours to lift pipes (as required)

Perception Classification (number of receivers)

- Noticeable = 19
- Clearly Audible = 18
- Moderately Intrusive = 0
- Highly Intrusive = 0



Cutting Pipes (Night)

Plant and Equipment

- 1 x Demolition Saw (113dB)
- 3 x Light Towers (93dB)

NCA Assessed (NML Period)

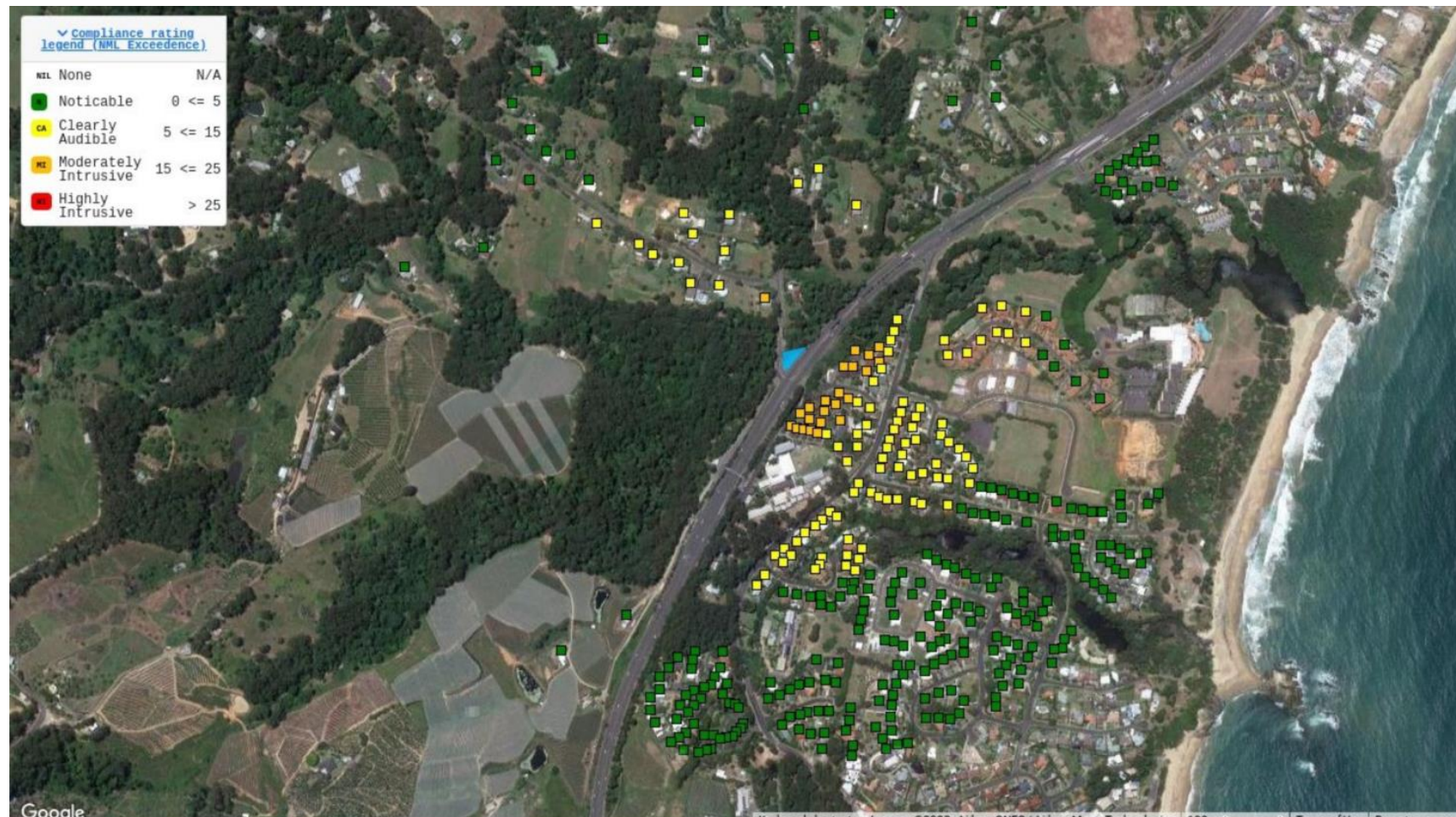
- NCA 26 (Night)

Duration

- Up to 16 cuts, with generally 30 minutes each. Occurring various times

Perception Classification (number of receivers)

- Noticeable = 270
- Clearly Audible = 94
- Moderately Intrusive = 23
- Highly Intrusive = 0



Hammering (Daytime)

Plant and Equipment

- 2 x 23T excavators with 1,000kg hammers (113dB)

NCA Assessed (NML Period)

- NCA 26 (Daytime)

Duration

- Up to 8 hours (continuous)

Perception Classification (number of receivers)

- Noticeable = 0
- Clearly Audible = 3
- Moderately Intrusive = 0
- Highly Intrusive = 0



Hammering (Night) – Not Proposed

Transport & Utilities Infrastructure

Plant and Equipment

- 2 x 23T excavators with 1,000kg hammers (113dB)
- 3 x Light Towers (93dB)

NCA Assessed (NML Period)

- NCA 26 (Night)

Duration

- Up to 8 hours (continuous)

Perception Classification (number of receivers)

- Noticeable = 260
- Clearly Audible = 94
- Moderately Intrusive = 23
- Highly Intrusive = 0



Concrete Pours (Night)

Plant and Equipment

- 1 x Concrete Truck / Agitator (93dB)
- 1 x Concrete Vibrator (95dB)
- 1 x 23T Excavator (96dB)
- 1 x 4" Grinder (83dB)
- 3 x Light Towers (93dB)

NCA Assessed (NML Period)

- NCA 26 (Night)

Duration

- Main pours – 2 x 6 hour periods.
Various small pours throughout.

Perception Classification (number of receivers)

- Noticeable = 24
- Clearly Audible = 7
- Moderately Intrusive = 0
- Highly Intrusive = 0



Vacc Truck (Night)



Transport & Utilities Infrastructure

Plant and Equipment

- 1 x Vacc Truck (105dB)
- 3 x Light Towers (93dB)

NCA Assessed (NML Period)

- NCA 26 (Night)

Duration

- As/if required

Perception Classification (number of receivers)

- Noticeable = 34
- Clearly Audible = 33
- Moderately Intrusive = 0
- Highly Intrusive = 0



Vibration Rolling (Night)

Plant and Equipment

- 1 x 10T Vibratory Roller (101dB)
- 3 x Light Towers (93dB)

NCA Assessed (NML Period)

- NCA 26 (Night)

Duration

- Up to 8 hours (continuous)

Perception Classification (number of receivers)

- Noticeable = 20
- Clearly Audible = 17
- Moderately Intrusive = 0
- Highly Intrusive = 0



CHB Project OOHW application form

Appendix B

Draft Community Notification



December 2022

Out of Hours Work on the Coffs Harbour bypass project – northern utilities

Notification of upcoming out of hours work on Old Coast Road, Korora

Quickway has been engaged to continue low impact work on the Coffs Harbour bypass project. As part of the utility relocations, watermain works will occur at the intersection of the Pacific Highway and Old Coast Road, Korora.

Work will take up to 5 days (including 4 consecutive nights) when a suitable clear weather window permits.

Residents can expect the work to be undertaken between **Monday 16 January 2023** and **28 February 2023**.

Further details (including exact dates) will be issued **at least 24 hours** prior to commencement of the 5 day (4 consecutive nights) utility relocation work.

This critical work must happen continuously (24 hours a day, over five days) to ensure the recycled watermain setup can be reinstated as quickly as possible. In addition, the work must occur during good weather to reduce any risk of operational or environmental impact that could happen if there was an uncontrolled release of recycled water.

Work will involve trenching, disconnection of existing recycled watermain services, removal of an existing concrete anchor block, installation of new pipes, pouring of concrete and reconnection to the existing service.

Machinery will include excavators, rock hammers, a pump, a concrete saw, concrete trucks and vibrators, heavy and light vehicles, tipper trucks, lighting towers and use of a vacuum excavation truck as required.

Traffic control will be in place where required on Old Coast Road, with intermittent stoppages to accommodate safe truck movements.

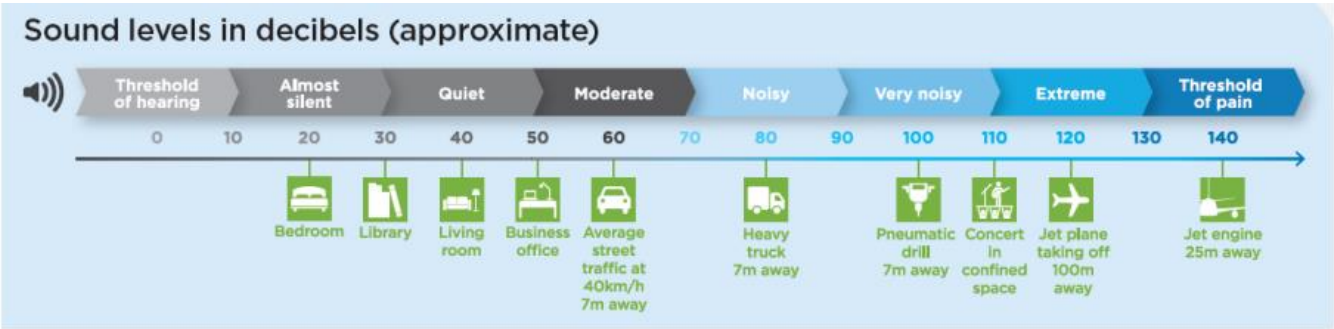
Should you have any questions or concerns about the upcoming works, we strongly encourage you to contact our project team on 1800 550 621.

How could this work impact you?

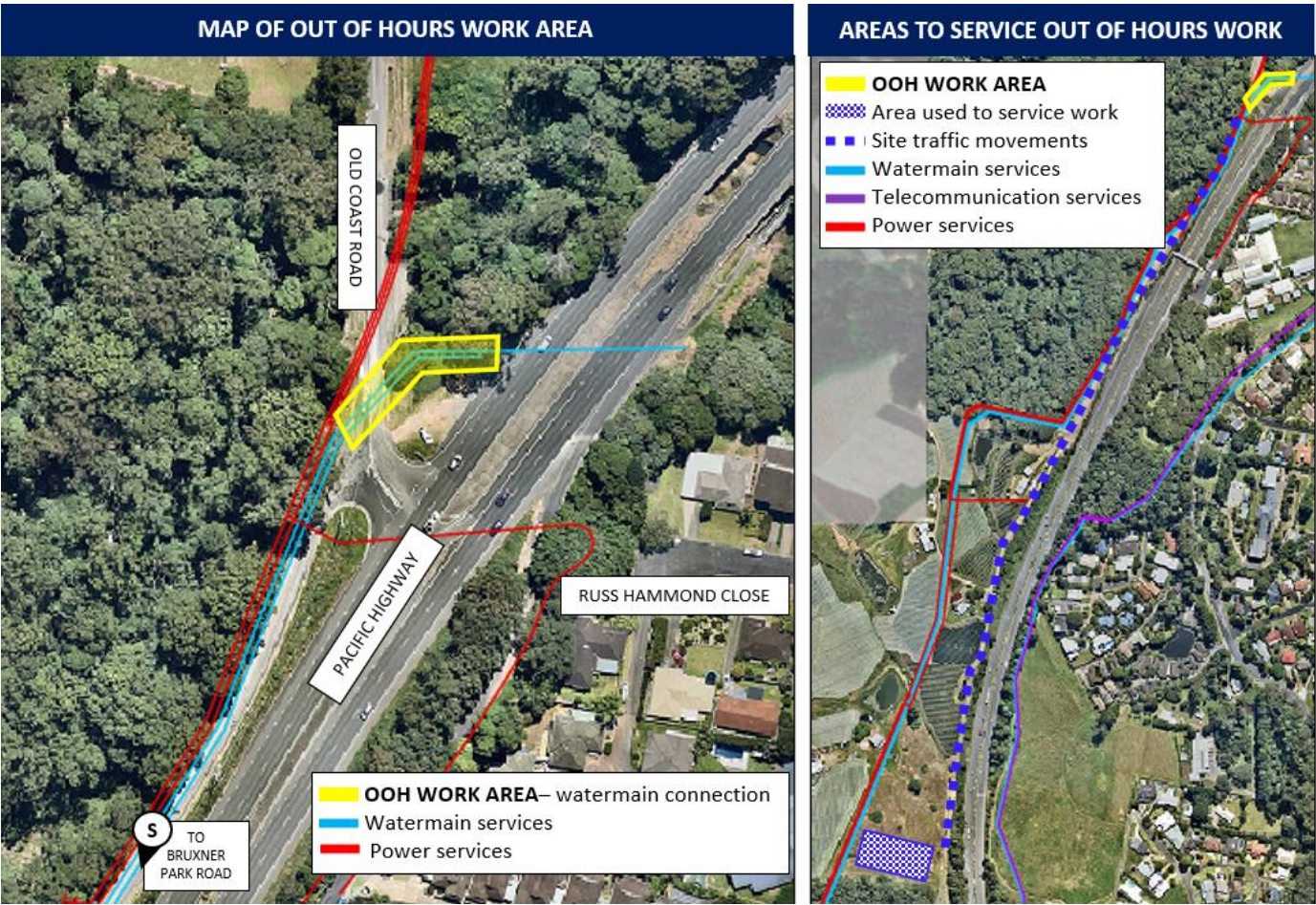
This work will not cause any disruptions to water services in the area and all efforts will be made to minimise dust, noise and added disruption to the surrounding community and environment while this work is being carried out. We are committed to mitigating construction impacts on the surrounding residents by:

- consulting with directly impacted residents ahead of the work starting and during works
- work involving machinery will occur in stages to minimise noise levels
- turning off vehicles when not in use
- using non-tonal reversing beepers and instructing workers to keep noise to a minimum
- noise blankets where appropriate
- verification monitoring of generated noise levels
- orientating machinery with the noisiest elements directed away from receivers wherever possible

The predicted noise levels are expected to moderate in nature for residents closest to the works, and can be viewed in the illustration below:



Location of work



Looking ahead

Over the next three months, additional out of hours work is anticipated for the following:

- Additional underboring and trenching activities next to and under the Pacific Highway and local roads, including Old Coast Road, James Small Drive, Bruxner Park Road, and Charlesworth Bay Road, periodically until March 2023
- Semi trailer deliveries into with working areas at Pacific Bay Resort, Charlesworth Bay Road, Bruxner Park Road and James Small Drive, periodically until May 2023
- Vegetation clearing next to the eastern side of the Pacific Highway and local roads near Charlesworth Bay Road throughout December 2022 and January 2023
- Geotechnical investigations in the median and shoulder of the Pacific Highway near Pine Brush Creek in January 2023 will require lane closures.

Unexpected circumstances may initiate the need for additional out of hours work to occur outside of the above timeframes. In all events, Transport for NSW will provide written notification before the work commences. In addition, directly impacted residents will be contacted and advised of the likely impact and what we are doing to minimise disruption during the work.

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coffsharbourbypass@transport.nsw.gov.au

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January 2023

Out of Hours Work on the Coffs Harbour bypass project – northern utilities

Out of Hours works to commence on XX XX January 2023 on Old Coast Road, Korora

Quickway has been engaged to continue low impact work on the Coffs Harbour bypass project. As part of the utility relocations, watermain works will occur at the intersection of the Pacific Highway and Old Coast Road, Korora.

Works will be undertaken for up to 5 days (including 4 consecutive nights) from INSERT DATES HERE 2023 (weather permitting).

This critical work must happen continuously (24 hours a day, over five days) to ensure the recycled watermain setup can be reinstated as quickly as possible. In addition, the work must occur during good weather to reduce any risk of operational or environmental impact that could happen if there was an uncontrolled release of recycled water.

Work will involve trenching, disconnection of existing recycled watermain services, removal of an existing concrete anchor block, installation of new pipes, pouring of concrete and reconnection to the existing service.

Machinery will include excavators, rock hammers, a pump, a concrete saw, concrete trucks and vibrators, heavy and light vehicles, tipper trucks, lighting towers and use of a vacuum excavation truck as required.

Traffic control will be in place where required on Old Coast Road, with intermittent stoppages to accommodate safe truck movements.

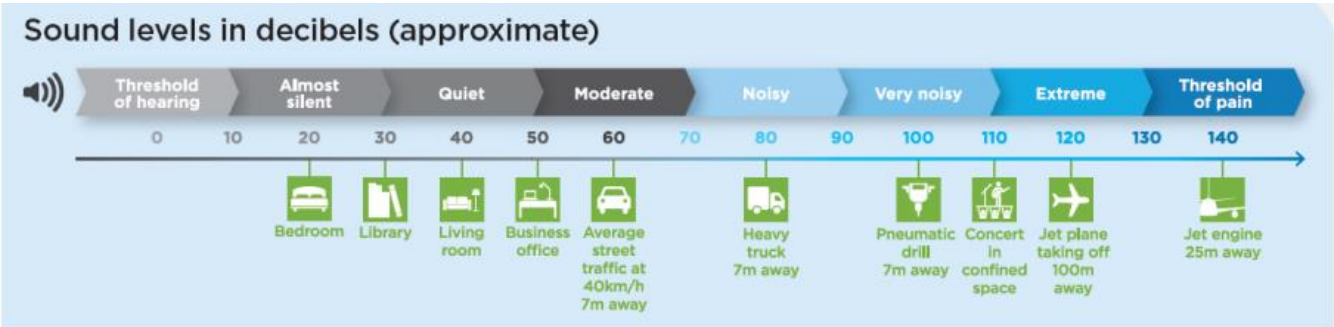
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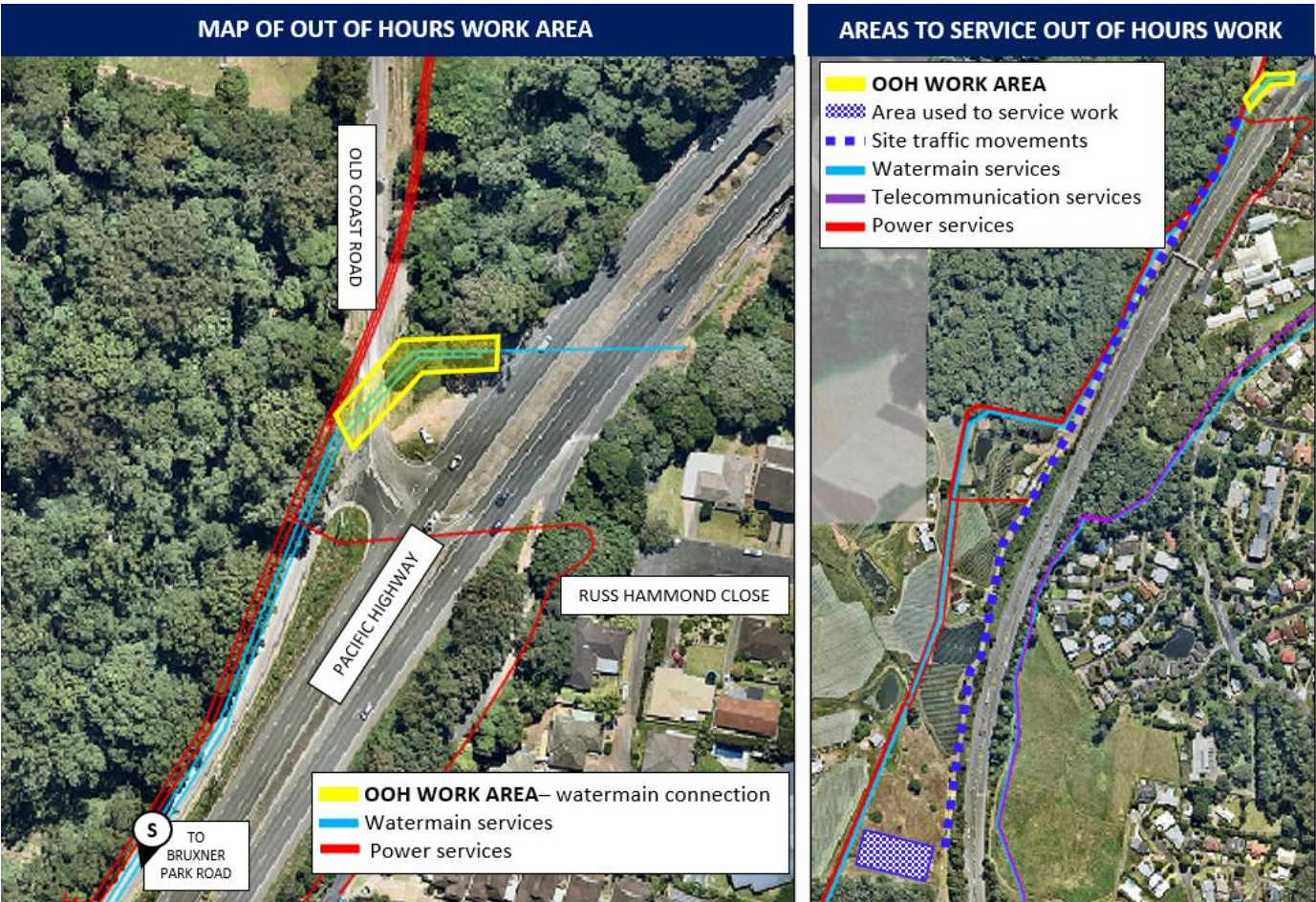
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Appendix C

Noise Assessments

Construction noise impact assessment

Vibration Rolling - Night

OCR Dual Watermain connection			
Proposed works	OCR Dual Watermain Connection at OCR		
Proponent	Quickway		
Assessment Date	07/12/2022		
Prepared by	Tom St Vincent Welch	Assessment Id	OOH14

Introduction

This report has been prepared using the construction noise self-assessment platform KNOWnoise: *Minor Works* and presents an assessment of the likely noise impacts related to proposed works associated with the above project. Where possible, these works would be completed during standard construction hours; however, there may be a need to work outside these hours due to technical, community or access limitations. The location of the proposed works is illustrated in Appendix A.

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OCR Dual Watermain Connection at OCR. Works required over 24hour consecutive shifts to minimise ensure works are within 5 day window permitted by Coffs Harbour City Council

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Though subject to change, the works are expected to commence around 16/01/2023 and would be completed by 22/01/2023.

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The Interim Construction Noise Guideline (ICNG) (DECC 2009) describes noise more than the background level as potentially having an adverse impact on sensitive receivers and increasing the likelihood of complaint. During standard construction hours, where construction noise is within 10 dB(A) of the RBL, impacts would be acceptable.

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Above a LAeq, 15 minute noise level of 75 dB(A), a receiver is highly affected, requiring consideration of additional mitigation measures including alternative accommodation in the night period.

Outside standard construction hours, construction noise at a residential receiver more than 5 dB(A) above the RBL is taken to be noise affected.

In addition, annoying noise such as rock hammers, impact piling, or other impulsive noise sources usually result in greater annoyance than continuous construction noise. A 5 dB(A) penalty is applicable to such activities prior to comparison with the NMLs.

Other sensitive land uses, such as schools and offices, typically find noise from construction disruptive when the properties are being used (such as during work and school times). Table 2 presents NMLs from the ICNG for sensitive land uses based on the principle that the characteristic activities for each of these land uses should not be unduly disturbed.

Table 1 Non-residential sensitive land uses noise management levels

Land use	Noise assessment location	NML (L _{Aeq,15min})
Classrooms at schools and other educational institutions	Internal	45
Places of worship		
Active recreation areas (such as sporting activities and activities which generate their own noise or focus for participants)	External	65
Passive recreation areas (contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External	60
Industrial premises	External	75
Office, retail outlets	External	70

As part of planning for out of hours works, standard mitigation measures, as described in the ICNG and CNVG, would be implemented where reasonable and feasible. However, after these measures have been applied, noise and vibration levels may continue to exceed the NMLs.

In this case, additional mitigation measures outlined in the CNVG, which largely focus on engagement with affected sensitive receivers, should be implemented where reasonable and feasible, unless other agreements are in place with the impacted receiver.

Triggers and additional mitigation measures for airborne noise are summarised in Table 2. Further details of specific additional mitigation measures are described in the CNVG.

Table 2 Triggers for additional mitigation measures – Airborne noise (Roads and Maritime 2016)

Predicted airborne L _{Aeq} (15min) noise level at receiver			
Perception	dB(A) above RBL	dB(A) above NML	Additional mitigation measures
All hours			
75 dB(A) or greater			N, V, PC, RO
Standard hours: Mon - Fri (7am – 6pm), Sat (8am – 1pm), Sun/Pub Hol (Nil)			
Noticeable	5 to 10	0	-
Clearly audible	10 to 20	< 10	-
Moderately intrusive	20 to 30	10 to 20	N, V
Highly intrusive	> 30	> 20	N, V
OOHW Period 1: Mon – Fri (6pm – 10pm), Sat (7am – 8am & 1pm – 10pm), Sun/Pub Hol (8am – 6pm)			
Noticeable	5 to 10	<5	-
Clearly audible	10 to 20	5 to 15	N, R1, DR
Moderately intrusive	20 to 30	15 to 25	V, N, R1, DR
Highly intrusive	> 30	>25	V, IB, N, R1, DR, PC, SN
OOHW Period 2: Mon – Fri (10pm – 7am), Sat (10pm – 8am), Sun/Pub Hol (6pm – 7am)			
Noticeable	5 to 10	<5	N
Clearly audible	10 to 20	5 to 15	V, N, R2, DR
Moderately intrusive	20 to 30	15 to 25	V, IB, N, PC, SN, R2, DR
Highly intrusive	> 30	>25	AA, V, IB, N, PC, SN, R2, DR

Notes:

PC = Phone calls

V = verification

IB = Individual briefings

N= Notification

AA = Alternative accommodation

SN = Specific notifications

RO = Respite offer

R1 = Respite period 1

R2 = Respite period 2

DR = Duration respite

Perception = relates to levels above RBL

NML = Noise management level

HA = Highly affected

Existing environment and noise management levels

The proposed works would be undertaken in a predominantly Rural / Suburban, characterised as:

Areas with negligible transportation or very limited local traffic, typically light vehicles only.

100m or more from the road.

Background noise levels adopted for the project area and associated noise management levels (NMLs) are summarised in Table 3. NMLs have been established in line with the ICNG.

Table 3 Construction NMLs

Land use	Rural / Suburban		Using custom background noise data?		Yes
Criterion	Day	Weekend Day	Evening	Night	Sleep
RBL	52	52	46	37	
NML	62	57	51	42	65

Sleep disturbance

The ICNG recommends where construction works are planned to extend over more than two consecutive nights, the maximum noise level should be considered for the purposes of establishing the likelihood of sleep disturbance. The Road Noise Policy suggests that maximum internal noise levels below 50-55 dB(A) are unlikely to awaken people from sleep and one or two noise events per night, with maximum internal noise levels of 65-70 dB(A) are not likely to affect health and wellbeing significantly.

Based on this, a sleep awakening criterion of 55 dB(A) (internal) is typically adopted for works. Given that noise attenuation of 10 dB(A) is typically provided by an open window, a sleep awakening criterion of L_Amax 65 dB(A) (external) has been applied to residential bedroom façades. This is consistent with the sleep disturbance threshold described in Appendix E of the CNVG.

Vibration

Effects of vibration from construction may be segregated into:

- Human exposure – disturbance to building occupants: vibration in which the occupants or users of the building are inconvenienced or possibly disturbed.
- Effects on building contents – vibration where the building contents may be affected.
- Effects on building structures – vibration in which the integrity of the building or structure itself may be prejudiced.

Vibration criteria relating to human comfort applicable to this project are taken from the DEC (2006) document Assessing Vibration – A Technical Guideline for intermittent vibration – such as from drilling, compacting or activities that would result in continuous vibration if operated continuously. Intermittent vibration is assessed as a vibration dose value (VDV) and relates to the level of vibration over time (cumulative over the night or day period). VDV values that may result in adverse comment from receivers are summarised in Table 4.

Table 4 Summary of vibration dose values which might result in adverse comment

Time	Low probability of adverse comment (m/s ^{1.75})	Adverse comment possible (m/s ^{1.75})	Adverse comment probable (m/s ^{1.75})
Day (6am to 10pm)	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Night (10pm to 6am)	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Guidance for the consideration of potential building damage from construction vibration is in line with BS 7385-1 *Evaluation and measurement for vibration in buildings - Guide for measurement of vibration and evaluation of their effects on buildings*. These guideline values are presented in Table 5.

Table 5 Building damage vibration guidelines (BS 7385-1)

Type of building	Guideline values for vibration (PPV mm/s)		
	4Hz to 15Hz	15Hz to 40Hz	40Hz and above
Reinforced or framed structures / Industrial and heavy commercial buildings	50		
Un-reinforced or light framed structures / Residential or light commercial type buildings	15 - 20	20 - 50	50

For heritage structures, criteria are in line with the German Standard *DIN 4150-3: Structural Vibration- effects of vibration on structures*, as summarised in Table 6.

Table 6 Guideline values for vibration velocity to be used when evaluating the effects of short-term vibration on heritage structures (DIN 4150-3).

Type of building	Guideline values for vibration (PPV mm/s)			
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz	Vibration at horizontal plane of highest floor at all frequencies
Structures that, because of their sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	3	3 to 8	8 to 10	8

The safe working distances presented in Table 7 are indicative and will vary depending on the item of plant and local geotechnical conditions. The cosmetic damage thresholds apply to typical buildings under typical geotechnical conditions and vibration monitoring is recommended at specific sites. Where structures are more sensitive, such as heritage items, more stringent conditions are applicable and should be considered individually.

In relation to human response, the safe working distances relate to continuous vibration. For most construction activities, vibration emissions are intermittent and higher vibration levels over shorter periods are acceptable. Additional assessment should be undertaken where the human response criteria are exceeded.

Table 7 Safe working distances for vibration intensive plant

Plant item	Rating/description	Safe working distance	
		Cosmetic damage (BS 7385-1)	Human response (DECCW)
Vibratory roller	<50 kN (typically 1-2 t)	5 m	15 m to 20 m
	<100 kN (typically 2-4 t)	6 m	20 m
	<200 kN (typically 4-6 t)	12 m	40 m
	<300 kN (typically 7-13 t)	15 m	100 m
	>300 kN (typically 13-18 t)	20 m	100 m
	>300 kN (> 18 t)	25 m	100 m
Small hydraulic hammer	300 kg – 5 to 12 t excavator	2 m	7 m
Medium hydraulic hammer	900 kg – 12 to 18t excavator	7 m	23 m
Large hydraulic hammer	1600 kg – 18 to 34 t excavator	22 m	73 m
Vibratory pile driver	Sheet piles	2 m to 20 m	20 m
Pile boring	≤800 mm	2 m	n/a
Jackhammer	Hand held	1 m	Avoid contact with structure

Assessment methodology

Based on the nominated works area (illustrated in Appendix A), proposed equipment and the minimum distance from the works to each sensitive receiver, noise levels were calculated based on CONCAWE (1981) *Propagation of noise from petroleum and petrochemical complexes to neighboring communities*.

This method considers geometric spreading, atmospheric absorption, ground effects and is valid for meteorological conditions of a gentle breeze from source to receiver and stable atmosphere (temperature inversion).

KNOWnoise: Minor works is a 2-Dimensional assessment platform and does not consider terrain effects (e.g. hills, valleys) or the presence of solid structures such as homes or noise barriers. This will result in a conservative prediction, suitable for the project being assessed.

Considering the nature of the works and the type of surrounding land uses, sensitive receivers up to a radius of 1000 metres from the works have been included in the assessment.

Sound power levels and predicted noise levels depend on the number of plant items operating at any one time and their precise location relative to a sensitive receiver. Equipment was assumed to be working at the worst-case location relative to each receiver and represents a worst-case assessment. Where the activity is further away from receivers or less equipment is used the predicted levels will decrease.

Sound power levels for plant and equipment expected to be used for each activity has been estimated based on guidance in the following standards and guidelines as well as typical measured noise levels for specific equipment.

- “ Australian Standard AS2436-2010: Guide to noise and vibration control on construction, demolition and maintenance sites
- “ Construction Noise and Vibration Strategy 7TP-ST-157/2.0 (CNVS), (TfNSW, 2018)
- “ Construction Noise and Vibration Guideline (CNVG) (Roads and Maritime Services, 2016)
- “ British Standard 5228-1:2009 Code of practice for noise and vibration control on construction and open sites
- “ United Kingdom Department for Environment, Food and Rural Affairs (DEFRA) Noise database for prediction of noise on construction and open sites

Construction noise sources and associated sound power levels are listed in Appendix B. The maximum predicted LAeq noise level within the work area was identified for each receiver.

Predicted noise levels

Detailed predicted noise levels for each potentially affected receiver are presented Appendix C.

A summary of predicted noise levels in comparison with ICNG assessment criteria for the Night period is presented in Table 8.

Table 8 Summary of predicted noise levels with comparison against ICNG criteria for the Night period.

Criterion	Predicted number of receivers
Maximum cumulative predicted L _{Aeq} , 15 minute noise level	52 dB(A)
Number of highly noise affected receivers (>75 dB)	0
1 – 10 dB above NML	36
10 – 20 dB above NML	0
20+ dB above NML	0

In line with CNVG impact classes, up to 0 receivers are predicted to be classified as Highly Impacted during the Night period. A summary of the number of receivers in each class is presented in Table 9.

Table 9 Summary of predicted noise levels with comparison against CNVG criteria

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 <= 5 dB above NML	20
Clearly Audible	5 <= 15 dB above NML	17
Moderately Intrusive	15 <= 25 dB above NML	0
Highly Intrusive	> 25 dB above NML	0

Predicted impact classes for the Night period are illustrated graphically in Appendix C. Each identified receiver in the study area has been coloured to highlight the predicted level of impact.

Sleep disturbance

In the event works are planned for more than two consecutive nights, up to 0 are expected to exceed the sleep awakening criteria. Where any exceedances if the awakening criteria are predicted, additional care should be taken and mitigation measures implemented in the with the CNVG.

Predicted vibration impacts

The level of vibration impact on sensitive receivers (buildings and human comfort) will largely depend on the type of machinery in use and the distance from source to receiver.

Based on the proposed work locations and selected equipment, the following level of vibration impact is expected. A summary of vibration impacts is provided for each sensitive receiver in Appendix C.

Impact classification	Number of potentially affected receivers
Human comfort	7
Cosmetic damage	0
Heritage structure	0

Proposed noise mitigation measures

The safeguards and controls listed in Table 10 will be implemented where reasonable and feasible with the intention of achieving the project noise criteria and to maintain noise impacts at a practical minimum.

Table 10 Safeguards and controls

Action	Description
Community consultation or notification	Notify the affected community. The notification will detail work activities, dates and hours, impacts and mitigation measures, indication of work schedule over the night time period, any operational noise benefits from the works (where applicable) and contact telephone number. Notification should be a minimum of 7 calendar days prior to the start of works. For projects other than maintenance works more advanced consultation or notification may be required.
Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction would at least include: - all project specific and relevant standard noise and vibration mitigation measures - relevant licence and approval conditions - permissible hours of work - any limitations on high noise generating activities - location of nearest sensitive receivers - construction employee parking areas - designated loading/unloading areas and procedures site opening/closing times (including deliveries) environmental incident procedures
Behaviour	No swearing or unnecessary shouting or loud stereos/radios on site. Limit compression braking at night in residential areas. No dropping of materials from height, throwing of metal items and slamming of doors.
Verification	Where indicated in Appendix C, a noise verification program would be undertaken for the duration of the works.
Construction hours	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels should be scheduled during less sensitive time periods.
Respite for out-of-hours works	Respite would be scheduled as indicated in Appendix C and described in the CNVG.
Equipment selection	Use quieter construction methods where feasible and reasonable. Ensure plant including the silencer is well maintained. Plant noise levels will have an operating noise emission level compliant with Appendix F of the CNVG
Use and siting of plant	The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers.

Action	Description
Plan worksites and activities to minimise noise and vibration.	Locate compounds away from sensitive receivers and discourage access from local roads. Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site. Where additional activities or plant may only result in a marginal noise increase and speed up works, consider limiting duration of impact by concentrating noisy activities at one location and move to another as quickly as possible. Very noise activities should be scheduled for normal working hours. If the work can not be undertaken during the day, it should be completed before 11:00pm. Where practicable, work should be scheduled to avoid major student examination periods when students are studying for examinations such as before or during Higher School Certificate and at the end of higher education semesters.
Non-tonal reverse alarms	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work.
Shield stationary noise sources such as pumps, generators, and compressors	These should be enclosed or shielded where reasonable and feasible.
Implement any project specific mitigation measures	
1	None

Appendix A Project location and predicted level of impact



Appendix B Proposed activities and equipment

Vib Rolling

Equipment	Quantity	Usage	Reduction	SWL
Vibratory Roller (10 tonne)*	1	40 %	5	101
Daymakers / Lighting plant	3	100 %	5	93

Activity Sound Power Level: 102

Appendix C Detailed noise predicted for each receiver and activity

Assessment: OCR Dual Watermain Connection at OCR				Night	Results summary		
NCA	ID	Address	Land use	NML	Cumulative Predicted LAeq, 15 minute noise level	Exceedance of NML, dB	Impact classification
NCA 1	770254	15 JAMES SMALL DRIVE KORORA	RES	42	45	3	Noticable
NCA 1	770213	3 RUSS HAMMOND CLOSE KORORA	RES	42	46	4	Noticable
NCA 1	770205	13 RUSS HAMMOND CLOSE KORORA	RES	42	48	6	Clearly Audible
NCA 1	770204	9 RUSS HAMMOND CLOSE KORORA	RES	42	50	8	Clearly Audible
NCA 1	770202	13 RUSS HAMMOND CLOSE KORORA	RES	42	51	9	Clearly Audible
NCA 1	770201	13 RUSS HAMMOND CLOSE KORORA	RES	42	50	8	Clearly Audible
NCA 1	770200	UNIT 3/ 1 KORORA SCHOOL ROAD KORORA	RES	42	47	5	Clearly Audible
NCA 1	770199	UNIT 3/ 1 KORORA SCHOOL ROAD KORORA	RES	42	47	5	Noticable
NCA 1	770198	UNIT 3/ 1 KORORA SCHOOL ROAD KORORA	RES	42	46	4	Noticable
NCA 1	770180	13 JAMES SMALL DRIVE KORORA	RES	42	46	4	Noticable
NCA 1	770177	11A JAMES SMALL DRIVE KORORA	RES	42	46	4	Noticable
NCA 1	770176	6 RUSS HAMMOND CLOSE KORORA	RES	42	51	9	Clearly Audible
NCA 1	770162	2 RUSS HAMMOND CLOSE KORORA	RES	42	46	4	Noticable
NCA 1	770153	UNIT 2/ 7 RUSS HAMMOND CLOSE KORORA	RES	42	49	7	Clearly Audible
NCA 1	770087	33 JAMES SMALL DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	770086	37 JAMES SMALL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770016	31 JAMES SMALL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770013	UNIT 1/ 1 KORORA SCHOOL ROAD KORORA	RES	42	45	3	Noticable
NCA 1	769934	11 RUSS HAMMOND CLOSE KORORA	RES	42	47	5	Clearly Audible
NCA 1	769933	11 RUSS HAMMOND CLOSE KORORA	RES	42	49	7	Clearly Audible
NCA 1	769932	UNIT 5/ 1 KORORA SCHOOL ROAD KORORA	RES	42	48	6	Clearly Audible
NCA 1	769931	UNIT 5/ 1 KORORA SCHOOL ROAD KORORA	RES	42	48	6	Clearly Audible
NCA 1	769908	29 JAMES SMALL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	769907	1 RUSS HAMMOND CLOSE KORORA	RES	42	44	2	Noticable
NCA 1	769906	5 RUSS HAMMOND CLOSE KORORA	RES	42	47	5	Noticable
NCA 1	769905	27 JAMES SMALL DRIVE KORORA	RES	42	46	4	Noticable
NCA 1	769904	UNIT 2/ 7 RUSS HAMMOND CLOSE KORORA	RES	42	48	6	Clearly Audible
NCA 1	769838	10A RUSS HAMMOND CLOSE KORORA	RES	42	52	10	Clearly Audible
NCA 1	769837	4 RUSS HAMMOND CLOSE KORORA	RES	42	47	5	Clearly Audible
NCA 1	769836	8 RUSS HAMMOND CLOSE KORORA	RES	42	50	8	Clearly Audible
NCA 1	769835	4A RUSS HAMMOND CLOSE KORORA	RES	42	48	6	Clearly Audible
NCA 1	769826	5 JAMES SMALL DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	769821	1 KORORA BASIN ROAD KORORA	RES	42	50	8	Clearly Audible
NCA 1	769819	11 KORORA BASIN ROAD KORORA	RES	42	44	2	Noticable
NCA 1	769818	7 JAMES SMALL DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	769817	9 JAMES SMALL DRIVE KORORA	RES	42	45	3	Noticable
NCA 1	769816	11 JAMES SMALL DRIVE KORORA	RES	42	45	3	Noticable

Appendix C Detailed noise predicted for each receiver and activity

Construction noise impact assessment

Concrete pours and steel fixing

OCR Dual Watermain connection			
Proposed works	OCR Dual Watermain Connection at OCR		
Proponent	Quickway		
Assessment Date	07/12/2022		
Prepared by	Tom St Vincent Welch	Assessment Id	OOH14

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Above a LAeq, 15 minute noise level of 75 dB(A), a receiver is highly affected, requiring consideration of additional mitigation measures including alternative accommodation in the night period.

Outside standard construction hours, construction noise at a residential receiver more than 5 dB(A) above the RBL is taken to be noise affected.

In addition, annoying noise such as rock hammers, impact piling, or other impulsive noise sources usually result in greater annoyance than continuous construction noise. A 5 dB(A) penalty is applicable to such activities prior to comparison with the NMLs.

Other sensitive land uses, such as schools and offices, typically find noise from construction disruptive when the properties are being used (such as during work and school times). Table 2 presents NMLs from the ICNG for sensitive land uses based on the principle that the characteristic activities for each of these land uses should not be unduly disturbed.

Table 1 Non-residential sensitive land uses noise management levels

Land use	Noise assessment location	NML (L _{Aeq,15min})
Classrooms at schools and other educational institutions	Internal	45
Places of worship		
Active recreation areas (such as sporting activities and activities which generate their own noise or focus for participants)	External	65
Passive recreation areas (contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External	60
Industrial premises	External	75
Office, retail outlets	External	70

As part of planning for out of hours works, standard mitigation measures, as described in the ICNG and CNVG, would be implemented where reasonable and feasible. However, after these measures have been applied, noise and vibration levels may continue to exceed the NMLs.

In this case, additional mitigation measures outlined in the CNVG, which largely focus on engagement with affected sensitive receivers, should be implemented where reasonable and feasible, unless other agreements are in place with the impacted receiver.

Triggers and additional mitigation measures for airborne noise are summarised in Table 2. Further details of specific additional mitigation measures are described in the CNVG.

Table 2 Triggers for additional mitigation measures – Airborne noise (Roads and Maritime 2016)

Predicted airborne L _{Aeq} (15min) noise level at receiver			
Perception	dB(A) above RBL	dB(A) above NML	Additional mitigation measures
All hours			
75 dB(A) or greater			N, V, PC, RO
Standard hours: Mon - Fri (7am – 6pm), Sat (8am – 1pm), Sun/Pub Hol (Nil)			
Noticeable	5 to 10	0	-
Clearly audible	10 to 20	< 10	-
Moderately intrusive	20 to 30	10 to 20	N, V
Highly intrusive	> 30	> 20	N, V
OOHW Period 1: Mon – Fri (6pm – 10pm), Sat (7am – 8am & 1pm – 10pm), Sun/Pub Hol (8am – 6pm)			
Noticeable	5 to 10	<5	-
Clearly audible	10 to 20	5 to 15	N, R1, DR
Moderately intrusive	20 to 30	15 to 25	V, N, R1, DR
Highly intrusive	> 30	>25	V, IB, N, R1, DR, PC, SN
OOHW Period 2: Mon – Fri (10pm – 7am), Sat (10pm – 8am), Sun/Pub Hol (6pm – 7am)			
Noticeable	5 to 10	<5	N
Clearly audible	10 to 20	5 to 15	V, N, R2, DR
Moderately intrusive	20 to 30	15 to 25	V, IB, N, PC, SN, R2, DR
Highly intrusive	> 30	>25	AA, V, IB, N, PC, SN, R2, DR

Notes:

PC = Phone calls

V = verification

IB = Individual briefings

N= Notification

AA = Alternative accommodation

SN = Specific notifications

RO = Respite offer

R1 = Respite period 1

R2 = Respite period 2

DR = Duration respite

Perception = relates to levels above RBL

NML = Noise management level

HA = Highly affected

Existing environment and noise management levels

The proposed works would be undertaken in a predominantly Rural / Suburban, characterised as:

Areas with negligible transportation or very limited local traffic, typically light vehicles only.

100m or more from the road.

Background noise levels adopted for the project area and associated noise management levels (NMLs) are summarised in Table 3. NMLs have been established in line with the ICNG.

Table 3 Construction NMLs

Land use	Rural / Suburban		Using custom background noise data?		Yes
Criterion	Day	Weekend Day	Evening	Night	Sleep
RBL	52	52	46	37	
NML	62	57	51	42	65

Sleep disturbance

The ICNG recommends where construction works are planned to extend over more than two consecutive nights, the maximum noise level should be considered for the purposes of establishing the likelihood of sleep disturbance. The Road Noise Policy suggests that maximum internal noise levels below 50-55 dB(A) are unlikely to awaken people from sleep and one or two noise events per night, with maximum internal noise levels of 65-70 dB(A) are not likely to affect health and wellbeing significantly.

Based on this, a sleep awakening criterion of 55 dB(A) (internal) is typically adopted for works. Given that noise attenuation of 10 dB(A) is typically provided by an open window, a sleep awakening criterion of L_Amax 65 dB(A) (external) has been applied to residential bedroom façades. This is consistent with the sleep disturbance threshold described in Appendix E of the CNVG.

Vibration

Effects of vibration from construction may be segregated into:

- Human exposure – disturbance to building occupants: vibration in which the occupants or users of the building are inconvenienced or possibly disturbed.
- Effects on building contents – vibration where the building contents may be affected.
- Effects on building structures – vibration in which the integrity of the building or structure itself may be prejudiced.

Vibration criteria relating to human comfort applicable to this project are taken from the DEC (2006) document Assessing Vibration – A Technical Guideline for intermittent vibration – such as from drilling, compacting or activities that would result in continuous vibration if operated continuously. Intermittent vibration is assessed as a vibration dose value (VDV) and relates to the level of vibration over time (cumulative over the night or day period). VDV values that may result in adverse comment from receivers are summarised in Table 4.

Table 4 Summary of vibration dose values which might result in adverse comment

Time	Low probability of adverse comment (m/s ^{1.75})	Adverse comment possible (m/s ^{1.75})	Adverse comment probable (m/s ^{1.75})
Day (6am to 10pm)	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Night (10pm to 6am)	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Guidance for the consideration of potential building damage from construction vibration is in line with BS 7385-1 *Evaluation and measurement for vibration in buildings - Guide for measurement of vibration and evaluation of their effects on buildings*. These guideline values are presented in Table 5.

Table 5 Building damage vibration guidelines (BS 7385-1)

Type of building	Guideline values for vibration (PPV mm/s)		
	4Hz to 15Hz	15Hz to 40Hz	40Hz and above
Reinforced or framed structures / Industrial and heavy commercial buildings	50		
Un-reinforced or light framed structures / Residential or light commercial type buildings	15 - 20	20 - 50	50

For heritage structures, criteria are in line with the German Standard *DIN 4150-3: Structural Vibration- effects of vibration on structures*, as summarised in Table 6.

Table 6 Guideline values for vibration velocity to be used when evaluating the effects of short-term vibration on heritage structures (DIN 4150-3).

Type of building	Guideline values for vibration (PPV mm/s)			
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz	Vibration at horizontal plane of highest floor at all frequencies
Structures that, because of their sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	3	3 to 8	8 to 10	8

The safe working distances presented in Table 7 are indicative and will vary depending on the item of plant and local geotechnical conditions. The cosmetic damage thresholds apply to typical buildings under typical geotechnical conditions and vibration monitoring is recommended at specific sites. Where structures are more sensitive, such as heritage items, more stringent conditions are applicable and should be considered individually.

In relation to human response, the safe working distances relate to continuous vibration. For most construction activities, vibration emissions are intermittent and higher vibration levels over shorter periods are acceptable. Additional assessment should be undertaken where the human response criteria are exceeded.

Table 7 Safe working distances for vibration intensive plant

Plant item	Rating/description	Safe working distance	
		Cosmetic damage (BS 7385-1)	Human response (DECCW)
Vibratory roller	<50 kN (typically 1-2 t)	5 m	15 m to 20 m
	<100 kN (typically 2-4 t)	6 m	20 m
	<200 kN (typically 4-6 t)	12 m	40 m
	<300 kN (typically 7-13 t)	15 m	100 m
	>300 kN (typically 13-18 t)	20 m	100 m
	>300 kN (> 18 t)	25 m	100 m
Small hydraulic hammer	300 kg – 5 to 12 t excavator	2 m	7 m
Medium hydraulic hammer	900 kg – 12 to 18t excavator	7 m	23 m
Large hydraulic hammer	1600 kg – 18 to 34 t excavator	22 m	73 m
Vibratory pile driver	Sheet piles	2 m to 20 m	20 m
Pile boring	≤800 mm	2 m	n/a
Jackhammer	Hand held	1 m	Avoid contact with structure

Assessment methodology

Based on the nominated works area (illustrated in Appendix A), proposed equipment and the minimum distance from the works to each sensitive receiver, noise levels were calculated based on CONCAWE (1981) *Propagation of noise from petroleum and petrochemical complexes to neighboring communities*.

This method considers geometric spreading, atmospheric absorption, ground effects and is valid for meteorological conditions of a gentle breeze from source to receiver and stable atmosphere (temperature inversion).

KNOWnoise: Minor works is a 2-Dimensional assessment platform and does not consider terrain effects (e.g. hills, valleys) or the presence of solid structures such as homes or noise barriers. This will result in a conservative prediction, suitable for the project being assessed.

Considering the nature of the works and the type of surrounding land uses, sensitive receivers up to a radius of 1000 metres from the works have been included in the assessment.

Sound power levels and predicted noise levels depend on the number of plant items operating at any one time and their precise location relative to a sensitive receiver. Equipment was assumed to be working at the worst-case location relative to each receiver and represents a worst-case assessment. Where the activity is further away from receivers or less equipment is used the predicted levels will decrease.

Sound power levels for plant and equipment expected to be used for each activity has been estimated based on guidance in the following standards and guidelines as well as typical measured noise levels for specific equipment.

- “ Australian Standard AS2436-2010: Guide to noise and vibration control on construction, demolition and maintenance sites
- “ Construction Noise and Vibration Strategy 7TP-ST-157/2.0 (CNVS), (TfNSW, 2018)
- “ Construction Noise and Vibration Guideline (CNVG) (Roads and Maritime Services, 2016)
- “ British Standard 5228-1:2009 Code of practice for noise and vibration control on construction and open sites
- “ United Kingdom Department for Environment, Food and Rural Affairs (DEFRA) Noise database for prediction of noise on construction and open sites

Construction noise sources and associated sound power levels are listed in Appendix B. The maximum predicted LAeq noise level within the work area was identified for each receiver.

Predicted noise levels

Detailed predicted noise levels for each potentially affected receiver are presented Appendix C.

A summary of predicted noise levels in comparison with ICNG assessment criteria for the Night period is presented in Table 8.

Table 8 Summary of predicted noise levels with comparison against ICNG criteria for the Night period.

Criterion	Predicted number of receivers
Maximum cumulative predicted L _{Aeq} , 15 minute noise level	50 dB(A)
Number of highly noise affected receivers (>75 dB)	0
1 – 10 dB above NML	27
10 – 20 dB above NML	0
20+ dB above NML	0

In line with CNVG impact classes, up to 0 receivers are predicted to be classified as Highly Impacted during the Night period. A summary of the number of receivers in each class is presented in Table 9.

Table 9 Summary of predicted noise levels with comparison against CNVG criteria

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 <= 5 dB above NML	24
Clearly Audible	5 <= 15 dB above NML	7
Moderately Intrusive	15 <= 25 dB above NML	0
Highly Intrusive	> 25 dB above NML	0

Predicted impact classes for the Night period are illustrated graphically in Appendix C. Each identified receiver in the study area has been coloured to highlight the predicted level of impact.

Sleep disturbance

In the event works are planned for more than two consecutive nights, up to 0 are expected to exceed the sleep awakening criteria. Where any exceedances if the awakening criteria are predicted, additional care should be taken and mitigation measures implemented in the with the CNVG.

Predicted vibration impacts

The level of vibration impact on sensitive receivers (buildings and human comfort) will largely depend on the type of machinery in use and the distance from source to receiver.

Based on the proposed work locations and selected equipment, the following level of vibration impact is expected. A summary of vibration impacts is provided for each sensitive receiver in Appendix C.

Impact classification	Number of potentially affected receivers
Human comfort	0
Cosmetic damage	0
Heritage structure	0

Proposed noise mitigation measures

The safeguards and controls listed in Table 10 will be implemented where reasonable and feasible with the intention of achieving the project noise criteria and to maintain noise impacts at a practical minimum.

Table 10 Safeguards and controls

Action	Description
Community consultation or notification	Notify the affected community. The notification will detail work activities, dates and hours, impacts and mitigation measures, indication of work schedule over the night time period, any operational noise benefits from the works (where applicable) and contact telephone number. Notification should be a minimum of 7 calendar days prior to the start of works. For projects other than maintenance works more advanced consultation or notification may be required.
Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction would at least include: - all project specific and relevant standard noise and vibration mitigation measures - relevant licence and approval conditions - permissible hours of work - any limitations on high noise generating activities - location of nearest sensitive receivers - construction employee parking areas - designated loading/unloading areas and procedures site opening/closing times (including deliveries) environmental incident procedures
Behaviour	No swearing or unnecessary shouting or loud stereos/radios on site. Limit compression braking at night in residential areas. No dropping of materials from height, throwing of metal items and slamming of doors.
Verification	Where indicated in Appendix C, a noise verification program would be undertaken for the duration of the works.
Construction hours	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels should be scheduled during less sensitive time periods.
Respite for out-of-hours works	Respite would be scheduled as indicated in Appendix C and described in the CNVG.
Equipment selection	Use quieter construction methods where feasible and reasonable. Ensure plant including the silencer is well maintained. Plant noise levels will have an operating noise emission level compliant with Appendix F of the CNVG
Use and siting of plant	The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers.

Action	Description
Plan worksites and activities to minimise noise and vibration.	Locate compounds away from sensitive receivers and discourage access from local roads. Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site. Where additional activities or plant may only result in a marginal noise increase and speed up works, consider limiting duration of impact by concentrating noisy activities at one location and move to another as quickly as possible. Very noise activities should be scheduled for normal working hours. If the work can not be undertaken during the day, it should be completed before 11:00pm. Where practicable, work should be scheduled to avoid major student examination periods when students are studying for examinations such as before or during Higher School Certificate and at the end of higher education semesters.
Non-tonal reverse alarms	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work.
Shield stationary noise sources such as pumps, generators, and compressors	These should be enclosed or shielded where reasonable and feasible.
Implement any project specific mitigation measures	
1	None

Appendix A Project location and predicted level of impact



Appendix B Proposed activities and equipment

Concreting works

Equipment	Quantity	Usage	Reduction	SWL
Concrete Truck / Agitator - discharging	1	80 %	5	93
Concrete Vibrator	1	90 %	5	95
Excavator (25 tonne)	1	40 %	5	96
Grinder 4 inch	1	10 %	5	83

Activity Sound Power Level: 100

Appendix C Detailed noise predicted for each receiver and activity

Assessment: OCR Dual Watermain Connection at OCR				Night	Results summary		
NCA	ID	Address	Land use	NML	Cumulative Predicted LAeq, 15 minute noise level	Exceedance of NML, dB	Impact classification
NCA 1	770254	15 JAMES SMALL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770213	3 RUSS HAMMOND CLOSE KORORA	RES	42	43	1	Noticable
NCA 1	770205	13 RUSS HAMMOND CLOSE KORORA	RES	42	46	4	Noticable
NCA 1	770204	9 RUSS HAMMOND CLOSE KORORA	RES	42	48	6	Clearly Audible
NCA 1	770202	13 RUSS HAMMOND CLOSE KORORA	RES	42	49	7	Clearly Audible
NCA 1	770201	13 RUSS HAMMOND CLOSE KORORA	RES	42	48	6	Clearly Audible
NCA 1	770200	UNIT 3/ 1 KORORA SCHOOL ROAD KORORA	RES	42	45	3	Noticable
NCA 1	770199	UNIT 3/ 1 KORORA SCHOOL ROAD KORORA	RES	42	44	2	Noticable
NCA 1	770198	UNIT 3/ 1 KORORA SCHOOL ROAD KORORA	RES	42	44	2	Noticable
NCA 1	770180	13 JAMES SMALL DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	770177	11A JAMES SMALL DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	770176	6 RUSS HAMMOND CLOSE KORORA	RES	42	49	7	Clearly Audible
NCA 1	770162	2 RUSS HAMMOND CLOSE KORORA	RES	42	44	2	Noticable
NCA 1	770153	UNIT 2/ 7 RUSS HAMMOND CLOSE KORORA	RES	42	47	5	Noticable
NCA 1	770013	UNIT 1/ 1 KORORA SCHOOL ROAD KORORA	RES	42	43	1	Noticable
NCA 1	769934	11 RUSS HAMMOND CLOSE KORORA	RES	42	45	3	Noticable
NCA 1	769933	11 RUSS HAMMOND CLOSE KORORA	RES	42	47	5	Noticable
NCA 1	769932	UNIT 5/ 1 KORORA SCHOOL ROAD KORORA	RES	42	46	4	Noticable
NCA 1	769931	UNIT 5/ 1 KORORA SCHOOL ROAD KORORA	RES	42	45	3	Noticable
NCA 1	769906	5 RUSS HAMMOND CLOSE KORORA	RES	42	45	3	Noticable
NCA 1	769905	27 JAMES SMALL DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	769904	UNIT 2/ 7 RUSS HAMMOND CLOSE KORORA	RES	42	46	4	Noticable
NCA 1	769838	10A RUSS HAMMOND CLOSE KORORA	RES	42	50	8	Clearly Audible
NCA 1	769837	4 RUSS HAMMOND CLOSE KORORA	RES	42	45	3	Noticable
NCA 1	769836	8 RUSS HAMMOND CLOSE KORORA	RES	42	48	6	Clearly Audible
NCA 1	769835	4A RUSS HAMMOND CLOSE KORORA	RES	42	46	4	Noticable
NCA 1	769821	1 KORORA BASIN ROAD KORORA	RES	42	48	6	Clearly Audible
NCA 1	769819	11 KORORA BASIN ROAD KORORA	RES	42	42	0	Noticable
NCA 1	769818	7 JAMES SMALL DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	769817	9 JAMES SMALL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	769816	11 JAMES SMALL DRIVE KORORA	RES	42	43	1	Noticable

Construction noise impact assessment

Cutting Pipes - Night

OCR Dual Watermain connection

Proposed works	OCR Dual Watermain Connection at OCR		
Proponent	Quickway		
Assessment Date	07/12/2022		
Prepared by	Tom St Vincent Welch	Assessment Id	OOH14

Introduction

This report has been prepared using the construction noise self-assessment platform KNOWnoise: *Minor Works* and presents an assessment of the likely noise impacts related to proposed works associated with the above project. Where possible, these works would be completed during standard construction hours; however, there may be a need to work outside these hours due to technical, community or access limitations. The location of the proposed works is illustrated in Appendix A.

Planned works

A description of the proposed works is as follows.

OCR Dual Watermain Connection at OCR. Works required over 24hour consecutive shifts to minimise ensure works are within 5 day window permitted by Coffs Harbour City Council

Proposed activities and equipment for the works are summarised in Appendix B.

Though subject to change, the works are expected to commence around 16/01/2023 and would be completed by 22/01/2023.

Assessment criteria and mitigation requirements

The Interim Construction Noise Guideline (ICNG) (DECC 2009) describes noise more than the background level as potentially having an adverse impact on sensitive receivers and increasing the likelihood of complaint. During standard construction hours, where construction noise is within 10 dB(A) of the RBL, impacts would be acceptable.

Where construction noise is more than 10 dB(A) above the RBL during standard construction hours, a residential receiver is considered noise affected and the proponent should undertake all reasonable and feasible steps necessary to manage the impact and consult with the affected community.

Above a LAeq, 15 minute noise level of 75 dB(A), a receiver is highly affected, requiring consideration of additional mitigation measures including alternative accommodation in the night period.

Outside standard construction hours, construction noise at a residential receiver more than 5 dB(A) above the RBL is taken to be noise affected.

In addition, annoying noise such as rock hammers, impact piling, or other impulsive noise sources usually result in greater annoyance than continuous construction noise. A 5 dB(A) penalty is applicable to such activities prior to comparison with the NMLs.

Other sensitive land uses, such as schools and offices, typically find noise from construction disruptive when the properties are being used (such as during work and school times). Table 2 presents NMLs from the ICNG for sensitive land uses based on the principle that the characteristic activities for each of these land uses should not be unduly disturbed.

Table 1 Non-residential sensitive land uses noise management levels

Land use	Noise assessment location	NML (L _{Aeq,15min})
Classrooms at schools and other educational institutions	Internal	45
Places of worship		
Active recreation areas (such as sporting activities and activities which generate their own noise or focus for participants)	External	65
Passive recreation areas (contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External	60
Industrial premises	External	75
Office, retail outlets	External	70

As part of planning for out of hours works, standard mitigation measures, as described in the ICNG and CNVG, would be implemented where reasonable and feasible. However, after these measures have been applied, noise and vibration levels may continue to exceed the NMLs.

In this case, additional mitigation measures outlined in the CNVG, which largely focus on engagement with affected sensitive receivers, should be implemented where reasonable and feasible, unless other agreements are in place with the impacted receiver.

Triggers and additional mitigation measures for airborne noise are summarised in Table 2. Further details of specific additional mitigation measures are described in the CNVG.

Table 2 Triggers for additional mitigation measures – Airborne noise (Roads and Maritime 2016)

Predicted airborne LAeq(15min) noise level at receiver			
Perception	dB(A) above RBL	dB(A) above NML	Additional mitigation measures
All hours			
75 dB(A) or greater			N, V, PC, RO
Standard hours: Mon - Fri (7am – 6pm), Sat (8am – 1pm), Sun/Pub Hol (Nil)			
Noticeable	5 to 10	0	-
Clearly audible	10 to 20	< 10	-
Moderately intrusive	20 to 30	10 to 20	N, V
Highly intrusive	> 30	> 20	N, V
OOHW Period 1: Mon – Fri (6pm – 10pm), Sat (7am – 8am & 1pm – 10pm), Sun/Pub Hol (8am – 6pm)			
Noticeable	5 to 10	<5	-
Clearly audible	10 to 20	5 to 15	N, R1, DR
Moderately intrusive	20 to 30	15 to 25	V, N, R1, DR
Highly intrusive	> 30	>25	V, IB, N, R1, DR, PC, SN
OOHW Period 2: Mon – Fri (10pm – 7am), Sat (10pm – 8am), Sun/Pub Hol (6pm – 7am)			
Noticeable	5 to 10	<5	N
Clearly audible	10 to 20	5 to 15	V, N, R2, DR
Moderately intrusive	20 to 30	15 to 25	V, IB, N, PC, SN, R2, DR
Highly intrusive	> 30	>25	AA, V, IB, N, PC, SN, R2, DR

Notes:

PC = Phone calls

V = verification

IB = Individual briefings

N= Notification

AA = Alternative accommodation

SN = Specific notifications

RO = Respite offer

R1 = Respite period 1

R2 = Respite period 2

DR = Duration respite

Perception = relates to levels above RBL

NML = Noise management level

HA = Highly affected

Existing environment and noise management levels

The proposed works would be undertaken in a predominantly Rural / Suburban, characterised as:

Areas with negligible transportation or very limited local traffic, typically light vehicles only.

100m or more from the road.

Background noise levels adopted for the project area and associated noise management levels (NMLs) are summarised in Table 3. NMLs have been established in line with the ICNG.

Table 3 Construction NMLs

Land use	Rural / Suburban		Using custom background noise data?		Yes
Criterion	Day	Weekend Day	Evening	Night	Sleep
RBL	52	52	46	37	
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Sleep disturbance

The ICNG recommends where construction works are planned to extend over more than two consecutive nights, the maximum noise level should be considered for the purposes of establishing the likelihood of sleep disturbance. The Road Noise Policy suggests that maximum internal noise levels below 50-55 dB(A) are unlikely to awaken people from sleep and one or two noise events per night, with maximum internal noise levels of 65-70 dB(A) are not likely to affect health and wellbeing significantly.

Based on this, a sleep awakening criterion of 55 dB(A) (internal) is typically adopted for works. Given that noise attenuation of 10 dB(A) is typically provided by an open window, a sleep awakening criterion of L_Amax 65 dB(A) (external) has been applied to residential bedroom façades. This is consistent with the sleep disturbance threshold described in Appendix E of the CNVG.

Vibration

Effects of vibration from construction may be segregated into:

- Human exposure – disturbance to building occupants: vibration in which the occupants or users of the building are inconvenienced or possibly disturbed.
- Effects on building contents – vibration where the building contents may be affected.
- Effects on building structures – vibration in which the integrity of the building or structure itself may be prejudiced.

Vibration criteria relating to human comfort applicable to this project are taken from the DEC (2006) document Assessing Vibration – A Technical Guideline for intermittent vibration – such as from drilling, compacting or activities that would result in continuous vibration if operated continuously. Intermittent vibration is assessed as a vibration dose value (VDV) and relates to the level of vibration over time (cumulative over the night or day period). VDV's that may result in adverse comment from receivers are summarised in Table 4.

Table 4 Summary of vibration dose values which might result in adverse comment

Time	Low probability of adverse comment (m/s ^{1.75})	Adverse comment possible (m/s ^{1.75})	Adverse comment probable (m/s ^{1.75})
Day (6am to 10pm)	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Night (10pm to 6am)	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Guidance for the consideration of potential building damage from construction vibration is in line with BS 7385-1 *Evaluation and measurement for vibration in buildings - Guide for measurement of vibration and evaluation of their effects on buildings*. These guideline values are presented in Table 5.

Table 5 Building damage vibration guidelines (BS 7385-1)

Type of building	Guideline values for vibration (PPV mm/s)		
	4Hz to 15Hz	15Hz to 40Hz	40Hz and above
Reinforced or framed structures / Industrial and heavy commercial buildings	50		
Un-reinforced or light framed structures / Residential or light commercial type buildings	15 - 20	20 - 50	50

For heritage structures, criteria are in line with the German Standard *DIN 4150-3: Structural Vibration- effects of vibration on structures*, as summarised in Table 6.

Table 6 Guideline values for vibration velocity to be used when evaluating the effects of short-term vibration on heritage structures (DIN 4150-3).

Type of building	Guideline values for vibration (PPV mm/s)			
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz	Vibration at horizontal plane of highest floor at all frequencies
Structures that, because of their sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	3	3 to 8	8 to 10	8

The safe working distances presented in Table 7 are indicative and will vary depending on the item of plant and local geotechnical conditions. The cosmetic damage thresholds apply to typical buildings under typical geotechnical conditions and vibration monitoring is recommended at specific sites. Where structures are more sensitive, such as heritage items, more stringent conditions are applicable and should be considered individually.

In relation to human response, the safe working distances relate to continuous vibration. For most construction activities, vibration emissions are intermittent and higher vibration levels over shorter periods are acceptable. Additional assessment should be undertaken where the human response criteria are exceeded.

Table 7 Safe working distances for vibration intensive plant

Plant item	Rating/description	Safe working distance	
		Cosmetic damage (BS 7385-1)	Human response (DECCW)
Vibratory roller	<50 kN (typically 1-2 t)	5 m	15 m to 20 m
	<100 kN (typically 2-4 t)	6 m	20 m
	<200 kN (typically 4-6 t)	12 m	40 m
	<300 kN (typically 7-13 t)	15 m	100 m
	>300 kN (typically 13-18 t)	20 m	100 m
	>300 kN (> 18 t)	25 m	100 m
Small hydraulic hammer	300 kg – 5 to 12 t excavator	2 m	7 m
Medium hydraulic hammer	900 kg – 12 to 18t excavator	7 m	23 m
Large hydraulic hammer	1600 kg – 18 to 34 t excavator	22 m	73 m
Vibratory pile driver	Sheet piles	2 m to 20 m	20 m
Pile boring	≤800 mm	2 m	n/a
Jackhammer	Hand held	1 m	Avoid contact with structure

Assessment methodology

Based on the nominated works area (illustrated in Appendix A), proposed equipment and the minimum distance from the works to each sensitive receiver, noise levels were calculated based on CONCAWE (1981) *Propagation of noise from petroleum and petrochemical complexes to neighboring communities*.

This method considers geometric spreading, atmospheric absorption, ground effects and is valid for meteorological conditions of a gentle breeze from source to receiver and stable atmosphere (temperature inversion).

KNOWnoise: Minor works is a 2-Dimensional assessment platform and does not consider terrain effects (e.g. hills, valleys) or the presence of solid structures such as homes or noise barriers. This will result in a conservative prediction, suitable for the project being assessed.

Considering the nature of the works and the type of surrounding land uses, sensitive receivers up to a radius of 1000 metres from the works have been included in the assessment.

Sound power levels and predicted noise levels depend on the number of plant items operating at any one time and their precise location relative to a sensitive receiver. Equipment was assumed to be working at the worst-case location relative to each receiver and represents a worst-case assessment. Where the activity is further away from receivers or less equipment is used the predicted levels will decrease.

Sound power levels for plant and equipment expected to be used for each activity has been estimated based on guidance in the following standards and guidelines as well as typical measured noise levels for specific equipment.

- “ Australian Standard AS2436-2010: Guide to noise and vibration control on construction, demolition and maintenance sites
- “ Construction Noise and Vibration Strategy 7TP-ST-157/2.0 (CNVS), (TfNSW, 2018)
- “ Construction Noise and Vibration Guideline (CNVG) (Roads and Maritime Services, 2016)
- “ British Standard 5228-1:2009 Code of practice for noise and vibration control on construction and open sites
- “ United Kingdom Department for Environment, Food and Rural Affairs (DEFRA) Noise database for prediction of noise on construction and open sites

Construction noise sources and associated sound power levels are listed in Appendix B. The maximum predicted LAeq noise level within the work area was identified for each receiver.

Predicted noise levels

Detailed predicted noise levels for each potentially affected receiver are presented Appendix C.

A summary of predicted noise levels in comparison with ICNG assessment criteria for the Night period is presented in Table 8.

Table 8 Summary of predicted noise levels with comparison against ICNG criteria for the Night period.

Criterion	Predicted number of receivers
Maximum cumulative predicted L _{Aeq} , 15 minute noise level	63 dB(A)
Number of highly noise affected receivers (>75 dB)	0
1 – 10 dB above NML	248
10 – 20 dB above NML	42
20+ dB above NML	3

In line with CNVG impact classes, up to 0 receivers are predicted to be classified as Highly Impacted during the Night period. A summary of the number of receivers in each class is presented in Table 9.

Table 9 Summary of predicted noise levels with comparison against CNVG criteria

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 <= 5 dB above NML	270
Clearly Audible	5 <= 15 dB above NML	94
Moderately Intrusive	15 <= 25 dB above NML	23
Highly Intrusive	> 25 dB above NML	0

Predicted impact classes for the Night period are illustrated graphically in Appendix C. Each identified receiver in the study area has been coloured to highlight the predicted level of impact.

Sleep disturbance

In the event works are planned for more than two consecutive nights, up to 0 are expected to exceed the sleep awakening criteria. Where any exceedances if the awakening criteria are predicted, additional care should be taken and mitigation measures implemented in the with the CNVG.

Predicted vibration impacts

The level of vibration impact on sensitive receivers (buildings and human comfort) will largely depend on the type of machinery in use and the distance from source to receiver.

Based on the proposed work locations and selected equipment, the following level of vibration impact is expected. A summary of vibration impacts is provided for each sensitive receiver in Appendix C.

Impact classification	Number of potentially affected receivers
Human comfort	0
Cosmetic damage	0
Heritage structure	0

Proposed noise mitigation measures

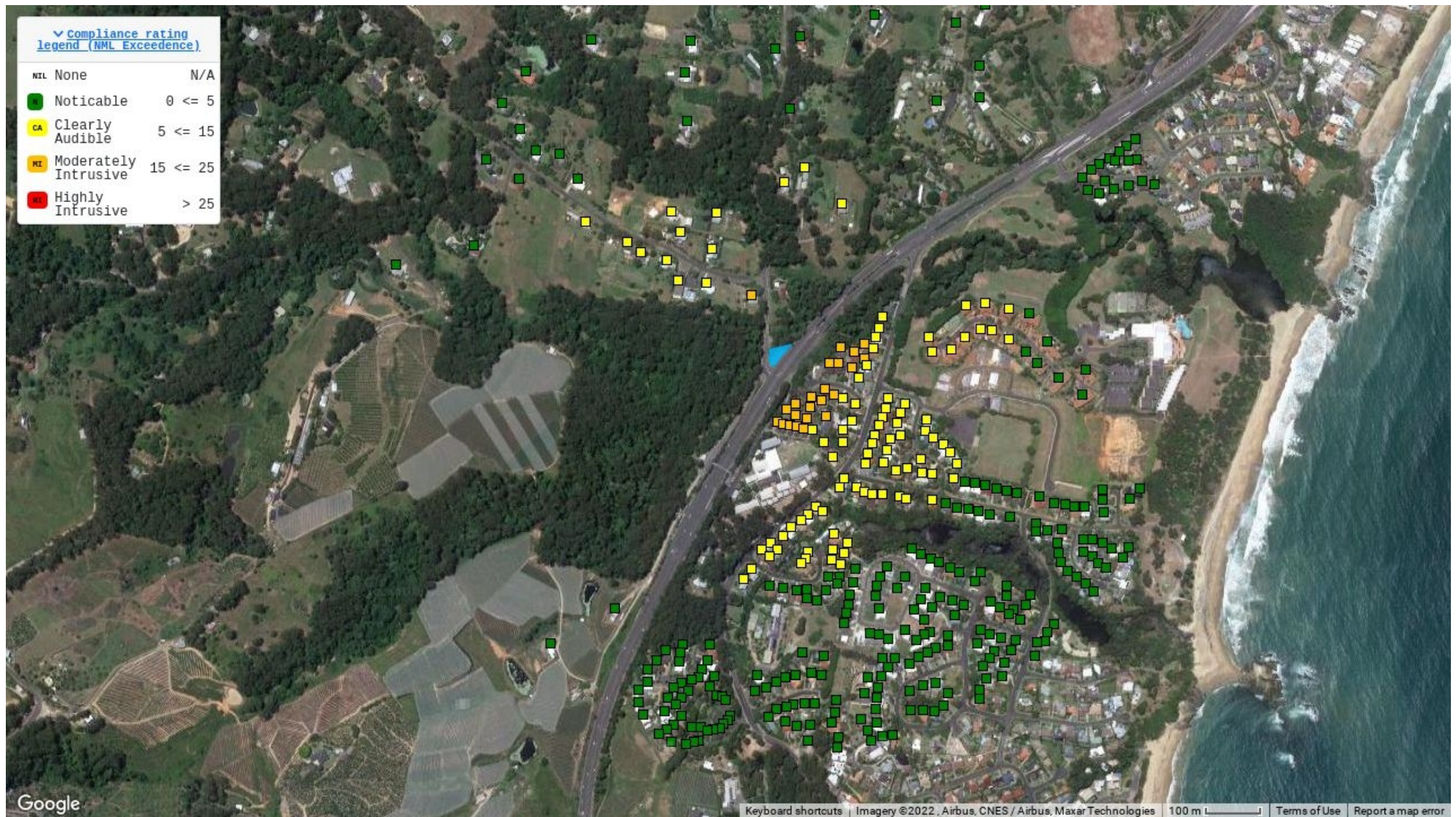
The safeguards and controls listed in Table 10 will be implemented where reasonable and feasible with the intention of achieving the project noise criteria and to maintain noise impacts at a practical minimum.

Table 10 Safeguards and controls

Action	Description
Community consultation or notification	Notify the affected community. The notification will detail work activities, dates and hours, impacts and mitigation measures, indication of work schedule over the night time period, any operational noise benefits from the works (where applicable) and contact telephone number. Notification should be a minimum of 7 calendar days prior to the start of works. For projects other than maintenance works more advanced consultation or notification may be required.
Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction would at least include: - all project specific and relevant standard noise and vibration mitigation measures - relevant licence and approval conditions - permissible hours of work - any limitations on high noise generating activities - location of nearest sensitive receivers - construction employee parking areas - designated loading/unloading areas and procedures site opening/closing times (including deliveries) environmental incident procedures
Behaviour	No swearing or unnecessary shouting or loud stereos/radios on site. Limit compression braking at night in residential areas. No dropping of materials from height, throwing of metal items and slamming of doors.
Verification	Where indicated in Appendix C, a noise verification program would be undertaken for the duration of the works.
Construction hours	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels should be scheduled during less sensitive time periods.
Respite for out-of-hours works	Respite would be scheduled as indicated in Appendix C and described in the CNVG.
Equipment selection	Use quieter construction methods where feasible and reasonable. Ensure plant including the silencer is well maintained. Plant noise levels will have an operating noise emission level compliant with Appendix F of the CNVG
Use and siting of plant	The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers.

Action	Description
Plan worksites and activities to minimise noise and vibration.	Locate compounds away from sensitive receivers and discourage access from local roads. Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site. Where additional activities or plant may only result in a marginal noise increase and speed up works, consider limiting duration of impact by concentrating noisy activities at one location and move to another as quickly as possible. Very noise activities should be scheduled for normal working hours. If the work can not be undertaken during the day, it should be completed before 11:00pm. Where practicable, work should be scheduled to avoid major student examination periods when students are studying for examinations such as before or during Higher School Certificate and at the end of higher education semesters.
Non-tonal reverse alarms	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work.
Shield stationary noise sources such as pumps, generators, and compressors	These should be enclosed or shielded where reasonable and feasible.
Implement any project specific mitigation measures	
1	None

Appendix A Project location and predicted level of impact



Appendix B Proposed activities and equipment

Cutting Pipes

Equipment	Quantity	Usage	Reduction	SWL
Daymakers / Lighting plant	3	100 %	5	93
Demolition saw*	1	80 %	5	113

Activity Sound Power Level: 113

Appendix C Detailed noise predicted for each receiver and activity

Assessment: OCR Dual Watermain Connection at OCR				Night	Results summary		
NCA	ID	Address	Land use	NML	Cumulative Predicted LAeq, 15 minute noise level	Exceedance of NML, dB	Impact classification
NCA 1	770275	46 PARKES DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	770272	UNIT 7/ 95 JAMES SMALL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770259	4 LAUREL STREET KORORA	RES	42	43	1	Noticable
NCA 1	770254	15 JAMES SMALL DRIVE KORORA	RES	42	57	15	Clearly Audible
NCA 1	770245	15 FERN TREE PLACE KORORA	RES	42	43	1	Noticable
NCA 1	770235	UNIT 2/ 18 LINKS AVENUE KORORA	RES	42	42	0	Noticable
NCA 1	770233	UNIT 2/ 9 TROPIC LODGE PLACE KORORA	RES	42	46	4	Noticable
NCA 1	770232	5 TROPIC LODGE PLACE KORORA	RES	42	47	5	Noticable
NCA 1	770231	54 JAMES SMALL DRIVE KORORA	RES	42	47	5	Clearly Audible
NCA 1	770227	23 NORMAN HILL DRIVE KORORA	RES	42	46	4	Noticable
NCA 1	770226	22 NORMAN HILL DRIVE KORORA	RES	42	46	4	Noticable
NCA 1	770225	28 NORMAN HILL DRIVE KORORA	RES	42	45	3	Noticable
NCA 1	770220	UNIT 1/ 10-12 TROPIC LODGE PLACE KORORA	RES	42	48	6	Clearly Audible
NCA 1	770219	2 NORMAN HILL DRIVE KORORA	RES	42	50	8	Clearly Audible
NCA 1	770216	UNIT 1/ 40 JAMES SMALL DRIVE KORORA	RES	42	50	8	Clearly Audible
NCA 1	770215	46 JAMES SMALL DRIVE KORORA	RES	42	50	8	Clearly Audible
NCA 1	770213	3 RUSS HAMMOND CLOSE KORORA	RES	42	57	15	Clearly Audible
NCA 1	770212	38 JAMES SMALL DRIVE KORORA	RES	42	51	9	Clearly Audible
NCA 1	770211	4 BLUE LUBEN CLOSE KORORA	RES	42	44	2	Noticable
NCA 1	770205	13 RUSS HAMMOND CLOSE KORORA	RES	42	60	18	Moderately Intrusive
NCA 1	770204	9 RUSS HAMMOND CLOSE KORORA	RES	42	61	19	Moderately Intrusive
NCA 1	770202	13 RUSS HAMMOND CLOSE KORORA	RES	42	62	20	Moderately Intrusive
NCA 1	770201	13 RUSS HAMMOND CLOSE KORORA	RES	42	62	20	Moderately Intrusive
NCA 1	770200	UNIT 3/ 1 KORORA SCHOOL ROAD KORORA	RES	42	59	17	Moderately Intrusive
NCA 1	770199	UNIT 3/ 1 KORORA SCHOOL ROAD KORORA	RES	42	58	16	Moderately Intrusive
NCA 1	770198	UNIT 3/ 1 KORORA SCHOOL ROAD KORORA	RES	42	57	15	Moderately Intrusive
NCA 1	770193	8 BRUCE TAYLOR CIRCUIT KORORA	RES	42	47	5	Noticable
NCA 1	770190	3 PARKES DRIVE KORORA	RES	42	45	3	Noticable
NCA 1	770188	3 AINSLIE ROAD KORORA	RES	42	45	3	Noticable
NCA 1	770183	UNIT 1/ 50 JAMES SMALL DRIVE KORORA	RES	42	49	7	Clearly Audible
NCA 1	770182	13 NORMAN HILL DRIVE KORORA	RES	42	48	6	Clearly Audible
NCA 1	770180	13 JAMES SMALL DRIVE KORORA	RES	42	57	15	Moderately Intrusive
NCA 1	770177	11A JAMES SMALL DRIVE KORORA	RES	42	58	16	Moderately Intrusive
NCA 1	770176	6 RUSS HAMMOND CLOSE KORORA	RES	42	62	20	Moderately Intrusive
NCA 1	770175	UNIT 3/ 7-13 SHEARWATER PLACE KORORA	RES	42	49	7	Clearly Audible
NCA 1	770173	10 KORORA BASIN ROAD KORORA	RES	42	53	11	Clearly Audible
NCA 1	770165	10 AINSLIE ROAD KORORA	RES	42	46	4	Noticable
NCA 1	770163	UNIT 1/ 44 NORMAN HILL DRIVE KORORA	RES	42	42	0	Noticable

Appendix C Detailed noise predicted for each receiver and activity

Assessment: OCR Dual Watermain Connection at OCR				Night	Results summary		
NCA	ID	Address	Land use	NML	Cumulative Predicted LAeq, 15 minute noise level	Exceedance of NML, dB	Impact classification
NCA 1	770162	2 RUSS HAMMOND CLOSE KORORA	RES	42	57	15	Clearly Audible
NCA 1	770161	8 MALIBU DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	770158	23 PARKES DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770153	UNIT 2/ 7 RUSS HAMMOND CLOSE KORORA	RES	42	60	18	Moderately Intrusive
NCA 1	770152	8 ALBERT CHAPPELL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770151	1 ALBERT CHAPPELL DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	770145	42 NORMAN HILL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770144	46 NORMAN HILL DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	770142	5 ASCOT CLOSE KORORA	RES	42	44	2	Noticable
NCA 1	770141	5 PARKES DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	770138	UNIT 2/ 50 JAMES SMALL DRIVE KORORA	RES	42	48	6	Clearly Audible
NCA 1	770136	UNIT 5/ 10-12 TROPIC LODGE PLACE KORORA	RES	42	48	6	Clearly Audible
NCA 1	770135	UNIT 5/ 10-12 TROPIC LODGE PLACE KORORA	RES	42	48	6	Clearly Audible
NCA 1	770134	UNIT 5/ 10-12 TROPIC LODGE PLACE KORORA	RES	42	47	5	Clearly Audible
NCA 1	770133	13 TROPIC LODGE PLACE KORORA	RES	42	47	5	Noticable
NCA 1	770132	11 MALIBU DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770131	80 JAMES SMALL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770130	78 JAMES SMALL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770128	3A ASCOT CLOSE KORORA	RES	42	44	2	Noticable
NCA 1	770127	3A ASCOT CLOSE KORORA	RES	42	44	2	Noticable
NCA 1	770125	21 LINKS AVENUE KORORA	RES	42	43	1	Noticable
NCA 1	770122	UNIT 16/ 95 JAMES SMALL DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	770121	UNIT 15/ 95 JAMES SMALL DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	770120	UNIT 1/ 95 JAMES SMALL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770119	UNIT 2/ 95 JAMES SMALL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770118	UNIT 14/ 95 JAMES SMALL DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	770117	95A JAMES SMALL DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	770116	UNIT 11/ 95 JAMES SMALL DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	770115	56 PARKES DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	770114	6 GROSS MICHEL ROAD KORORA	RES	42	42	0	Noticable
NCA 1	770113	8 LAUREL STREET KORORA	RES	42	44	2	Noticable
NCA 1	770112	23 LINKS AVENUE KORORA	RES	42	43	1	Noticable
NCA 1	770111	42 PARKES DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770110	38 PARKES DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770109	27 PARKES DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770108	21 PARKES DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	770107	UNIT 2/ 18 LINKS AVENUE KORORA	RES	42	42	0	Noticable
NCA 1	770106	5 LAUREL STREET KORORA	RES	42	43	1	Noticable
NCA 1	770104	UNIT 9/ 95 JAMES SMALL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770103	95 JAMES SMALL DRIVE KORORA	RES	42	43	1	Noticable

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NCA 1	770102	UNIT 6/ 95A JAMES SMALL DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	770101	UNIT 3/ 95 JAMES SMALL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770100	UNIT 6/ 95 JAMES SMALL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770099	UNIT 8/ 95 JAMES SMALL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770097	74 JAMES SMALL DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	770095	20 BRUCE TAYLOR CIRCUIT KORORA	RES	42	45	3	Noticable
NCA 1	770094	14 BRUCE TAYLOR CIRCUIT KORORA	RES	42	46	4	Noticable
NCA 1	770093	50 PARKES DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	770091	11 FERN TREE PLACE KORORA	RES	42	43	1	Noticable
NCA 1	770090	9 FERN TREE PLACE KORORA	RES	42	44	2	Noticable
NCA 1	770089	6B ALBERT CHAPPELL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770088	17 ALBERT CHAPPELL DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	770087	33 JAMES SMALL DRIVE KORORA	RES	42	54	12	Clearly Audible
NCA 1	770086	37 JAMES SMALL DRIVE KORORA	RES	42	55	13	Clearly Audible
NCA 1	770083	30 JAMES SMALL DRIVE KORORA	RES	42	52	10	Clearly Audible
NCA 1	770082	1 BELLEVUE DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	770080	16 PARKES DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	770079	8 PARKES DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770077	17 PARKES DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	770076	29 PARKES DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770067	4 GROSS MICHEL ROAD KORORA	RES	42	43	1	Noticable
NCA 1	770065	1 PARKES DRIVE KORORA	RES	42	45	3	Noticable
NCA 1	770064	24 JAMES SMALL DRIVE KORORA	RES	42	53	11	Clearly Audible
NCA 1	770063	22 JAMES SMALL DRIVE KORORA	RES	42	53	11	Clearly Audible
NCA 1	770062	15 HERMAN REICK AVENUE KORORA	RES	42	52	10	Clearly Audible
NCA 1	770061	48 NORMAN HILL DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	770060	13 PARKES DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	770059	1 ASCOT CLOSE KORORA	RES	42	44	2	Noticable
NCA 1	770058	40 NORMAN HILL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770057	1 BLUE LUBEN CLOSE KORORA	RES	42	43	1	Noticable
NCA 1	770056	3 ASCOT CLOSE KORORA	RES	42	44	2	Noticable
NCA 1	770055	2 ASCOT CLOSE KORORA	RES	42	44	2	Noticable
NCA 1	770054	54 PARKES DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	770053	22 LINKS AVENUE KORORA	RES	42	42	0	Noticable
NCA 1	770052	20 LINKS AVENUE KORORA	RES	42	42	0	Noticable
NCA 1	770051	15 LINKS AVENUE KORORA	RES	42	43	1	Noticable
NCA 1	770050	6A PARKES DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770049	7 LAUREL STREET KORORA	RES	42	43	1	Noticable
NCA 1	770048	3 LAUREL STREET KORORA	RES	42	43	1	Noticable
NCA 1	770047	17 LINKS AVENUE KORORA	RES	42	43	1	Noticable

Appendix C Detailed noise predicted for each receiver and activity

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NCA 1	770046	19 LINKS AVENUE KORORA	RES	42	43	1	Noticable
NCA 1	770045	4 LAUREL STREET KORORA	RES	42	43	1	Noticable
NCA 1	770044	6 LAUREL STREET KORORA	RES	42	44	2	Noticable
NCA 1	770043	2 PARKES DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	770042	4 PARKES DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	770040	41 NORMAN HILL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770039	1 GROSS MICHEL ROAD KORORA	RES	42	43	1	Noticable
NCA 1	770038	5 GROSS MICHEL ROAD KORORA	RES	42	43	1	Noticable
NCA 1	770037	37 NORMAN HILL DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	770036	19 PARKES DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	770032	32 JAMES SMALL DRIVE KORORA	RES	42	52	10	Clearly Audible
NCA 1	770029	25 PARKES DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770028	34A PARKES DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	770027	44 PARKES DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	770026	16 MALIBU DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	770025	16 MALIBU DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770024	40 PARKES DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770023	12 MALIBU DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770022	36 PARKES DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770021	10 MALIBU DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	770020	46A PARKES DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	770019	27 NORMAN HILL DRIVE KORORA	RES	42	45	3	Noticable
NCA 1	770018	34 NORMAN HILL DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	770017	8 NORMAN HILL DRIVE KORORA	RES	42	49	7	Clearly Audible
NCA 1	770016	31 JAMES SMALL DRIVE KORORA	RES	42	55	13	Clearly Audible
NCA 1	770015	2 CAVENDISH PLACE KORORA	RES	42	51	9	Clearly Audible
NCA 1	770014	39 JAMES SMALL DRIVE KORORA	RES	42	53	11	Clearly Audible
NCA 1	770013	UNIT 1/ 1 KORORA SCHOOL ROAD KORORA	RES	42	57	15	Clearly Audible
NCA 1	770012	4 CAVENDISH PLACE KORORA	RES	42	51	9	Clearly Audible
NCA 1	770011	6 CAVENDISH PLACE KORORA	RES	42	51	9	Clearly Audible
NCA 1	770008	15 PARKES DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770007	13 LINKS AVENUE KORORA	RES	42	42	0	Noticable
NCA 1	770005	14 PARKES DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	770004	11 LINKS AVENUE KORORA	RES	42	42	0	Noticable
NCA 1	770003	12 PARKES DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	770002	6 PARKES DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770000	13 BRUCE TAYLOR CIRCUIT KORORA	RES	42	46	4	Noticable
NCA 1	769999	12 BRUCE TAYLOR CIRCUIT KORORA	RES	42	46	4	Noticable
NCA 1	769998	10 BRUCE TAYLOR CIRCUIT KORORA	RES	42	47	5	Noticable
NCA 1	769997	38 BRUCE TAYLOR CIRCUIT KORORA	RES	42	45	3	Noticable

Appendix C Detailed noise predicted for each receiver and activity

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NCA	ID	Address	Land use	NML	Cumulative Predicted LAeq, 15 minute noise level	Exceedance of NML, dB	Impact classification
NCA 1	769996	36 BRUCE TAYLOR CIRCUIT KORORA	RES	42	45	3	Noticable
NCA 1	769993	9 HERMAN REICK AVENUE KORORA	RES	42	52	10	Clearly Audible
NCA 1	769992	11 HERMAN REICK AVENUE KORORA	RES	42	52	10	Clearly Audible
NCA 1	769991	26 JAMES SMALL DRIVE KORORA	RES	42	53	11	Clearly Audible
NCA 1	769990	28 JAMES SMALL DRIVE KORORA	RES	42	52	10	Clearly Audible
NCA 1	769989	13 TROPIC LODGE PLACE KORORA	RES	42	47	5	Noticable
NCA 1	769988	11 TROPIC LODGE PLACE KORORA	RES	42	47	5	Noticable
NCA 1	769987	UNIT 2/ 9 TROPIC LODGE PLACE KORORA	RES	42	47	5	Noticable
NCA 1	769986	7 TROPIC LODGE PLACE KORORA	RES	42	47	5	Noticable
NCA 1	769985	3 TROPIC LODGE PLACE KORORA	RES	42	47	5	Noticable
NCA 1	769984	1 TROPIC LODGE PLACE KORORA	RES	42	48	6	Clearly Audible
NCA 1	769983	UNIT 2/ 9 TROPIC LODGE PLACE KORORA	RES	42	46	4	Noticable
NCA 1	769981	2A NORMAN HILL DRIVE KORORA	RES	42	50	8	Clearly Audible
NCA 1	769980	44 JAMES SMALL DRIVE KORORA	RES	42	50	8	Clearly Audible
NCA 1	769979	34 JAMES SMALL DRIVE KORORA	RES	42	52	10	Clearly Audible
NCA 1	769978	36 JAMES SMALL DRIVE KORORA	RES	42	51	9	Clearly Audible
NCA 1	769977	4 AINSLIE ROAD KORORA	RES	42	45	3	Noticable
NCA 1	769976	UNIT 1/ 5 HERMAN REICK AVENUE KORORA	RES	42	49	7	Clearly Audible
NCA 1	769975	3 CAVENDISH PLACE KORORA	RES	42	49	7	Clearly Audible
NCA 1	769974	11 NORMAN HILL DRIVE KORORA	RES	42	49	7	Clearly Audible
NCA 1	769973	4 HERMAN REICK AVENUE KORORA	RES	42	48	6	Clearly Audible
NCA 1	769972	15 NORMAN HILL DRIVE KORORA	RES	42	47	5	Clearly Audible
NCA 1	769971	17 NORMAN HILL DRIVE KORORA	RES	42	47	5	Noticable
NCA 1	769970	19 NORMAN HILL DRIVE KORORA	RES	42	47	5	Noticable
NCA 1	769968	5 CAVENDISH PLACE KORORA	RES	42	51	9	Clearly Audible
NCA 1	769967	3A CAVENDISH PLACE KORORA	RES	42	50	8	Clearly Audible
NCA 1	769966	14 HERMAN REICK AVENUE KORORA	RES	42	50	8	Clearly Audible
NCA 1	769965	12 HERMAN REICK AVENUE KORORA	RES	42	50	8	Clearly Audible
NCA 1	769964	10 HERMAN REICK AVENUE KORORA	RES	42	49	7	Clearly Audible
NCA 1	769963	8 HERMAN REICK AVENUE KORORA	RES	42	49	7	Clearly Audible
NCA 1	769962	6 HERMAN REICK AVENUE KORORA	RES	42	48	6	Clearly Audible
NCA 1	769959	5 BLUE LUBEN CLOSE KORORA	RES	42	43	1	Noticable
NCA 1	769958	3 BLUE LUBEN CLOSE KORORA	RES	42	43	1	Noticable
NCA 1	769957	6 BLUE LUBEN CLOSE KORORA	RES	42	43	1	Noticable
NCA 1	769956	35 NORMAN HILL DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	769955	33 NORMAN HILL DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	769954	2 BLUE LUBEN CLOSE KORORA	RES	42	44	2	Noticable
NCA 1	769953	UNIT 5/ 10-12 TROPIC LODGE PLACE KORORA	RES	42	49	7	Clearly Audible
NCA 1	769952	4 BRUCE TAYLOR CIRCUIT KORORA	RES	42	47	5	Noticable
NCA 1	769951	UNIT 12/ 2-4 OSPREY PLACE KORORA	RES	42	45	3	Noticable

Appendix C Detailed noise predicted for each receiver and activity

Assessment: OCR Dual Watermain Connection at OCR				Night	Results summary		
NCA	ID	Address	Land use	NML	Cumulative Predicted LAeq, 15 minute noise level	Exceedance of NML, dB	Impact classification
NCA 1	769950	9 BLUE LUBEN CLOSE KORORA	RES	42	42	0	Noticable
NCA 1	769949	7 BLUE LUBEN CLOSE KORORA	RES	42	42	0	Noticable
NCA 1	769946	16 BLUE LUBEN CLOSE KORORA	RES	42	42	0	Noticable
NCA 1	769945	14 BLUE LUBEN CLOSE KORORA	RES	42	42	0	Noticable
NCA 1	769944	12 BLUE LUBEN CLOSE KORORA	RES	42	43	1	Noticable
NCA 1	769943	10 BLUE LUBEN CLOSE KORORA	RES	42	43	1	Noticable
NCA 1	769942	8 BLUE LUBEN CLOSE KORORA	RES	42	43	1	Noticable
NCA 1	769941	2 BRUCE TAYLOR CIRCUIT KORORA	RES	42	46	4	Noticable
NCA 1	769940	8 AINSLIE ROAD KORORA	RES	42	46	4	Noticable
NCA 1	769939	6 AINSLIE ROAD KORORA	RES	42	45	3	Noticable
NCA 1	769938	5 AINSLIE ROAD KORORA	RES	42	45	3	Noticable
NCA 1	769937	40 BRUCE TAYLOR CIRCUIT KORORA	RES	42	45	3	Noticable
NCA 1	769936	1 BRUCE TAYLOR CIRCUIT KORORA	RES	42	46	4	Noticable
NCA 1	769935	23 BRUCE TAYLOR CIRCUIT KORORA	RES	42	46	4	Noticable
NCA 1	769934	11 RUSS HAMMOND CLOSE KORORA	RES	42	59	17	Moderately Intrusive
NCA 1	769933	11 RUSS HAMMOND CLOSE KORORA	RES	42	60	18	Moderately Intrusive
NCA 1	769932	UNIT 5/ 1 KORORA SCHOOL ROAD KORORA	RES	42	59	17	Moderately Intrusive
NCA 1	769931	UNIT 5/ 1 KORORA SCHOOL ROAD KORORA	RES	42	59	17	Moderately Intrusive
NCA 1	769929	21 NORMAN HILL DRIVE KORORA	RES	42	46	4	Noticable
NCA 1	769928	25 NORMAN HILL DRIVE KORORA	RES	42	46	4	Noticable
NCA 1	769927	10 NORMAN HILL DRIVE KORORA	RES	42	48	6	Clearly Audible
NCA 1	769926	14 NORMAN HILL DRIVE KORORA	RES	42	48	6	Clearly Audible
NCA 1	769925	16 NORMAN HILL DRIVE KORORA	RES	42	47	5	Noticable
NCA 1	769924	20 NORMAN HILL DRIVE KORORA	RES	42	46	4	Noticable
NCA 1	769923	24-26 NORMAN HILL DRIVE KORORA	RES	42	46	4	Noticable
NCA 1	769922	18 NORMAN HILL DRIVE KORORA	RES	42	47	5	Noticable
NCA 1	769921	36 LINKS AVENUE KORORA	RES	42	44	2	Noticable
NCA 1	769920	32 NORMAN HILL DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	769916	38A JAMES SMALL DRIVE KORORA	RES	42	51	9	Clearly Audible
NCA 1	769915	4A NORMAN HILL DRIVE KORORA	RES	42	50	8	Clearly Audible
NCA 1	769914	6 NORMAN HILL DRIVE KORORA	RES	42	49	7	Clearly Audible
NCA 1	769913	UNIT 1/ 40 JAMES SMALL DRIVE KORORA	RES	42	50	8	Clearly Audible
NCA 1	769912	42 JAMES SMALL DRIVE KORORA	RES	42	50	8	Clearly Audible
NCA 1	769911	48A JAMES SMALL DRIVE KORORA	RES	42	49	7	Clearly Audible
NCA 1	769910	5 BRUCE TAYLOR CIRCUIT KORORA	RES	42	47	5	Noticable
NCA 1	769909	9 BRUCE TAYLOR CIRCUIT KORORA	RES	42	46	4	Noticable
NCA 1	769908	29 JAMES SMALL DRIVE KORORA	RES	42	55	13	Clearly Audible
NCA 1	769907	1 RUSS HAMMOND CLOSE KORORA	RES	42	55	13	Clearly Audible
NCA 1	769906	5 RUSS HAMMOND CLOSE KORORA	RES	42	58	16	Moderately Intrusive
NCA 1	769905	27 JAMES SMALL DRIVE KORORA	RES	42	57	15	Moderately Intrusive

Appendix C Detailed noise predicted for each receiver and activity

Assessment: OCR Dual Watermain Connection at OCR				Night	Results summary		
NCA	ID	Address	Land use	NML	Cumulative Predicted LAeq, 15 minute noise level	Exceedance of NML, dB	Impact classification
NCA 1	769904	UNIT 2/ 7 RUSS HAMMOND CLOSE KORORA	RES	42	59	17	Moderately Intrusive
NCA 1	769899	16 BRUCE TAYLOR CIRCUIT KORORA	RES	42	46	4	Noticable
NCA 1	769898	6 ALBERT CHAPPELL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	769896	4 ALBERT CHAPPELL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	769895	9 ALBERT CHAPPELL DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	769894	3 ALBERT CHAPPELL DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	769893	5 ALBERT CHAPPELL DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	769892	7 ALBERT CHAPPELL DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	769891	52 PARKES DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	769890	32 BRUCE TAYLOR CIRCUIT KORORA	RES	42	45	3	Noticable
NCA 1	769889	28 BRUCE TAYLOR CIRCUIT KORORA	RES	42	44	2	Noticable
NCA 1	769888	26 BRUCE TAYLOR CIRCUIT KORORA	RES	42	45	3	Noticable
NCA 1	769887	24 BRUCE TAYLOR CIRCUIT KORORA	RES	42	45	3	Noticable
NCA 1	769886	17 BRUCE TAYLOR CIRCUIT KORORA	RES	42	45	3	Noticable
NCA 1	769885	4 ASCOT CLOSE KORORA	RES	42	45	3	Noticable
NCA 1	769884	UNIT 10/ 95 JAMES SMALL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	769883	2 ALBERT CHAPPELL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	769882	UNIT 4/ 95 JAMES SMALL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	769881	UNIT 5/ 95 JAMES SMALL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	769880	9B MALIBU DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	769877	13 ALBERT CHAPPELL DRIVE KORORA	RES	42	45	3	Noticable
NCA 1	769876	11 ALBERT CHAPPELL DRIVE KORORA	RES	42	45	3	Noticable
NCA 1	769874	UNIT 7/ 95A JAMES SMALL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	769872	50A JAMES SMALL DRIVE KORORA	RES	42	48	6	Clearly Audible
NCA 1	769871	50A JAMES SMALL DRIVE KORORA	RES	42	48	6	Clearly Audible
NCA 1	769870	6 TROPIC LODGE PLACE KORORA	RES	42	48	6	Clearly Audible
NCA 1	769869	8 TROPIC LODGE PLACE KORORA	RES	42	48	6	Clearly Audible
NCA 1	769868	8A TROPIC LODGE PLACE KORORA	RES	42	48	6	Clearly Audible
NCA 1	769867	UNIT 14/ 10-12 TROPIC LODGE PLACE KORORA	RES	42	48	6	Clearly Audible
NCA 1	769866	13A TROPIC LODGE PLACE KORORA	RES	42	47	5	Noticable
NCA 1	769865	13A FERN TREE PLACE KORORA	RES	42	43	1	Noticable
NCA 1	769864	11A FERN TREE PLACE KORORA	RES	42	44	2	Noticable
NCA 1	769863	13 FERN TREE PLACE KORORA	RES	42	43	1	Noticable
NCA 1	769862	7 FERN TREE PLACE KORORA	RES	42	44	2	Noticable
NCA 1	769861	5 FERN TREE PLACE KORORA	RES	42	44	2	Noticable
NCA 1	769860	7 MALIBU DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	769859	84 JAMES SMALL DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	769858	82 JAMES SMALL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	769857	8 FERN TREE PLACE KORORA	RES	42	44	2	Noticable
NCA 1	769856	6 FERN TREE PLACE KORORA	RES	42	44	2	Noticable

Appendix C Detailed noise predicted for each receiver and activity

Assessment: OCR Dual Watermain Connection at OCR				Night	Results summary		
NCA	ID	Address	Land use	NML	Cumulative Predicted LAeq, 15 minute noise level	Exceedance of NML, dB	Impact classification
NCA 1	769855	4 FERN TREE PLACE KORORA	RES	42	45	3	Noticable
NCA 1	769843	13 MALIBU DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	769842	10 ALBERT CHAPPELL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	769841	3 FERN TREE PLACE KORORA	RES	42	44	2	Noticable
NCA 1	769840	1 FERN TREE PLACE KORORA	RES	42	45	3	Noticable
NCA 1	769839	UNIT 6/ 1-5 SHEARWATER PLACE KORORA	RES	42	47	5	Noticable
NCA 1	769838	10A RUSS HAMMOND CLOSE KORORA	RES	42	63	21	Moderately Intrusive
NCA 1	769837	4 RUSS HAMMOND CLOSE KORORA	RES	42	59	17	Moderately Intrusive
NCA 1	769836	8 RUSS HAMMOND CLOSE KORORA	RES	42	62	20	Moderately Intrusive
NCA 1	769835	4A RUSS HAMMOND CLOSE KORORA	RES	42	59	17	Moderately Intrusive
NCA 1	769833	UNIT 24/ 7-13 SHEARWATER PLACE KORORA	RES	42	47	5	Clearly Audible
NCA 1	769832	UNIT 6/ 7-13 SHEARWATER PLACE KORORA	RES	42	49	7	Clearly Audible
NCA 1	769831	UNIT 2/ 7-13 SHEARWATER PLACE KORORA	RES	42	48	6	Clearly Audible
NCA 1	769830	UNIT 17/ 7-13 SHEARWATER PLACE KORORA	RES	42	51	9	Clearly Audible
NCA 1	769829	UNIT 15/ 7-13 SHEARWATER PLACE KORORA	RES	42	51	9	Clearly Audible
NCA 1	769828	18 KORORA BASIN ROAD KORORA	RES	42	51	9	Clearly Audible
NCA 1	769826	5 JAMES SMALL DRIVE KORORA	RES	42	55	13	Clearly Audible
NCA 1	769824	UNIT 21/ 7-13 SHEARWATER PLACE KORORA	RES	42	48	6	Clearly Audible
NCA 1	769823	UNIT 19/ 7-13 SHEARWATER PLACE KORORA	RES	42	49	7	Clearly Audible
NCA 1	769821	1 KORORA BASIN ROAD KORORA	RES	42	61	19	Moderately Intrusive
NCA 1	769820	11 KORORA BASIN ROAD KORORA	RES	42	53	11	Clearly Audible
NCA 1	769819	11 KORORA BASIN ROAD KORORA	RES	42	56	14	Clearly Audible
NCA 1	769818	7 JAMES SMALL DRIVE KORORA	RES	42	56	14	Clearly Audible
NCA 1	769817	9 JAMES SMALL DRIVE KORORA	RES	42	56	14	Clearly Audible
NCA 1	769816	11 JAMES SMALL DRIVE KORORA	RES	42	56	14	Clearly Audible
NCA 1	769814	48 PARKES DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	769812	10 PARKES DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	769811	15 ALBERT CHAPPELL DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	769810	3 GROSS MICHEL ROAD KORORA	RES	42	43	1	Noticable
NCA 1	769809	5A MALIBU DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	769808	32 PARKES DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	769807	11 BRUCE TAYLOR CIRCUIT KORORA	RES	42	46	4	Noticable
NCA 1	769805	UNIT 10/ 7-13 SHEARWATER PLACE KORORA	RES	42	50	8	Clearly Audible
NCA 1	769804	UNIT 4/ 1-5 SHEARWATER PLACE KORORA	RES	42	47	5	Clearly Audible
NCA 1	769803	29 NORMAN HILL DRIVE KORORA	RES	42	45	3	Noticable
NCA 1	769802	UNIT 6/ 2-4 OSPREY PLACE KORORA	RES	42	45	3	Noticable
NCA 1	769801	UNIT 13/ 1-5 SHEARWATER PLACE KORORA	RES	42	45	3	Noticable
NCA 1	769799	UNIT 10/ 1-5 SHEARWATER PLACE KORORA	RES	42	46	4	Noticable
NCA 1	769798	UNIT 26/ 1-5 SHEARWATER PLACE KORORA	RES	42	46	4	Noticable
NCA 1	769797	UNIT 22/ 1-5 SHEARWATER PLACE KORORA	RES	42	46	4	Noticable

Appendix C Detailed noise predicted for each receiver and activity

Assessment: OCR Dual Watermain Connection at OCR				Night	Results summary		
NCA	ID	Address	Land use	NML	Cumulative Predicted LAeq, 15 minute noise level	Exceedance of NML, dB	Impact classification
NCA 1	769769	14 FERN TREE PLACE KORORA	RES	42	44	2	Noticable
NCA 1	769767	UNIT 1/ 95A JAMES SMALL DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	769766	UNIT 4/ 95A JAMES SMALL DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	769762	23 FERN TREE PLACE KORORA	RES	42	43	1	Noticable
NCA 1	769758	UNIT 5/ 95A JAMES SMALL DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	769757	599-599 PACIFIC HIGHWAY KORORA	RES	42	45	3	Noticable
NCA 1	769756	21 FERN TREE PLACE KORORA	RES	42	43	1	Noticable
NCA 1	769755	17 FERN TREE PLACE KORORA	RES	42	43	1	Noticable
NCA 1	769754	15 FERN TREE PLACE KORORA	RES	42	43	1	Noticable
NCA 1	769753	10-12 FERN TREE PLACE KORORA	RES	42	44	2	Noticable
NCA 1	769752	25 FERN TREE PLACE KORORA	RES	42	43	1	Noticable
NCA 1	769751	27 FERN TREE PLACE KORORA	RES	42	43	1	Noticable
NCA 1	769750	16 FERN TREE PLACE KORORA	RES	42	44	2	Noticable
NCA 1	769748	19 KORORA BASIN ROAD KORORA	RES	42	49	7	Clearly Audible
NCA 1	769747	19 KORORA BASIN ROAD KORORA	RES	42	50	8	Clearly Audible
NCA 1	769746	17 KORORA BASIN ROAD KORORA	RES	42	52	10	Clearly Audible
NCA 1	769744	11 FINLAYS ROAD KORORA	RES	42	44	2	Noticable
NCA 1	769743	6 MUSA LANE KORORA	RES	42	42	0	Noticable
NCA 1	769742	599-599 PACIFIC HIGHWAY KORORA	RES	42	43	1	Noticable
NCA 1	769739	10 COACHMANS CLOSE KORORA	RES	42	43	1	Noticable
NCA 1	769723	22 OLD COAST ROAD KORORA	RES	42	51	9	Clearly Audible
NCA 1	769721	7 PINE BRUSH CRESCENT KORORA	RES	42	43	1	Noticable
NCA 1	769720	10 COACHMANS CLOSE KORORA	RES	42	43	1	Noticable
NCA 1	769712	59 OLD COAST ROAD KORORA	RES	42	45	3	Noticable
NCA 1	769708	75 OLD COAST ROAD KORORA	RES	42	43	1	Noticable
NCA 1	769680	5 PINE BRUSH CRESCENT KORORA	RES	42	43	1	Noticable
NCA 1	769679	3 PINE BRUSH CRESCENT KORORA	RES	42	42	0	Noticable
NCA 1	769676	60 OLD COAST ROAD KORORA	RES	42	47	5	Noticable
NCA 1	769675	26 OLD COAST ROAD KORORA	RES	42	49	7	Clearly Audible
NCA 1	769674	RIVENDELL 40 OLD COAST ROAD KORORA	RES	42	50	8	Clearly Audible
NCA 1	769672	28 KORORA BASIN ROAD KORORA	RES	42	51	9	Clearly Audible
NCA 1	769670	2 DAINTREE DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	769669	66 OLD COAST ROAD KORORA	RES	42	44	2	Noticable
NCA 1	769662	699 PACIFIC HIGHWAY KORORA	RES	42	44	2	Noticable
NCA 1	769661	689 PACIFIC HIGHWAY KORORA	RES	42	44	2	Noticable
NCA 1	769660	59A OLD COAST ROAD KORORA	RES	42	44	2	Noticable
NCA 1	769659	82 OLD COAST ROAD KORORA	RES	42	43	1	Noticable
NCA 1	769658	70 OLD COAST ROAD KORORA	RES	42	43	1	Noticable
NCA 1	769657	74 OLD COAST ROAD KORORA	RES	42	43	1	Noticable
NCA 1	769656	61 OLD COAST ROAD KORORA	RES	42	45	3	Noticable

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Assessment: OCR Dual Watermain Connection at OCR				Night	Results summary		
NCA	ID	Address	Land use	NML	Cumulative Predicted LAeq, 15 minute noise level	Exceedance of NML, dB	Impact classification
NCA 1	769655	75 OLD COAST ROAD KORORA	RES	42	43	1	Noticable
NCA 1	769652	16 COACHMANS CLOSE KORORA	RES	42	42	0	Noticable
NCA 1	769651	6 PINE BRUSH CRESCENT KORORA	RES	42	42	0	Noticable
NCA 1	769645	UNIT 25/ 675 PACIFIC HIGHWAY KORORA	RES	42	45	3	Noticable
NCA 1	769642	4 PINE BRUSH CRESCENT KORORA	RES	42	42	0	Noticable
NCA 1	769640	14 COACHMANS CLOSE KORORA	RES	42	42	0	Noticable
NCA 1	769637	12 COACHMANS CLOSE KORORA	RES	42	43	1	Noticable
NCA 1	769636	8 COACHMANS CLOSE KORORA	RES	42	43	1	Noticable
NCA 1	769635	4 COACHMANS CLOSE KORORA	RES	42	44	2	Noticable
NCA 1	769634	8 PINE BRUSH CRESCENT KORORA	RES	42	44	2	Noticable
NCA 1	769633	12 PINE BRUSH CRESCENT KORORA	RES	42	43	1	Noticable
NCA 1	769632	10 PINE BRUSH CRESCENT KORORA	RES	42	43	1	Noticable
NCA 1	769631	6 COACHMANS CLOSE KORORA	RES	42	43	1	Noticable
NCA 1	769629	122B OLD COAST ROAD KORORA	RES	42	42	0	Noticable
NCA 1	769627	122-122 OLD COAST ROAD KORORA	RES	42	43	1	Noticable
NCA 1	769625	45 OLD COAST ROAD KORORA	RES	42	46	4	Noticable
NCA 1	769623		RES	42	44	2	Noticable
NCA 1	769615	33 KORORA BASIN ROAD KORORA	RES	42	47	5	Clearly Audible
NCA 1	769611	2 ROWSELLS ROAD KORORA	RES	42	43	1	Noticable
NCA 1	769603	33 KORORA BASIN ROAD KORORA	RES	42	44	2	Noticable
NCA 1	769602	38 KORORA BASIN ROAD KORORA	RES	42	46	4	Noticable
NCA 1	769601	46 KORORA BASIN ROAD KORORA	RES	42	44	2	Noticable
NCA 1	769600	54 KORORA BASIN ROAD KORORA	RES	42	44	2	Noticable
NCA 1	769599	46 KORORA BASIN ROAD KORORA	RES	42	45	3	Noticable
NCA 1	769597	12 ROWSELLS ROAD KORORA	RES	42	43	1	Noticable
NCA 1	769596	26 ROWSELLS ROAD KORORA	RES	42	42	0	Noticable
NCA 1	769595	28A KORORA BASIN ROAD KORORA	RES	42	50	8	Clearly Audible
NCA 1	769592	55 KORORA BASIN ROAD KORORA	RES	42	43	1	Noticable
NCA 1	769590	24 ROWSELLS ROAD KORORA	RES	42	43	1	Noticable

Construction noise impact assessment

Excavation and Lifting Pipes - Night

OCR Dual Watermain connection			
Proposed works	OCR Dual Watermain Connection at OCR		
Proponent	Quickway		
Assessment Date	07/12/2022		
Prepared by	Tom St Vincent Welch	Assessment Id	OOH14

Introduction

This report has been prepared using the construction noise self-assessment platform KNOWnoise: *Minor Works* and presents an assessment of the likely noise impacts related to proposed works associated with the above project. Where possible, these works would be completed during standard construction hours; however, there may be a need to work outside these hours due to technical, community or access limitations. The location of the proposed works is illustrated in Appendix A.

Planned works

A description of the proposed works is as follows.

OCR Dual Watermain Connection at OCR. Works required over 24hour consecutive shifts to minimise ensure works are within 5 day window permitted by Coffs Harbour City Council

Proposed activities and equipment for the works are summarised in Appendix B.

Though subject to change, the works are expected to commence around 16/01/2023 and would be completed by 22/01/2023.

Assessment criteria and mitigation requirements

The Interim Construction Noise Guideline (ICNG) (DECC 2009) describes noise more than the background level as potentially having an adverse impact on sensitive receivers and increasing the likelihood of complaint. During standard construction hours, where construction noise is within 10 dB(A) of the RBL, impacts would be acceptable.

Where construction noise is more than 10 dB(A) above the RBL during standard construction hours, a residential receiver is considered noise affected and the proponent should undertake all reasonable and feasible steps necessary to manage the impact and consult with the affected community.

Above a LAeq, 15 minute noise level of 75 dB(A), a receiver is highly affected, requiring consideration of additional mitigation measures including alternative accommodation in the night period.

Outside standard construction hours, construction noise at a residential receiver more than 5 dB(A) above the RBL is taken to be noise affected.

In addition, annoying noise such as rock hammers, impact piling, or other impulsive noise sources usually result in greater annoyance than continuous construction noise. A 5 dB(A) penalty is applicable to such activities prior to comparison with the NMLs.

Other sensitive land uses, such as schools and offices, typically find noise from construction disruptive when the properties are being used (such as during work and school times). Table 2 presents NMLs from the ICNG for sensitive land uses based on the principle that the characteristic activities for each of these land uses should not be unduly disturbed.

Table 1 Non-residential sensitive land uses noise management levels

Land use	Noise assessment location	NML (L _{Aeq,15min})
Classrooms at schools and other educational institutions	Internal	45
Places of worship		
Active recreation areas (such as sporting activities and activities which generate their own noise or focus for participants)	External	65
Passive recreation areas (contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External	60
Industrial premises	External	75
Office, retail outlets	External	70

As part of planning for out of hours works, standard mitigation measures, as described in the ICNG and CNVG, would be implemented where reasonable and feasible. However, after these measures have been applied, noise and vibration levels may continue to exceed the NMLs.

In this case, additional mitigation measures outlined in the CNVG, which largely focus on engagement with affected sensitive receivers, should be implemented where reasonable and feasible, unless other agreements are in place with the impacted receiver.

Triggers and additional mitigation measures for airborne noise are summarised in Table 2. Further details of specific additional mitigation measures are described in the CNVG.

Table 2 Triggers for additional mitigation measures – Airborne noise (Roads and Maritime 2016)

Predicted airborne LAeq(15min) noise level at receiver			
Perception	dB(A) above RBL	dB(A) above NML	Additional mitigation measures
All hours			
75 dB(A) or greater			N, V, PC, RO
Standard hours: Mon - Fri (7am – 6pm), Sat (8am – 1pm), Sun/Pub Hol (Nil)			
Noticeable	5 to 10	0	-
Clearly audible	10 to 20	< 10	-
Moderately intrusive	20 to 30	10 to 20	N, V
Highly intrusive	> 30	> 20	N, V
OOHW Period 1: Mon – Fri (6pm – 10pm), Sat (7am – 8am & 1pm – 10pm), Sun/Pub Hol (8am – 6pm)			
Noticeable	5 to 10	<5	-
Clearly audible	10 to 20	5 to 15	N, R1, DR
Moderately intrusive	20 to 30	15 to 25	V, N, R1, DR
Highly intrusive	> 30	>25	V, IB, N, R1, DR, PC, SN
OOHW Period 2: Mon – Fri (10pm – 7am), Sat (10pm – 8am), Sun/Pub Hol (6pm – 7am)			
Noticeable	5 to 10	<5	N
Clearly audible	10 to 20	5 to 15	V, N, R2, DR
Moderately intrusive	20 to 30	15 to 25	V, IB, N, PC, SN, R2, DR
Highly intrusive	> 30	>25	AA, V, IB, N, PC, SN, R2, DR

Notes:

PC = Phone calls

V = verification

IB = Individual briefings

N= Notification

AA = Alternative accommodation

SN = Specific notifications

RO = Respite offer

R1 = Respite period 1

R2 = Respite period 2

DR = Duration respite

Perception = relates to levels above RBL

NML = Noise management level

HA = Highly affected

Existing environment and noise management levels

The proposed works would be undertaken in a predominantly Rural / Suburban, characterised as:

Areas with negligible transportation or very limited local traffic, typically light vehicles only.

100m or more from the road.

Background noise levels adopted for the project area and associated noise management levels (NMLs) are summarised in Table 3. NMLs have been established in line with the ICNG.

Table 3 Construction NMLs

Land use	Rural / Suburban		Using custom background noise data?		Yes
Criterion	Day	Weekend Day	Evening	Night	Sleep
RBL	52	52	46	37	
NML	62	57	51	42	65

Sleep disturbance

The ICNG recommends where construction works are planned to extend over more than two consecutive nights, the maximum noise level should be considered for the purposes of establishing the likelihood of sleep disturbance. The Road Noise Policy suggests that maximum internal noise levels below 50-55 dB(A) are unlikely to awaken people from sleep and one or two noise events per night, with maximum internal noise levels of 65-70 dB(A) are not likely to affect health and wellbeing significantly.

Based on this, a sleep awakening criterion of 55 dB(A) (internal) is typically adopted for works. Given that noise attenuation of 10 dB(A) is typically provided by an open window, a sleep awakening criterion of L_Amax 65 dB(A) (external) has been applied to residential bedroom façades. This is consistent with the sleep disturbance threshold described in Appendix E of the CNVG.

Vibration

Effects of vibration from construction may be segregated into:

- Human exposure – disturbance to building occupants: vibration in which the occupants or users of the building are inconvenienced or possibly disturbed.
- Effects on building contents – vibration where the building contents may be affected.
- Effects on building structures – vibration in which the integrity of the building or structure itself may be prejudiced.

Vibration criteria relating to human comfort applicable to this project are taken from the DEC (2006) document Assessing Vibration – A Technical Guideline for intermittent vibration – such as from drilling, compacting or activities that would result in continuous vibration if operated continuously. Intermittent vibration is assessed as a vibration dose value (VDV) and relates to the level of vibration over time (cumulative over the night or day period). VDV's that may result in adverse comment from receivers are summarised in Table 4.

Table 4 Summary of vibration dose values which might result in adverse comment

Time	Low probability of adverse comment (m/s ^{1.75})	Adverse comment possible (m/s ^{1.75})	Adverse comment probable (m/s ^{1.75})
Day (6am to 10pm)	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Night (10pm to 6am)	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Guidance for the consideration of potential building damage from construction vibration is in line with BS 7385-1 *Evaluation and measurement for vibration in buildings - Guide for measurement of vibration and evaluation of their effects on buildings*. These guideline values are presented in Table 5.

Table 5 Building damage vibration guidelines (BS 7385-1)

Type of building	Guideline values for vibration (PPV mm/s)		
	4Hz to 15Hz	15Hz to 40Hz	40Hz and above
Reinforced or framed structures / Industrial and heavy commercial buildings	50		
Un-reinforced or light framed structures / Residential or light commercial type buildings	15 - 20	20 - 50	50

For heritage structures, criteria are in line with the German Standard *DIN 4150-3: Structural Vibration- effects of vibration on structures*, as summarised in Table 6.

Table 6 Guideline values for vibration velocity to be used when evaluating the effects of short-term vibration on heritage structures (DIN 4150-3).

Type of building	Guideline values for vibration (PPV mm/s)			
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz	Vibration at horizontal plane of highest floor at all frequencies
Structures that, because of their sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	3	3 to 8	8 to 10	8

The safe working distances presented in Table 7 are indicative and will vary depending on the item of plant and local geotechnical conditions. The cosmetic damage thresholds apply to typical buildings under typical geotechnical conditions and vibration monitoring is recommended at specific sites. Where structures are more sensitive, such as heritage items, more stringent conditions are applicable and should be considered individually.

In relation to human response, the safe working distances relate to continuous vibration. For most construction activities, vibration emissions are intermittent and higher vibration levels over shorter periods are acceptable. Additional assessment should be undertaken where the human response criteria are exceeded.

Table 7 Safe working distances for vibration intensive plant

Plant item	Rating/description	Safe working distance	
		Cosmetic damage (BS 7385-1)	Human response (DECCW)
Vibratory roller	<50 kN (typically 1-2 t)	5 m	15 m to 20 m
	<100 kN (typically 2-4 t)	6 m	20 m
	<200 kN (typically 4-6 t)	12 m	40 m
	<300 kN (typically 7-13 t)	15 m	100 m
	>300 kN (typically 13-18 t)	20 m	100 m
	>300 kN (> 18 t)	25 m	100 m
Small hydraulic hammer	300 kg – 5 to 12 t excavator	2 m	7 m
Medium hydraulic hammer	900 kg – 12 to 18t excavator	7 m	23 m
Large hydraulic hammer	1600 kg – 18 to 34 t excavator	22 m	73 m
Vibratory pile driver	Sheet piles	2 m to 20 m	20 m
Pile boring	≤800 mm	2 m	n/a
Jackhammer	Hand held	1 m	Avoid contact with structure

Assessment methodology

Based on the nominated works area (illustrated in Appendix A), proposed equipment and the minimum distance from the works to each sensitive receiver, noise levels were calculated based on CONCAWE (1981) *Propagation of noise from petroleum and petrochemical complexes to neighboring communities*.

This method considers geometric spreading, atmospheric absorption, ground effects and is valid for meteorological conditions of a gentle breeze from source to receiver and stable atmosphere (temperature inversion).

KNOWnoise: Minor works is a 2-Dimensional assessment platform and does not consider terrain effects (e.g. hills, valleys) or the presence of solid structures such as homes or noise barriers. This will result in a conservative prediction, suitable for the project being assessed.

Considering the nature of the works and the type of surrounding land uses, sensitive receivers up to a radius of 1000 metres from the works have been included in the assessment.

Sound power levels and predicted noise levels depend on the number of plant items operating at any one time and their precise location relative to a sensitive receiver. Equipment was assumed to be working at the worst-case location relative to each receiver and represents a worst-case assessment. Where the activity is further away from receivers or less equipment is used the predicted levels will decrease.

Sound power levels for plant and equipment expected to be used for each activity has been estimated based on guidance in the following standards and guidelines as well as typical measured noise levels for specific equipment.

- “ Australian Standard AS2436-2010: Guide to noise and vibration control on construction, demolition and maintenance sites
- “ Construction Noise and Vibration Strategy 7TP-ST-157/2.0 (CNVS), (TfNSW, 2018)
- “ Construction Noise and Vibration Guideline (CNVG) (Roads and Maritime Services, 2016)
- “ British Standard 5228-1:2009 Code of practice for noise and vibration control on construction and open sites
- “ United Kingdom Department for Environment, Food and Rural Affairs (DEFRA) Noise database for prediction of noise on construction and open sites

Construction noise sources and associated sound power levels are listed in Appendix B. The maximum predicted LAeq noise level within the work area was identified for each receiver.

Predicted noise levels

Detailed predicted noise levels for each potentially affected receiver are presented Appendix C.

A summary of predicted noise levels in comparison with ICNG assessment criteria for the Night period is presented in Table 8.

Table 8 Summary of predicted noise levels with comparison against ICNG criteria for the Night period.

Criterion	Predicted number of receivers
Maximum cumulative predicted L _{Aeq} , 15 minute noise level	52 dB(A)
Number of highly noise affected receivers (>75 dB)	0
1 – 10 dB above NML	35
10 – 20 dB above NML	1
20+ dB above NML	0

In line with CNVG impact classes, up to 0 receivers are predicted to be classified as Highly Impacted during the Night period. A summary of the number of receivers in each class is presented in Table 9.

Table 9 Summary of predicted noise levels with comparison against CNVG criteria

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 <= 5 dB above NML	19
Clearly Audible	5 <= 15 dB above NML	18
Moderately Intrusive	15 <= 25 dB above NML	0
Highly Intrusive	> 25 dB above NML	0

Predicted impact classes for the Night period are illustrated graphically in Appendix C. Each identified receiver in the study area has been coloured to highlight the predicted level of impact.

Sleep disturbance

In the event works are planned for more than two consecutive nights, up to 0 are expected to exceed the sleep awakening criteria. Where any exceedances if the awakening criteria are predicted, additional care should be taken and mitigation measures implemented in the with the CNVG.

Predicted vibration impacts

The level of vibration impact on sensitive receivers (buildings and human comfort) will largely depend on the type of machinery in use and the distance from source to receiver.

Based on the proposed work locations and selected equipment, the following level of vibration impact is expected. A summary of vibration impacts is provided for each sensitive receiver in Appendix C.

Impact classification	Number of potentially affected receivers
Human comfort	0
Cosmetic damage	0
Heritage structure	0

Proposed noise mitigation measures

The safeguards and controls listed in Table 10 will be implemented where reasonable and feasible with the intention of achieving the project noise criteria and to maintain noise impacts at a practical minimum.

Table 10 Safeguards and controls

Action	Description
Community consultation or notification	Notify the affected community. The notification will detail work activities, dates and hours, impacts and mitigation measures, indication of work schedule over the night time period, any operational noise benefits from the works (where applicable) and contact telephone number. Notification should be a minimum of 7 calendar days prior to the start of works. For projects other than maintenance works more advanced consultation or notification may be required.
Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction would at least include: - all project specific and relevant standard noise and vibration mitigation measures - relevant licence and approval conditions - permissible hours of work - any limitations on high noise generating activities - location of nearest sensitive receivers - construction employee parking areas - designated loading/unloading areas and procedures site opening/closing times (including deliveries) environmental incident procedures
Behaviour	No swearing or unnecessary shouting or loud stereos/radios on site. Limit compression braking at night in residential areas. No dropping of materials from height, throwing of metal items and slamming of doors.
Verification	Where indicated in Appendix C, a noise verification program would be undertaken for the duration of the works.
Construction hours	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels should be scheduled during less sensitive time periods.
Respite for out-of-hours works	Respite would be scheduled as indicated in Appendix C and described in the CNVG.
Equipment selection	Use quieter construction methods where feasible and reasonable. Ensure plant including the silencer is well maintained. Plant noise levels will have an operating noise emission level compliant with Appendix F of the CNVG
Use and siting of plant	The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers.

Action	Description
Plan worksites and activities to minimise noise and vibration.	Locate compounds away from sensitive receivers and discourage access from local roads. Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site. Where additional activities or plant may only result in a marginal noise increase and speed up works, consider limiting duration of impact by concentrating noisy activities at one location and move to another as quickly as possible. Very noise activities should be scheduled for normal working hours. If the work can not be undertaken during the day, it should be completed before 11:00pm. Where practicable, work should be scheduled to avoid major student examination periods when students are studying for examinations such as before or during Higher School Certificate and at the end of higher education semesters.
Non-tonal reverse alarms	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work.
Shield stationary noise sources such as pumps, generators, and compressors	These should be enclosed or shielded where reasonable and feasible.
Implement any project specific mitigation measures	
1	None

Appendix A Project location and predicted level of impact



Appendix B Proposed activities and equipment

Excavation and lifting pipes

Equipment	Quantity	Usage	Reduction	SWL
Bogies	1	30 %	0	95
Daymakers / Lighting plant	3	100 %	5	93
Excavator (25 tonne)	2	50 %	5	100

Activity Sound Power Level: 102

Appendix C Detailed noise predicted for each receiver and activity

Assessment: OCR Dual Watermain Connection at OCR				Night	Results summary		
NCA	ID	Address	Land use	NML	Cumulative Predicted LAeq, 15 minute noise level	Exceedance of NML, dB	Impact classification
NCA 1	770254	15 JAMES SMALL DRIVE KORORA	RES	42	46	4	Noticable
NCA 1	770213	3 RUSS HAMMOND CLOSE KORORA	RES	42	46	4	Noticable
NCA 1	770205	13 RUSS HAMMOND CLOSE KORORA	RES	42	49	7	Clearly Audible
NCA 1	770204	9 RUSS HAMMOND CLOSE KORORA	RES	42	50	8	Clearly Audible
NCA 1	770202	13 RUSS HAMMOND CLOSE KORORA	RES	42	51	9	Clearly Audible
NCA 1	770201	13 RUSS HAMMOND CLOSE KORORA	RES	42	50	8	Clearly Audible
NCA 1	770200	UNIT 3/ 1 KORORA SCHOOL ROAD KORORA	RES	42	47	5	Clearly Audible
NCA 1	770199	UNIT 3/ 1 KORORA SCHOOL ROAD KORORA	RES	42	47	5	Noticable
NCA 1	770198	UNIT 3/ 1 KORORA SCHOOL ROAD KORORA	RES	42	46	4	Noticable
NCA 1	770180	13 JAMES SMALL DRIVE KORORA	RES	42	46	4	Noticable
NCA 1	770177	11A JAMES SMALL DRIVE KORORA	RES	42	46	4	Noticable
NCA 1	770176	6 RUSS HAMMOND CLOSE KORORA	RES	42	51	9	Clearly Audible
NCA 1	770162	2 RUSS HAMMOND CLOSE KORORA	RES	42	46	4	Noticable
NCA 1	770153	UNIT 2/ 7 RUSS HAMMOND CLOSE KORORA	RES	42	49	7	Clearly Audible
NCA 1	770087	33 JAMES SMALL DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	770086	37 JAMES SMALL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770016	31 JAMES SMALL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770013	UNIT 1/ 1 KORORA SCHOOL ROAD KORORA	RES	42	45	3	Noticable
NCA 1	769934	11 RUSS HAMMOND CLOSE KORORA	RES	42	47	5	Clearly Audible
NCA 1	769933	11 RUSS HAMMOND CLOSE KORORA	RES	42	49	7	Clearly Audible
NCA 1	769932	UNIT 5/ 1 KORORA SCHOOL ROAD KORORA	RES	42	48	6	Clearly Audible
NCA 1	769931	UNIT 5/ 1 KORORA SCHOOL ROAD KORORA	RES	42	48	6	Clearly Audible
NCA 1	769908	29 JAMES SMALL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	769907	1 RUSS HAMMOND CLOSE KORORA	RES	42	44	2	Noticable
NCA 1	769906	5 RUSS HAMMOND CLOSE KORORA	RES	42	47	5	Clearly Audible
NCA 1	769905	27 JAMES SMALL DRIVE KORORA	RES	42	46	4	Noticable
NCA 1	769904	UNIT 2/ 7 RUSS HAMMOND CLOSE KORORA	RES	42	48	6	Clearly Audible
NCA 1	769838	10A RUSS HAMMOND CLOSE KORORA	RES	42	52	10	Clearly Audible
NCA 1	769837	4 RUSS HAMMOND CLOSE KORORA	RES	42	47	5	Clearly Audible
NCA 1	769836	8 RUSS HAMMOND CLOSE KORORA	RES	42	50	8	Clearly Audible
NCA 1	769835	4A RUSS HAMMOND CLOSE KORORA	RES	42	48	6	Clearly Audible
NCA 1	769826	5 JAMES SMALL DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	769821	1 KORORA BASIN ROAD KORORA	RES	42	50	8	Clearly Audible
NCA 1	769819	11 KORORA BASIN ROAD KORORA	RES	42	44	2	Noticable
NCA 1	769818	7 JAMES SMALL DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	769817	9 JAMES SMALL DRIVE KORORA	RES	42	45	3	Noticable
NCA 1	769816	11 JAMES SMALL DRIVE KORORA	RES	42	45	3	Noticable

Appendix C Detailed noise predicted for each receiver and activity

Construction noise impact assessment

Hammering - Daytime

OCR Dual Watermain connection			
Proposed works	OCR Dual Watermain Connection at OCR		
Proponent	Quickway		
Assessment Date	07/12/2022		
Prepared by	Tom St Vincent Welch	Assessment Id	OOH14

Introduction

This report has been prepared using the construction noise self-assessment platform KNOWnoise: *Minor Works* and presents an assessment of the likely noise impacts related to proposed works associated with the above project. Where possible, these works would be completed during standard construction hours; however, there may be a need to work outside these hours due to technical, community or access limitations. The location of the proposed works is illustrated in Appendix A.

Planned works

A description of the proposed works is as follows.

OCR Dual Watermain Connection at OCR. Works required over 24hour consecutive shifts to minimise ensure works are within 5 day window permitted by Coffs Harbour City Council

Proposed activities and equipment for the works are summarised in Appendix B.

Though subject to change, the works are expected to commence around 16/01/2023 and would be completed by 22/01/2023.

Assessment criteria and mitigation requirements

The Interim Construction Noise Guideline (ICNG) (DECC 2009) describes noise more than the background level as potentially having an adverse impact on sensitive receivers and increasing the likelihood of complaint. During standard construction hours, where construction noise is within 10 dB(A) of the RBL, impacts would be acceptable.

Where construction noise is more than 10 dB(A) above the RBL during standard construction hours, a residential receiver is considered noise affected and the proponent should undertake all reasonable and feasible steps necessary to manage the impact and consult with the affected community.

Above a LAeq, 15 minute noise level of 75 dB(A), a receiver is highly affected, requiring consideration of additional mitigation measures including alternative accommodation in the night period.

Outside standard construction hours, construction noise at a residential receiver more than 5 dB(A) above the RBL is taken to be noise affected.

In addition, annoying noise such as rock hammers, impact piling, or other impulsive noise sources usually result in greater annoyance than continuous construction noise. A 5 dB(A) penalty is applicable to such activities prior to comparison with the NMLs.

Other sensitive land uses, such as schools and offices, typically find noise from construction disruptive when the properties are being used (such as during work and school times). Table 2 presents NMLs from the ICNG for sensitive land uses based on the principle that the characteristic activities for each of these land uses should not be unduly disturbed.

Table 1 Non-residential sensitive land uses noise management levels

Land use	Noise assessment location	NML (L _{Aeq,15min})
Classrooms at schools and other educational institutions	Internal	45
Places of worship		
Active recreation areas (such as sporting activities and activities which generate their own noise or focus for participants)	External	65
Passive recreation areas (contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External	60
Industrial premises	External	75
Office, retail outlets	External	70

As part of planning for out of hours works, standard mitigation measures, as described in the ICNG and CNVG, would be implemented where reasonable and feasible. However, after these measures have been applied, noise and vibration levels may continue to exceed the NMLs.

In this case, additional mitigation measures outlined in the CNVG, which largely focus on engagement with affected sensitive receivers, should be implemented where reasonable and feasible, unless other agreements are in place with the impacted receiver.

Triggers and additional mitigation measures for airborne noise are summarised in Table 2. Further details of specific additional mitigation measures are described in the CNVG.

Table 2 Triggers for additional mitigation measures – Airborne noise (Roads and Maritime 2016)

Predicted airborne LAeq(15min) noise level at receiver			
Perception	dB(A) above RBL	dB(A) above NML	Additional mitigation measures
All hours			
75 dB(A) or greater			N, V, PC, RO
Standard hours: Mon - Fri (7am – 6pm), Sat (8am – 1pm), Sun/Pub Hol (Nil)			
Noticeable	5 to 10	0	-
Clearly audible	10 to 20	< 10	-
Moderately intrusive	20 to 30	10 to 20	N, V
Highly intrusive	> 30	> 20	N, V
OOHW Period 1: Mon – Fri (6pm – 10pm), Sat (7am – 8am & 1pm – 10pm), Sun/Pub Hol (8am – 6pm)			
Noticeable	5 to 10	<5	-
Clearly audible	10 to 20	5 to 15	N, R1, DR
Moderately intrusive	20 to 30	15 to 25	V, N, R1, DR
Highly intrusive	> 30	>25	V, IB, N, R1, DR, PC, SN
OOHW Period 2: Mon – Fri (10pm – 7am), Sat (10pm – 8am), Sun/Pub Hol (6pm – 7am)			
Noticeable	5 to 10	<5	N
Clearly audible	10 to 20	5 to 15	V, N, R2, DR
Moderately intrusive	20 to 30	15 to 25	V, IB, N, PC, SN, R2, DR
Highly intrusive	> 30	>25	AA, V, IB, N, PC, SN, R2, DR

Notes:

PC = Phone calls

V = verification

IB = Individual briefings

N= Notification

AA = Alternative accommodation

SN = Specific notifications

RO = Respite offer

R1 = Respite period 1

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DR = Duration respite

Perception = relates to levels above RBL

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The proposed works would be undertaken in a predominantly Rural / Suburban, characterised as:

Areas with negligible transportation or very limited local traffic, typically light vehicles only.

100m or more from the road.

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Based on this, a sleep awakening criterion of 55 dB(A) (internal) is typically adopted for works. Given that noise attenuation of 10 dB(A) is typically provided by an open window, a sleep awakening criterion of L_Amax 65 dB(A) (external) has been applied to residential bedroom façades. This is consistent with the sleep disturbance threshold described in Appendix E of the CNVG.

Vibration

Effects of vibration from construction may be segregated into:

- Human exposure – disturbance to building occupants: vibration in which the occupants or users of the building are inconvenienced or possibly disturbed.
- Effects on building contents – vibration where the building contents may be affected.
- Effects on building structures – vibration in which the integrity of the building or structure itself may be prejudiced.

Vibration criteria relating to human comfort applicable to this project are taken from the DEC (2006) document Assessing Vibration – A Technical Guideline for intermittent vibration – such as from drilling, compacting or activities that would result in continuous vibration if operated continuously. Intermittent vibration is assessed as a vibration dose value (VDV) and relates to the level of vibration over time (cumulative over the night or day period). VDV's that may result in adverse comment from receivers are summarised in Table 4.

Table 4 Summary of vibration dose values which might result in adverse comment

Time	Low probability of adverse comment (m/s ^{1.75})	Adverse comment possible (m/s ^{1.75})	Adverse comment probable (m/s ^{1.75})
Day (6am to 10pm)	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Night (10pm to 6am)	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Guidance for the consideration of potential building damage from construction vibration is in line with BS 7385-1 *Evaluation and measurement for vibration in buildings - Guide for measurement of vibration and evaluation of their effects on buildings*. These guideline values are presented in Table 5.

Table 5 Building damage vibration guidelines (BS 7385-1)

Type of building	Guideline values for vibration (PPV mm/s)		
	4Hz to 15Hz	15Hz to 40Hz	40Hz and above
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Un-reinforced or light framed structures / Residential or light commercial type buildings	15 - 20	20 - 50	50

For heritage structures, criteria are in line with the German Standard *DIN 4150-3: Structural Vibration- effects of vibration on structures*, as summarised in Table 6.

Table 6 Guideline values for vibration velocity to be used when evaluating the effects of short-term vibration on heritage structures (DIN 4150-3).

Type of building	Guideline values for vibration (PPV mm/s)			
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz	Vibration at horizontal plane of highest floor at all frequencies
Structures that, because of their sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	3	3 to 8	8 to 10	8

The safe working distances presented in Table 7 are indicative and will vary depending on the item of plant and local geotechnical conditions. The cosmetic damage thresholds apply to typical buildings under typical geotechnical conditions and vibration monitoring is recommended at specific sites. Where structures are more sensitive, such as heritage items, more stringent conditions are applicable and should be considered individually.

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		Cosmetic damage (BS 7385-1)	Human response (DECCW)
Vibratory roller	<50 kN (typically 1-2 t)	5 m	15 m to 20 m
	<100 kN (typically 2-4 t)	6 m	20 m
	<200 kN (typically 4-6 t)	12 m	40 m
	<300 kN (typically 7-13 t)	15 m	100 m
	>300 kN (typically 13-18 t)	20 m	100 m
	>300 kN (> 18 t)	25 m	100 m
Small hydraulic hammer	300 kg – 5 to 12 t excavator	2 m	7 m
Medium hydraulic hammer	900 kg – 12 to 18t excavator	7 m	23 m
Large hydraulic hammer	1600 kg – 18 to 34 t excavator	22 m	73 m
Vibratory pile driver	Sheet piles	2 m to 20 m	20 m
Pile boring	≤800 mm	2 m	n/a
Jackhammer	Hand held	1 m	Avoid contact with structure

Assessment methodology

Based on the nominated works area (illustrated in Appendix A), proposed equipment and the minimum distance from the works to each sensitive receiver, noise levels were calculated based on CONCAWE (1981) *Propagation of noise from petroleum and petrochemical complexes to neighboring communities*.

This method considers geometric spreading, atmospheric absorption, ground effects and is valid for meteorological conditions of a gentle breeze from source to receiver and stable atmosphere (temperature inversion).

KNOWnoise: Minor works is a 2-Dimensional assessment platform and does not consider terrain effects (e.g. hills, valleys) or the presence of solid structures such as homes or noise barriers. This will result in a conservative prediction, suitable for the project being assessed.

Considering the nature of the works and the type of surrounding land uses, sensitive receivers up to a radius of 1000 metres from the works have been included in the assessment.

Sound power levels and predicted noise levels depend on the number of plant items operating at any one time and their precise location relative to a sensitive receiver. Equipment was assumed to be working at the worst-case location relative to each receiver and represents a worst-case assessment. Where the activity is further away from receivers or less equipment is used the predicted levels will decrease.

Sound power levels for plant and equipment expected to be used for each activity has been estimated based on guidance in the following standards and guidelines as well as typical measured noise levels for specific equipment.

- “ Australian Standard AS2436-2010: Guide to noise and vibration control on construction, demolition and maintenance sites
- “ Construction Noise and Vibration Strategy 7TP-ST-157/2.0 (CNVS), (TfNSW, 2018)
- “ Construction Noise and Vibration Guideline (CNVG) (Roads and Maritime Services, 2016)
- “ British Standard 5228-1:2009 Code of practice for noise and vibration control on construction and open sites
- “ United Kingdom Department for Environment, Food and Rural Affairs (DEFRA) Noise database for prediction of noise on construction and open sites

Construction noise sources and associated sound power levels are listed in Appendix B. The maximum predicted LAeq noise level within the work area was identified for each receiver.

Predicted noise levels

Detailed predicted noise levels for each potentially affected receiver are presented Appendix C.

A summary of predicted noise levels in comparison with ICNG assessment criteria for the Day period is presented in Table 8.

Table 8 Summary of predicted noise levels with comparison against ICNG criteria for the Day period.

Criterion	Predicted number of receivers
Maximum cumulative predicted L _{Aeq} , 15 minute noise level	63 dB(A)
Number of highly noise affected receivers (>75 dB)	0
1 – 10 dB above NML	1
10 – 20 dB above NML	0
20+ dB above NML	0

In line with CNVG impact classes, up to 0 receivers are predicted to be classified as Highly Impacted during the Day period. A summary of the number of receivers in each class is presented in Table 9.

Table 9 Summary of predicted noise levels with comparison against CNVG criteria

Impact class	Predicted noise level	Predicted number of receivers
Noticable	= 0 dB above NML	0
Clearly Audible	0 <= 10 dB above NML	3
Moderately Intrusive	10 <= 20 dB above NML	0
Highly Intrusive	> 20 dB above NML	0

Predicted impact classes for the Day period are illustrated graphically in Appendix C. Each identified receiver in the study area has been coloured to highlight the predicted level of impact.

Sleep disturbance

In the event works are planned for more than two consecutive nights, up to 0 are expected to exceed the sleep awakening criteria. Where any exceedances if the awakening criteria are predicted, additional care should be taken and mitigation measures implemented in the with the CNVG.

Predicted vibration impacts

The level of vibration impact on sensitive receivers (buildings and human comfort) will largely depend on the type of machinery in use and the distance from source to receiver.

Based on the proposed work locations and selected equipment, the following level of vibration impact is expected. A summary of vibration impacts is provided for each sensitive receiver in Appendix C.

Impact classification	Number of potentially affected receivers
Human comfort	0
Cosmetic damage	0
Heritage structure	0

Proposed noise mitigation measures

The safeguards and controls listed in Table 10 will be implemented where reasonable and feasible with the intention of achieving the project noise criteria and to maintain noise impacts at a practical minimum.

Table 10 Safeguards and controls

Action	Description
Community consultation or notification	Notify the affected community. The notification will detail work activities, dates and hours, impacts and mitigation measures, indication of work schedule over the night time period, any operational noise benefits from the works (where applicable) and contact telephone number. Notification should be a minimum of 7 calendar days prior to the start of works. For projects other than maintenance works more advanced consultation or notification may be required.
Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction would at least include: - all project specific and relevant standard noise and vibration mitigation measures - relevant licence and approval conditions - permissible hours of work - any limitations on high noise generating activities - location of nearest sensitive receivers - construction employee parking areas - designated loading/unloading areas and procedures site opening/closing times (including deliveries) environmental incident procedures
Behaviour	No swearing or unnecessary shouting or loud stereos/radios on site. Limit compression braking at night in residential areas. No dropping of materials from height, throwing of metal items and slamming of doors.
Verification	Where indicated in Appendix C, a noise verification program would be undertaken for the duration of the works.
Construction hours	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels should be scheduled during less sensitive time periods.
Respite for out-of-hours works	Respite would be scheduled as indicated in Appendix C and described in the CNVG.
Equipment selection	Use quieter construction methods where feasible and reasonable. Ensure plant including the silencer is well maintained. Plant noise levels will have an operating noise emission level compliant with Appendix F of the CNVG
Use and siting of plant	The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers.

Action	Description
Plan worksites and activities to minimise noise and vibration.	Locate compounds away from sensitive receivers and discourage access from local roads. Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site. Where additional activities or plant may only result in a marginal noise increase and speed up works, consider limiting duration of impact by concentrating noisy activities at one location and move to another as quickly as possible. Very noise activities should be scheduled for normal working hours. If the work can not be undertaken during the day, it should be completed before 11:00pm. Where practicable, work should be scheduled to avoid major student examination periods when students are studying for examinations such as before or during Higher School Certificate and at the end of higher education semesters.
Non-tonal reverse alarms	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work.
Shield stationary noise sources such as pumps, generators, and compressors	These should be enclosed or shielded where reasonable and feasible.
Implement any project specific mitigation measures	
1	None

Appendix A Project location and predicted level of impact



Appendix B Proposed activities and equipment

Hammering and removal of existing Anchor Blocks

Equipment	Quantity	Usage	Reduction	SWL
Daymakers / Lighting plant	3	100 %	5	93
Excavator 12 t (1000 kg Breaker)*	2	50 %	5	113

Activity Sound Power Level: 113

Appendix C Detailed noise predicted for each receiver and activity

Assessment: OCR Dual Watermain Connection at OCR				Day	Results summary		
NCA	ID	Address	Land use	NML	Cumulative Predicted LAeq, 15 minute noise level	Exceedance of NML, dB	Impact classification
NCA 1	770202	13 RUSS HAMMOND CLOSE KORORA	RES	62	62	0	Clearly Audible
NCA 1	770176	6 RUSS HAMMOND CLOSE KORORA	RES	62	62	0	Clearly Audible
NCA 1	769838	10A RUSS HAMMOND CLOSE KORORA	RES	62	63	1	Clearly Audible

Construction noise impact assessment

Vacc Truck

OCR Dual Watermain connection			
Proposed works	OCR Dual Watermain Connection at OCR		
Proponent	Quickway		
Assessment Date	07/12/2022		
Prepared by	Tom St Vincent Welch	Assessment Id	OOH14

Introduction

This report has been prepared using the construction noise self-assessment platform KNOWnoise: *Minor Works* and presents an assessment of the likely noise impacts related to proposed works associated with the above project. Where possible, these works would be completed during standard construction hours; however, there may be a need to work outside these hours due to technical, community or access limitations. The location of the proposed works is illustrated in Appendix A.

Planned works

A description of the proposed works is as follows.

OCR Dual Watermain Connection at OCR. Works required over 24hour consecutive shifts to minimise ensure works are within 5 day window permitted by Coffs Harbour City Council

Proposed activities and equipment for the works are summarised in Appendix B.

Though subject to change, the works are expected to commence around 16/01/2023 and would be completed by 22/01/2023.

Assessment criteria and mitigation requirements

The Interim Construction Noise Guideline (ICNG) (DECC 2009) describes noise more than the background level as potentially having an adverse impact on sensitive receivers and increasing the likelihood of complaint. During standard construction hours, where construction noise is within 10 dB(A) of the RBL, impacts would be acceptable.

Where construction noise is more than 10 dB(A) above the RBL during standard construction hours, a residential receiver is considered noise affected and the proponent should undertake all reasonable and feasible steps necessary to manage the impact and consult with the affected community.

Above a LAeq, 15 minute noise level of 75 dB(A), a receiver is highly affected, requiring consideration of additional mitigation measures including alternative accommodation in the night period.

Outside standard construction hours, construction noise at a residential receiver more than 5 dB(A) above the RBL is taken to be noise affected.

In addition, annoying noise such as rock hammers, impact piling, or other impulsive noise sources usually result in greater annoyance than continuous construction noise. A 5 dB(A) penalty is applicable to such activities prior to comparison with the NMLs.

Other sensitive land uses, such as schools and offices, typically find noise from construction disruptive when the properties are being used (such as during work and school times). Table 2 presents NMLs from the ICNG for sensitive land uses based on the principle that the characteristic activities for each of these land uses should not be unduly disturbed.

Table 1 Non-residential sensitive land uses noise management levels

Land use	Noise assessment location	NML (L _{Aeq,15min})
Classrooms at schools and other educational institutions	Internal	45
Places of worship		
Active recreation areas (such as sporting activities and activities which generate their own noise or focus for participants)	External	65
Passive recreation areas (contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External	60
Industrial premises	External	75
Office, retail outlets	External	70

As part of planning for out of hours works, standard mitigation measures, as described in the ICNG and CNVG, would be implemented where reasonable and feasible. However, after these measures have been applied, noise and vibration levels may continue to exceed the NMLs.

In this case, additional mitigation measures outlined in the CNVG, which largely focus on engagement with affected sensitive receivers, should be implemented where reasonable and feasible, unless other agreements are in place with the impacted receiver.

Triggers and additional mitigation measures for airborne noise are summarised in Table 2. Further details of specific additional mitigation measures are described in the CNVG.

Table 2 Triggers for additional mitigation measures – Airborne noise (Roads and Maritime 2016)

Predicted airborne LAeq(15min) noise level at receiver			
Perception	dB(A) above RBL	dB(A) above NML	Additional mitigation measures
All hours			
75 dB(A) or greater			N, V, PC, RO
Standard hours: Mon - Fri (7am – 6pm), Sat (8am – 1pm), Sun/Pub Hol (Nil)			
Noticeable	5 to 10	0	-
Clearly audible	10 to 20	< 10	-
Moderately intrusive	20 to 30	10 to 20	N, V
Highly intrusive	> 30	> 20	N, V
OOHW Period 1: Mon – Fri (6pm – 10pm), Sat (7am – 8am & 1pm – 10pm), Sun/Pub Hol (8am – 6pm)			
Noticeable	5 to 10	<5	-
Clearly audible	10 to 20	5 to 15	N, R1, DR
Moderately intrusive	20 to 30	15 to 25	V, N, R1, DR
Highly intrusive	> 30	>25	V, IB, N, R1, DR, PC, SN
OOHW Period 2: Mon – Fri (10pm – 7am), Sat (10pm – 8am), Sun/Pub Hol (6pm – 7am)			
Noticeable	5 to 10	<5	N
Clearly audible	10 to 20	5 to 15	V, N, R2, DR
Moderately intrusive	20 to 30	15 to 25	V, IB, N, PC, SN, R2, DR
Highly intrusive	> 30	>25	AA, V, IB, N, PC, SN, R2, DR

Notes:

PC = Phone calls

V = verification

IB = Individual briefings

N= Notification

AA = Alternative accommodation

SN = Specific notifications

RO = Respite offer

R1 = Respite period 1

R2 = Respite period 2

DR = Duration respite

Perception = relates to levels above RBL

NML = Noise management level

HA = Highly affected

Existing environment and noise management levels

The proposed works would be undertaken in a predominantly Rural / Suburban, characterised as:

Areas with negligible transportation or very limited local traffic, typically light vehicles only.

100m or more from the road.

Background noise levels adopted for the project area and associated noise management levels (NMLs) are summarised in Table 3. NMLs have been established in line with the ICNG.

Table 3 Construction NMLs

Land use	Rural / Suburban		Using custom background noise data?		Yes
Criterion	Day	Weekend Day	Evening	Night	Sleep
RBL	52	52	46	37	
NML	62	57	51	42	65

Sleep disturbance

The ICNG recommends where construction works are planned to extend over more than two consecutive nights, the maximum noise level should be considered for the purposes of establishing the likelihood of sleep disturbance. The Road Noise Policy suggests that maximum internal noise levels below 50-55 dB(A) are unlikely to awaken people from sleep and one or two noise events per night, with maximum internal noise levels of 65-70 dB(A) are not likely to affect health and wellbeing significantly.

Based on this, a sleep awakening criterion of 55 dB(A) (internal) is typically adopted for works. Given that noise attenuation of 10 dB(A) is typically provided by an open window, a sleep awakening criterion of L_{Amax} 65 dB(A) (external) has been applied to residential bedroom façades. This is consistent with the sleep disturbance threshold described in Appendix E of the CNVG.

Vibration

Effects of vibration from construction may be segregated into:

- Human exposure – disturbance to building occupants: vibration in which the occupants or users of the building are inconvenienced or possibly disturbed.
- Effects on building contents – vibration where the building contents may be affected.
- Effects on building structures – vibration in which the integrity of the building or structure itself may be prejudiced.

Vibration criteria relating to human comfort applicable to this project are taken from the DEC (2006) document Assessing Vibration – A Technical Guideline for intermittent vibration – such as from drilling, compacting or activities that would result in continuous vibration if operated continuously. Intermittent vibration is assessed as a vibration dose value (VDV) and relates to the level of vibration over time (cumulative over the night or day period). VDV's that may result in adverse comment from receivers are summarised in Table 4.

Table 4 Summary of vibration dose values which might result in adverse comment

Time	Low probability of adverse comment (m/s ^{1.75})	Adverse comment possible (m/s ^{1.75})	Adverse comment probable (m/s ^{1.75})
Day (6am to 10pm)	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Night (10pm to 6am)	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Guidance for the consideration of potential building damage from construction vibration is in line with BS 7385-1 *Evaluation and measurement for vibration in buildings - Guide for measurement of vibration and evaluation of their effects on buildings*. These guideline values are presented in Table 5.

Table 5 Building damage vibration guidelines (BS 7385-1)

Type of building	Guideline values for vibration (PPV mm/s)		
	4Hz to 15Hz	15Hz to 40Hz	40Hz and above
Reinforced or framed structures / Industrial and heavy commercial buildings	50		
Un-reinforced or light framed structures / Residential or light commercial type buildings	15 - 20	20 - 50	50

For heritage structures, criteria are in line with the German Standard *DIN 4150-3: Structural Vibration- effects of vibration on structures*, as summarised in Table 6.

Table 6 Guideline values for vibration velocity to be used when evaluating the effects of short-term vibration on heritage structures (DIN 4150-3).

Type of building	Guideline values for vibration (PPV mm/s)			
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz	Vibration at horizontal plane of highest floor at all frequencies
Structures that, because of their sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	3	3 to 8	8 to 10	8

The safe working distances presented in Table 7 are indicative and will vary depending on the item of plant and local geotechnical conditions. The cosmetic damage thresholds apply to typical buildings under typical geotechnical conditions and vibration monitoring is recommended at specific sites. Where structures are more sensitive, such as heritage items, more stringent conditions are applicable and should be considered individually.

In relation to human response, the safe working distances relate to continuous vibration. For most construction activities, vibration emissions are intermittent and higher vibration levels over shorter periods are acceptable. Additional assessment should be undertaken where the human response criteria are exceeded.

Table 7 Safe working distances for vibration intensive plant

Plant item	Rating/description	Safe working distance	
		Cosmetic damage (BS 7385-1)	Human response (DECCW)
Vibratory roller	<50 kN (typically 1-2 t)	5 m	15 m to 20 m
	<100 kN (typically 2-4 t)	6 m	20 m
	<200 kN (typically 4-6 t)	12 m	40 m
	<300 kN (typically 7-13 t)	15 m	100 m
	>300 kN (typically 13-18 t)	20 m	100 m
	>300 kN (> 18 t)	25 m	100 m
Small hydraulic hammer	300 kg – 5 to 12 t excavator	2 m	7 m
Medium hydraulic hammer	900 kg – 12 to 18t excavator	7 m	23 m
Large hydraulic hammer	1600 kg – 18 to 34 t excavator	22 m	73 m
Vibratory pile driver	Sheet piles	2 m to 20 m	20 m
Pile boring	≤800 mm	2 m	n/a
Jackhammer	Hand held	1 m	Avoid contact with structure

Assessment methodology

Based on the nominated works area (illustrated in Appendix A), proposed equipment and the minimum distance from the works to each sensitive receiver, noise levels were calculated based on CONCAWE (1981) *Propagation of noise from petroleum and petrochemical complexes to neighboring communities*.

This method considers geometric spreading, atmospheric absorption, ground effects and is valid for meteorological conditions of a gentle breeze from source to receiver and stable atmosphere (temperature inversion).

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Considering the nature of the works and the type of surrounding land uses, sensitive receivers up to a radius of 1000 metres from the works have been included in the assessment.

Sound power levels and predicted noise levels depend on the number of plant items operating at any one time and their precise location relative to a sensitive receiver. Equipment was assumed to be working at the worst-case location relative to each receiver and represents a worst-case assessment. Where the activity is further away from receivers or less equipment is used the predicted levels will decrease.

Sound power levels for plant and equipment expected to be used for each activity has been estimated based on guidance in the following standards and guidelines as well as typical measured noise levels for specific equipment.

- “ Australian Standard AS2436-2010: Guide to noise and vibration control on construction, demolition and maintenance sites
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- “ United Kingdom Department for Environment, Food and Rural Affairs (DEFRA) Noise database for prediction of noise on construction and open sites

Construction noise sources and associated sound power levels are listed in Appendix B. The maximum predicted LAeq noise level within the work area was identified for each receiver.

Predicted noise levels

Detailed predicted noise levels for each potentially affected receiver are presented Appendix C.

A summary of predicted noise levels in comparison with ICNG assessment criteria for the Night period is presented in Table 8.

Table 8 Summary of predicted noise levels with comparison against ICNG criteria for the Night period.

Criterion	Predicted number of receivers
Maximum cumulative predicted L _{Aeq} , 15 minute noise level	55 dB(A)
Number of highly noise affected receivers (>75 dB)	0
1 – 10 dB above NML	49
10 – 20 dB above NML	8
20+ dB above NML	0

In line with CNVG impact classes, up to 0 receivers are predicted to be classified as Highly Impacted during the Night period. A summary of the number of receivers in each class is presented in Table 9.

Table 9 Summary of predicted noise levels with comparison against CNVG criteria

Impact class	Predicted noise level	Predicted number of receivers
Noticable	0 <= 5 dB above NML	34
Clearly Audible	5 <= 15 dB above NML	33
Moderately Intrusive	15 <= 25 dB above NML	0
Highly Intrusive	> 25 dB above NML	0

Predicted impact classes for the Night period are illustrated graphically in Appendix C. Each identified receiver in the study area has been coloured to highlight the predicted level of impact.

Sleep disturbance

In the event works are planned for more than two consecutive nights, up to 0 are expected to exceed the sleep awakening criteria. Where any exceedances if the awakening criteria are predicted, additional care should be taken and mitigation measures implemented in the with the CNVG.

Predicted vibration impacts

The level of vibration impact on sensitive receivers (buildings and human comfort) will largely depend on the type of machinery in use and the distance from source to receiver.

Based on the proposed work locations and selected equipment, the following level of vibration impact is expected. A summary of vibration impacts is provided for each sensitive receiver in Appendix C.

Impact classification	Number of potentially affected receivers
Human comfort	0
Cosmetic damage	0
Heritage structure	0

Proposed noise mitigation measures

The safeguards and controls listed in Table 10 will be implemented where reasonable and feasible with the intention of achieving the project noise criteria and to maintain noise impacts at a practical minimum.

Table 10 Safeguards and controls

Action	Description
Community consultation or notification	Notify the affected community. The notification will detail work activities, dates and hours, impacts and mitigation measures, indication of work schedule over the night time period, any operational noise benefits from the works (where applicable) and contact telephone number. Notification should be a minimum of 7 calendar days prior to the start of works. For projects other than maintenance works more advanced consultation or notification may be required.
Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction would at least include: - all project specific and relevant standard noise and vibration mitigation measures - relevant licence and approval conditions - permissible hours of work - any limitations on high noise generating activities - location of nearest sensitive receivers - construction employee parking areas - designated loading/unloading areas and procedures site opening/closing times (including deliveries) environmental incident procedures
Behaviour	No swearing or unnecessary shouting or loud stereos/radios on site. Limit compression braking at night in residential areas. No dropping of materials from height, throwing of metal items and slamming of doors.
Verification	Where indicated in Appendix C, a noise verification program would be undertaken for the duration of the works.
Construction hours	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels should be scheduled during less sensitive time periods.
Respite for out-of-hours works	Respite would be scheduled as indicated in Appendix C and described in the CNVG.
Equipment selection	Use quieter construction methods where feasible and reasonable. Ensure plant including the silencer is well maintained. Plant noise levels will have an operating noise emission level compliant with Appendix F of the CNVG
Use and siting of plant	The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers.

Action	Description
Plan worksites and activities to minimise noise and vibration.	Locate compounds away from sensitive receivers and discourage access from local roads. Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site. Where additional activities or plant may only result in a marginal noise increase and speed up works, consider limiting duration of impact by concentrating noisy activities at one location and move to another as quickly as possible. Very noise activities should be scheduled for normal working hours. If the work can not be undertaken during the day, it should be completed before 11:00pm. Where practicable, work should be scheduled to avoid major student examination periods when students are studying for examinations such as before or during Higher School Certificate and at the end of higher education semesters.
Non-tonal reverse alarms	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work.
Shield stationary noise sources such as pumps, generators, and compressors	These should be enclosed or shielded where reasonable and feasible.
Implement any project specific mitigation measures	
1	None

Appendix A Project location and predicted level of impact



Appendix B Proposed activities and equipment

Vacc Truck use

Equipment	Quantity	Usage	Reduction	SWL
Vacc truck	1	60 %	5	105
Daymakers / Lighting plant	3	100 %	5	93

Activity Sound Power Level: 105

Appendix C Detailed noise predicted for each receiver and activity

Assessment: OCR Dual Watermain Connection at OCR				Night	Results summary		
NCA	ID	Address	Land use	NML	Cumulative Predicted LAeq, 15 minute noise level	Exceedance of NML, dB	Impact classification
NCA 1	770254	15 JAMES SMALL DRIVE KORORA	RES	42	49	7	Clearly Audible
NCA 1	770219	2 NORMAN HILL DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	770213	3 RUSS HAMMOND CLOSE KORORA	RES	42	49	7	Clearly Audible
NCA 1	770212	38 JAMES SMALL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	770205	13 RUSS HAMMOND CLOSE KORORA	RES	42	52	10	Clearly Audible
NCA 1	770204	9 RUSS HAMMOND CLOSE KORORA	RES	42	53	11	Clearly Audible
NCA 1	770202	13 RUSS HAMMOND CLOSE KORORA	RES	42	54	12	Clearly Audible
NCA 1	770201	13 RUSS HAMMOND CLOSE KORORA	RES	42	54	12	Clearly Audible
NCA 1	770200	UNIT 3/ 1 KORORA SCHOOL ROAD KORORA	RES	42	51	9	Clearly Audible
NCA 1	770199	UNIT 3/ 1 KORORA SCHOOL ROAD KORORA	RES	42	50	8	Clearly Audible
NCA 1	770198	UNIT 3/ 1 KORORA SCHOOL ROAD KORORA	RES	42	49	7	Clearly Audible
NCA 1	770180	13 JAMES SMALL DRIVE KORORA	RES	42	49	7	Clearly Audible
NCA 1	770177	11A JAMES SMALL DRIVE KORORA	RES	42	50	8	Clearly Audible
NCA 1	770176	6 RUSS HAMMOND CLOSE KORORA	RES	42	54	12	Clearly Audible
NCA 1	770173	10 KORORA BASIN ROAD KORORA	RES	42	45	3	Noticable
NCA 1	770162	2 RUSS HAMMOND CLOSE KORORA	RES	42	49	7	Clearly Audible
NCA 1	770153	UNIT 2/ 7 RUSS HAMMOND CLOSE KORORA	RES	42	52	10	Clearly Audible
NCA 1	770087	33 JAMES SMALL DRIVE KORORA	RES	42	46	4	Noticable
NCA 1	770086	37 JAMES SMALL DRIVE KORORA	RES	42	47	5	Noticable
NCA 1	770083	30 JAMES SMALL DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	770064	24 JAMES SMALL DRIVE KORORA	RES	42	45	3	Noticable
NCA 1	770063	22 JAMES SMALL DRIVE KORORA	RES	42	45	3	Noticable
NCA 1	770062	15 HERMAN REICK AVENUE KORORA	RES	42	44	2	Noticable
NCA 1	770032	32 JAMES SMALL DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	770016	31 JAMES SMALL DRIVE KORORA	RES	42	47	5	Noticable
NCA 1	770015	2 CAVENDISH PLACE KORORA	RES	42	43	1	Noticable
NCA 1	770014	39 JAMES SMALL DRIVE KORORA	RES	42	45	3	Noticable
NCA 1	770013	UNIT 1/ 1 KORORA SCHOOL ROAD KORORA	RES	42	49	7	Clearly Audible
NCA 1	770012	4 CAVENDISH PLACE KORORA	RES	42	43	1	Noticable
NCA 1	770011	6 CAVENDISH PLACE KORORA	RES	42	43	1	Noticable
NCA 1	769993	9 HERMAN REICK AVENUE KORORA	RES	42	44	2	Noticable
NCA 1	769992	11 HERMAN REICK AVENUE KORORA	RES	42	44	2	Noticable
NCA 1	769991	26 JAMES SMALL DRIVE KORORA	RES	42	45	3	Noticable
NCA 1	769990	28 JAMES SMALL DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	769979	34 JAMES SMALL DRIVE KORORA	RES	42	44	2	Noticable
NCA 1	769978	36 JAMES SMALL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	769968	5 CAVENDISH PLACE KORORA	RES	42	43	1	Noticable
NCA 1	769966	14 HERMAN REICK AVENUE KORORA	RES	42	42	0	Noticable

Appendix C Detailed noise predicted for each receiver and activity

Assessment: OCR Dual Watermain Connection at OCR				Night	Results summary		
NCA	ID	Address	Land use	NML	Cumulative Predicted LAeq, 15 minute noise level	Exceedance of NML, dB	Impact classification
NCA 1	769934	11 RUSS HAMMOND CLOSE KORORA	RES	42	51	9	Clearly Audible
NCA 1	769933	11 RUSS HAMMOND CLOSE KORORA	RES	42	52	10	Clearly Audible
NCA 1	769932	UNIT 5/ 1 KORORA SCHOOL ROAD KORORA	RES	42	51	9	Clearly Audible
NCA 1	769931	UNIT 5/ 1 KORORA SCHOOL ROAD KORORA	RES	42	51	9	Clearly Audible
NCA 1	769916	38A JAMES SMALL DRIVE KORORA	RES	42	43	1	Noticable
NCA 1	769913	UNIT 1/ 40 JAMES SMALL DRIVE KORORA	RES	42	42	0	Noticable
NCA 1	769908	29 JAMES SMALL DRIVE KORORA	RES	42	47	5	Noticable
NCA 1	769907	1 RUSS HAMMOND CLOSE KORORA	RES	42	47	5	Clearly Audible
NCA 1	769906	5 RUSS HAMMOND CLOSE KORORA	RES	42	50	8	Clearly Audible
NCA 1	769905	27 JAMES SMALL DRIVE KORORA	RES	42	49	7	Clearly Audible
NCA 1	769904	UNIT 2/ 7 RUSS HAMMOND CLOSE KORORA	RES	42	51	9	Clearly Audible
NCA 1	769838	10A RUSS HAMMOND CLOSE KORORA	RES	42	55	13	Clearly Audible
NCA 1	769837	4 RUSS HAMMOND CLOSE KORORA	RES	42	51	9	Clearly Audible
NCA 1	769836	8 RUSS HAMMOND CLOSE KORORA	RES	42	54	12	Clearly Audible
NCA 1	769835	4A RUSS HAMMOND CLOSE KORORA	RES	42	51	9	Clearly Audible
NCA 1	769830	UNIT 17/ 7-13 SHEARWATER PLACE KORORA	RES	42	43	1	Noticable
NCA 1	769829	UNIT 15/ 7-13 SHEARWATER PLACE KORORA	RES	42	43	1	Noticable
NCA 1	769828	18 KORORA BASIN ROAD KORORA	RES	42	43	1	Noticable
NCA 1	769826	5 JAMES SMALL DRIVE KORORA	RES	42	47	5	Clearly Audible
NCA 1	769821	1 KORORA BASIN ROAD KORORA	RES	42	53	11	Clearly Audible
NCA 1	769820	11 KORORA BASIN ROAD KORORA	RES	42	45	3	Noticable
NCA 1	769819	11 KORORA BASIN ROAD KORORA	RES	42	48	6	Clearly Audible
NCA 1	769818	7 JAMES SMALL DRIVE KORORA	RES	42	48	6	Clearly Audible
NCA 1	769817	9 JAMES SMALL DRIVE KORORA	RES	42	48	6	Clearly Audible
NCA 1	769816	11 JAMES SMALL DRIVE KORORA	RES	42	48	6	Clearly Audible
NCA 1	769746	17 KORORA BASIN ROAD KORORA	RES	42	44	2	Noticable
NCA 1	769723	22 OLD COAST ROAD KORORA	RES	42	43	1	Noticable
NCA 1	769674	RIVENDELL 40 OLD COAST ROAD KORORA	RES	42	42	0	Noticable
NCA 1	769672	28 KORORA BASIN ROAD KORORA	RES	42	43	1	Noticable

input information into yellow cells
pick from drop-down list in orange cells

Project name	OOHW_004
Scenario name	OCR WM Connection (water main install)
Receiver address	Pad 4 Activity
Select area ground type	Developed settlements (urban and suburban areas)
Select type of background noise level input	User Input

		Representative Noise Environment	User Input
Noise area category			NCA23
RBL or LA90 Background level (dB(A))	Day		43
	Evening		38
	Night		34
LAeq(15minute) Noise mangement level (dB(A))	Day		53
	Day (OOHW)		48
	Evening		43
	Night		39

Is all plant at the same representative distance to the receiver? Y/N	N
Representative distance (m)	Using Individual Distances!

Type/ model plant (See Sources Sheet)	SWL LAeq (dB(A))	SPL @7m (dB(A))	Quantity	Individual distance to receiver (m)	Is there line of sight to receiver? Y/N	Quantity correction (dBA)	Shielding correction (dBA)	Distance used in calculation (m)	Contribution SPL (dB(A))
	93	68	2	165	No (behind solid barrier)	3	-5	165	35
	101	76	0.3	170	Yes	-5	0	170	39
	96	71	0.3	170	Yes	-5	0	170	34

Total SPL LAeq(15minute) (dB(A))	41
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		Residential receiver	Non-residential receivers						
			Classroom at schools and other educational institutions	Hospital wards and operating theatres	Place of worship	Active recreation	Passive recreation	Industrial premise	Offices, retail outlets
Noise Management Level (dB(A))	Standard hours	53	55	65	55	65	60	75	70
	Day (OOHW)	48	55	65	55	65	60	75	70
	OOHW Period 1	43		65	55	65	60	75	70
	OOHW Period 2	39		65	55			75	70
Level above background (dB(A))	Standard hours	2							
	Day (OOHW)	2							
	OOHW Period 1	3							
	OOHW Period 2	7							
Level above NML (dB(A))	Standard hours	2							
	Day (OOHW)	2							
	OOHW Period 1								
	OOHW Period 2	2							
Additional mitigation measure	Standard Hours	-	-	-	-	-	-	-	-
	Day (OOHW)	-	-	-	-	-	-	-	-
	OOHW Period 1	-		-	-	-	-	-	-
	OOHW Period 2	N		-	-			-	-

- Steps:
1. Enter project name (cell C9).
 2. Enter scenario name (cell C10).
 3. Enter receiver address (cell C11).
 4. Select area ground type (cell C12) - water, undeveloped green fields (e.g. rural areas with isolated dwellings) or developed settlements (e.g. urban and suburban areas)
 5. Select the type of background noise level input - Representative noise environment (to make assumptions) or user input (where noise monitoring data is available):
 - (a) where representative noise environment is selected - select the appropriate noise area category (cell C16). The worksheet titled 'Representative Noise Environ.' provides a number of examples to help select the noise area category.
 - (b) where user input is selected - enter the measured background noise level for each time period (cells D17 to D19).
 6. Is all plant at the same representative distance to the receiver? Select Y or N (cell C24):
 - (a) where Y is selected - enter the representative distance in cell C25.
 - (b) where N is selected - go to step #7
 7. For the scenario (e.g. shallow excavation), select plant from the drop-down list in cells A28 to A47 (e.g. dump trucks + excavator).
 - (a) enter quantity for each selected plant in cells D28 to D47.
 - (b) where N is selected from step #6 - enter the distance to receiver for each individual plant in cells E28 to E47.
 - (c) is there line of sight to receiver? select from drop down list in cells F28 to F47. Solid barrier can be in the form of road cutting, solid construction hoarding, acoustic curtain, timber lapped and capped fence, shipping container, site office, etc. Please note that vegetation and trees are not considered to be a form of solid barrier.
 8. Identify the level above background and/or noise mangement level (see rows 57 to 62).
 9. Identify and implement standard mitigation measures where feasible and reasonable. Include any shielding implemented as part of the standard mitigation measures by changing the selection in the 'Is there line of sight to receiver' drop-down list.
 10. Identify and implement feasible and reasonable additional mitigation measures (see rows 63 to 65).
 11. Document a summary report detailing:
 - (a) project description (including location, duration, hours of work, construction methodology, plant , potentially impacted receivers, etc.).
 - (b) background noise levels.
 - (c) noise management levels .
 - (d) predicted noise levels for each time period.
 - (e) sleep disturbance affected distance for night works.
 - (f) mitigation measures.
 - (g) team member responsible for implementing mitigation measures and managing noise and vibration.

(Note that suitable noise management levels for other noise-sensitive businesses not identified in the Construction Noise Estimator should be investigated on a project-by-project basis. Please contact a Roads and Maritime noise speciliast for more information)

OCR Trenching (water main install)
Cnr Pacific Highway and Old Coast Rd

Pad 4	
Lighting tower	88
Excavator (25 tonne)	101
Truck (12-15 tonne)	96

Abbreviation	Measure
N	Notification (letterbox drop or equivalent)
SN	Specific notifications
PC	Phone calls
IB	Individual briefings
RO	Respite offer
R1	Respite period 1
R2	Respite period 2
DR	Duration respite
AA	Alternative accommodation
V	Verification

CHB Project OOHW application form

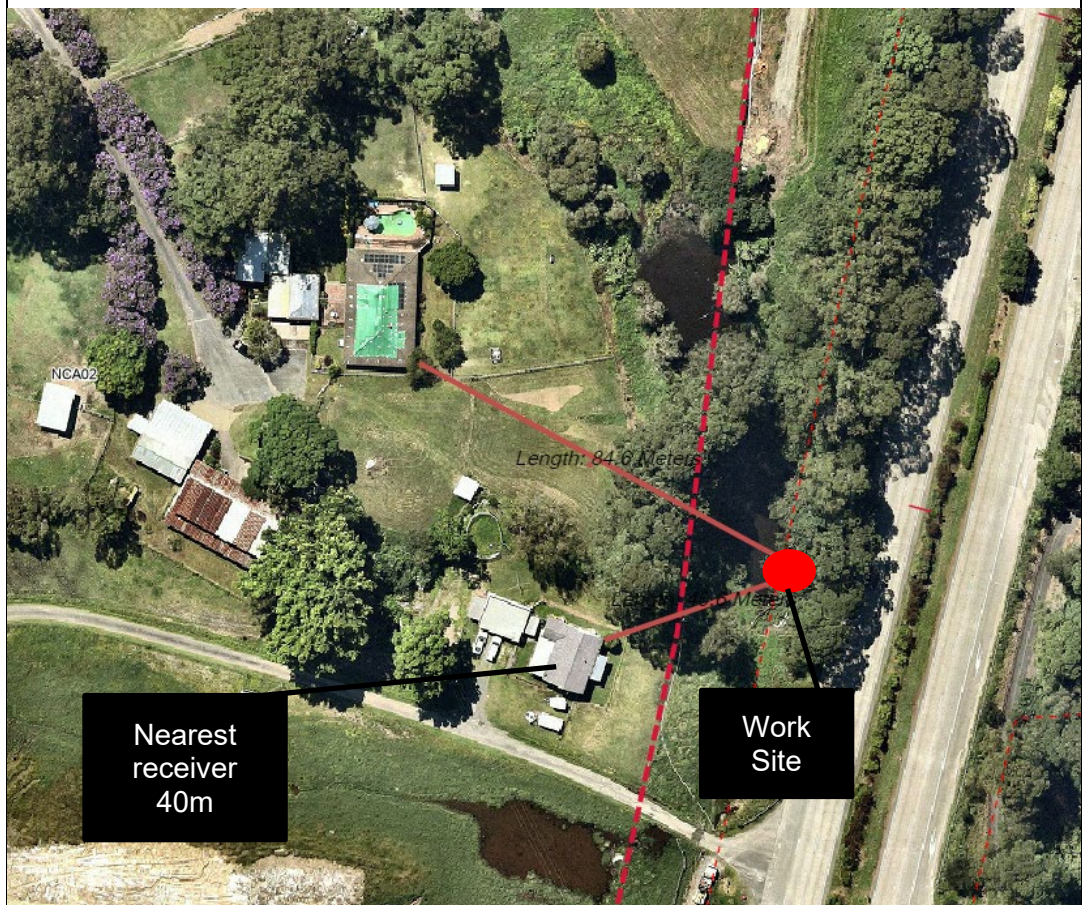
Out of hours work approval request form

No:	Notification date:	Approval date:	Project:
			WM 01 02 03 – Stage 2 – Ibis Dams
A. Contact details	Name	Mobile number	Email
TfNSW Environmental Site Representative	Shayne Walker	0467 818 189	Shayne.walker@transport.nsw.gov.au
TfNSW Project Manager	Kathleen Houston	0408 331 652	Kathleen.f.houston@transport.nsw.gov.au
Contractor Project Manager	Daniel Civitarese	0447 106 562	Daniel.civitarese@coastalworks.com.au
Contractor Project Engineer	N/A		

B. Details of work:

Include a map showing location of work extent and nearest sensitive receivers

Location / chainages: **Date and Time** 6pm to 7am, dates 16/1/2023 to 24/02/2023
Location 489A & 498B Pacific Hwy Boambee



	Nearest sensitive receiver. 489A – 40m	
NCA/s:	NCA 02	
Description of works – also include a brief description of the sequence of activities:	De-watering of groundwater likely to be entering trench to prevent the trench collapsing overnight.	
Machinery/ plant to be used	20kVA generator – 90dB SWL (100% usage) NCA 2 – Predicted Noise level is 43 dB at 40m to closest residential receiver with the use of noise blankets, which is less than the Night NML of 44dB.	
Traffic control measures required:	no	
Lighting required:	no	
Proposed dates:	16/1/2023 to 24/02/2023	
Proposed times:	6:00pm to 7:00am	
Justification - why does work need to occur outside of standard construction hours? (attach support information as required)	-24 hour de-watering is required to prevent the trench from collapsing. The trench is for water mains 01, 02 & 03 which get encased in concrete through the ibis dams area hence the trench needs to remain open for the duration of the works.	
Select OOHW Category as defined by MCoA E36	Select ☐	(a) for the delivery of materials required by the NSW Police Force or other authority for safety reasons; or
	☐	(b) where it is required in an emergency to avoid injury or the loss of life, to avoid damage or loss of property or to prevent environmental harm; or
	☐	(c) where different construction hours are permitted or required under an EPL in force in respect of the CSSI; or
	☒	(d) work not subject to an EPL that are approved under an Out-of-Hours Work Protocol as required by Condition E40 ; or
	☐	(e) construction that causes $L_{Aeq(15 \text{ minute})}$ noise levels: (i) no more than 5 dB(A) above the rating background level at any residence in accordance with the <i>Interim Construction Noise Guideline</i> (DECC, 2009), or (ii) no more than the 'Noise affected' noise management levels specified in Table 3 of the <i>Interim Construction Noise Guideline</i> (DECC, 2009) at other sensitive land uses, or
		(f) continuous or impulsive vibration values, measured at the most affected residence are no more than the preferred values for human exposure to vibration, specified in Table 2.2 of <i>Assessing Vibration: a technical guideline</i> (DEC, 2006), or

☐

	☐	
	☐	(g) intermittent vibration values measured at the most affected residence are no more than the preferred values for human exposure to vibration, specified in Table 2.4 of <i>Assessing Vibration: a technical guideline</i> (DEC, 2006); or
	☐	(h) negotiated agreements with directly affected residents and sensitive land uses.
C. Risk assessment		
NML (refer Table 3-2 of OOHW protocol)	NCA 2 – 44 dB night Commercial – 70dB	
Are any receivers highly noise affected by proposed OOHW ? (above 75dB(A) L_{Aeq} (15 minute))	No	

Out of hours work approval request form

**Risk factor category
(refer section 4.3 of
OOHW protocol):**

Less than NML

D. Details of noise or vibration assessment completed:

Comments: The Construction Noise Estimator was used to model predicted noise outputs for the work activities of:

For 24hr De-watering:

- 20kVA generator – 100% of time with SWL of 90dB.

E. Proposed mitigation measures, including respite

Comments:

Predicted noise levels from the works are less than the applicable night-time NML's, however the following standard mitigation measures would be applied to the works.

- Noise blankets will be installed around the generator
- The generator will be positioned as far away as practical from the resident at a minimum of 40m
- An earth mound will be installed around the generator in addition to the noise blankets

F. Community consultation

Outline consultation undertaken for the proposed OOHW:

- TfNSW comms has confirmed not required for this work.

Have respite periods for OOHW been identified with the affected community on a monthly basis and a three-month schedule of likely OOHW provided (refer CoA E39)?

Not required for this work.

Has the outcome of community consultation, the identified respite periods and scheduling of likely OOHW been provided to the ER, AA and Planning Secretary as required?

Not required for this work.

G. Respite framework

Outline any previous respite within the last month and the status of community agreements (where relevant)?

Not required for this work.

Have cumulative impacts from OOHV permitted by an EPL or third party works been considered during the development of appropriate respite?

Not required for this work.

H. Details of non-residential sensitive receivers (if any) and corresponding NMLs

Comments:

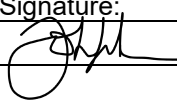
Nearest commercial receiver is 105m away. Predicted noise level is 34dB.

Out of hours work approval request form

I. Are there any properties at risk of exceeding the screening criteria (CNVG minimum distances for vibration intensive plant) safe working distance for plant) for cosmetic damage?

Comments:

I. Review / Endorsements

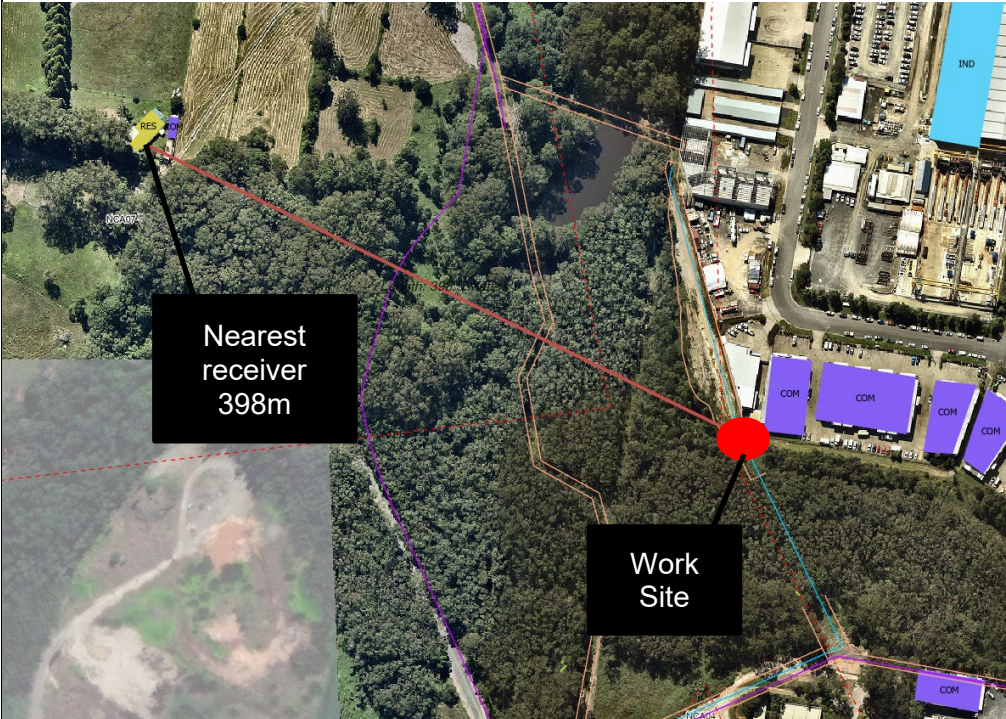
Transport for NSW Community Liaison Representative	Community notified – N/A		Date:
	Additional consultation requirements:		
	Have the works been reviewed and endorsed? YES		
	Name: Tammy Hosking	Signature:	Date:
	Comments: No community notification required.		
Transport for NSW Environmental Manager (or delegate)	Agreed mitigation measures: As per E.		
	Have the works been reviewed and endorsed? Have the works been approved where neither low nor high risk (predicted to be <NML and below cosmetic damage vibration screening criteria)?		
	Name: Shayne Walker	Signature:	Date:
	Comments: Works endorsed to proceed based on no anticipated community or traffic impacts.		
Project Acoustic Advisor	Agreed mitigation measures: I would ask the predicted noise level is verified when pump is commissioned		
	Have the works been reviewed and endorsed? Yes / No Have the works been approved where neither low nor high risk (predicted to be <NML and below cosmetic damage vibration screening criteria)? Yes / No		
	Name:	Signature:	Date:
	John Hutchison		15/12/2022
	Comments:		
Transport for NSW Project Manager	Have the works been reviewed and endorsed? Yes / No Have the works been approved where neither low nor high risk (predicted to be <NML and below cosmetic damage vibration screening criteria)? Yes / No		
	Name:	Signature:	Date:
	Kath Houston	K. Houston	29/11/2022
	Comments:		

ER approval (low risk activities)	Are the works approved?		Yes / No
	Name:	Signature:	Date:
	Comments:		
Planning Secretary approval (high risk activities)	Are the works approved?		Yes / No
	Name:	Signature:	Date:
	Comments:		



[illegible][illegible]

CHB Project OOHW application form

Out of hours work approval request form			
No:	Notification date:	Approval date:	Project:
			WM 01 02 03 – Thrust Bore under Wetland and HWY alignment
A. Contact details	Name	Mobile number	Email
TfNSW Environmental Site Representative	Shayne Walker	0467 818 189	Shayne.walker@transport.nsw.gov.au
TfNSW Project Manager	Kathleen Houston	0408 331 652	Kathleen.f.houston@transport.nsw.gov.au
Contractor Project Manager	Daniel Civitarese	0447 106 562	Daniel.civitarese@coastalworks.com.au
Contractor Project Engineer	N/A		
B. Details of work:			
Include a map showing location of work extent and nearest sensitive receivers			
Location / chainages:	Date and Time 6pm to 7am, dates 9/01/2023 to 15/2/2023 Location 52 Englands Rd Coffs Harbour		
			
	Nearest sensitive receiver.		

	102 Englands Rd – 398m Commercial – 20m (not open after 6pm)	
NCA/s:	NCA 07	
Description of works – also include a brief description of the sequence of activities:	Mirco tunnelling DN1000 steel casing under swamp. Installation of product pipe, welding of steel casings, lifting and welding of steel case pipes.	
Machinery/ plant to be used	• 14t ton excavator, • 10kL semi tanker sucker truck (recycling unit) 3000 cfm • Semi trailer w 300kVa generator (silenced) & vac unit 6000cfm • Semi-trailer with hiab crane • Welder generator • Daymakers X 3 NCA 7 – Predicted Noise level is 36 dB at 398m to closest residential receiver. Commercial – Predicted Noise level is 69 dB at 20m to closest commercial receiver.	
Traffic control measures required:	no	
Lighting required:	Yes	
Proposed dates:	9/01/2023 to 15/02/2023	
Proposed times:	6:00pm to 7:00am	
Justification - why does work need to occur outside of standard construction hours? (attach support information as required)	-Due to very soft ground conditions 24hr micortunneling is required to prevent collapse of the bore and inundation of drilling equipment.	
Select OOHW Category as defined by MCoA E36	Select ☐	(a) for the delivery of materials required by the NSW Police Force or other authority for safety reasons; or
	☐	(b) where it is required in an emergency to avoid injury or the loss of life, to avoid damage or loss of property or to prevent environmental harm; or
	☐	(c) where different construction hours are permitted or required under an EPL in force in respect of the CSSI; or
	☒	(d) work not subject to an EPL that are approved under an Out-of-Hours Work Protocol as required by Condition E40 ; or
	☐	(e) construction that causes $L_{Aeq(15 \text{ minute})}$ noise levels: (i) no more than 5 dB(A) above the rating background level at any residence in accordance with the <i>Interim Construction Noise Guideline</i> (DECC, 2009), or (ii) no more than the 'Noise affected' noise management levels specified in Table 3 of the <i>Interim Construction Noise Guideline</i> (DECC, 2009) at other sensitive land uses, or



	☐	(f) continuous or impulsive vibration values, measured at the most affected residence are no more than the preferred values for human exposure to vibration, specified in Table 2.2 of <i>Assessing Vibration: a technical guideline</i> (DEC, 2006), or
	☐	(g) intermittent vibration values measured at the most affected residence are no more than the preferred values for human exposure to vibration, specified in Table 2.4 of <i>Assessing Vibration: a technical guideline</i> (DEC, 2006); or
	☐	(h) negotiated agreements with directly affected residents and sensitive land uses.
C. Risk assessment		
NML (refer Table 3-2 of OOHV protocol)	NCA 7 – 39dB Evening and 41dB Night Commercial – 70dB	
Are any receivers highly noise affected by proposed OOHV ? (above 75dB(A) L_{Aeq} (15 minute))	No	

Out of hours work approval request form

Risk factor category
(refer section 4.3 of
OOHW protocol):

Less than NML

D. Details of noise or vibration assessment completed:

Comments: The Construction Noise Estimator was used to model predicted noise outputs for the work activities of:

For 24hr Drilling:

- 14T Hyundai Excavator (2016) (50% of time) = 97 dB
- Palfinger Hiab (25% of time) = 105 dB
- trailer w 300kVa Yanmar generator (silenced) & vac unit 6000cfm (100% of time) = 92 dB
- Vac Truck Industries 10000L Goliath Jetter Combo (100% of time) = 98 dB
- Shindaiwa Welder (25% of time) = 95 dB
- Daymakers X 3 (100% of time) = 73 dB

E. Proposed mitigation measures, including respite

Comments:

Predicted noise levels from the works are less than the applicable night-time NML's, however the following standard mitigation measures would be applied to the works.

- Equipment election/ maintaining and monitoring plant
- Switching off plant and machinery when not in use
- Site inductions
- Use of non-tonal reversing alarms
- Machinery will not be left running unnecessarily

F. Community consultation

Outline consultation undertaken for the proposed OOHW:

- TfNSW comms has confirmed not required for this work.

Have respite periods for OOHV been identified with the affected community on a monthly basis and a three-month schedule of likely OOHV provided (refer CoA E39)?

Not required for this work.

Has the outcome of community consultation, the identified respite periods and scheduling of likely OOHV been provided to the ER, AA and Planning Secretary as required?

Not required for this work.

G. Respite framework

Outline any previous respite within the last month and the status of community agreements (where relevant)?

Not required for this work.

Have cumulative impacts from OOHV permitted by an EPL or third party works been considered during the development of appropriate respite?

Not required for this work.

H. Details of non-residential sensitive receivers (if any) and corresponding NMLs

Comments:

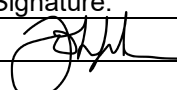
Nearest commercial receiver is 20m away. Predicted noise level is 69dB.

Out of hours work approval request form

I. Are there any properties at risk of exceeding the screening criteria (CNVG minimum distances for vibration intensive plant) safe working distance for plant) for cosmetic damage?

Comments:

I. Review / Endorsements

Transport for NSW Community Liaison Representative	Community notified – N/A		Date:
	Additional consultation requirements:		
	Have the works been reviewed and endorsed? YES		
	Name: Tammy Hosking	Signature:	Date:
Comments: No community notification required.			
Transport for NSW Environmental Manager (or delegate)	Agreed mitigation measures: As per E.		
	Have the works been reviewed and endorsed? Yes		
	Have the works been approved where neither low nor high risk (predicted to be <NML and below cosmetic damage vibration screening criteria)? Yes Less than NML		
	Name: Shayne Walker	Signature:	Date:
			12/12/22
Comments: Works endorsed to proceed based on no anticipated community or traffic impacts.			
Project Acoustic Advisor	Agreed mitigation measures:		
	Have the works been reviewed and endorsed? Yes / No		
	Have the works been approved where neither low nor high risk (predicted to be <NML and below cosmetic damage vibration screening criteria)? Yes / No		
	Name:	Signature:	Date:
	John Hutchison		15/12/2022
Comments:			
Transport for NSW Project Manager	Have the works been reviewed and endorsed? Yes / No		
	Have the works been approved where neither low nor high risk (predicted to be <NML and below cosmetic damage vibration screening criteria)? Yes / No		
	Name:	Signature:	Date:
	Kath Houston	K. Houston	29/11/2022
	Comments:		

ER approval (low risk activities)	Are the works approved?		Yes / No
	Name:	Signature:	Date:
	Comments:		
Planning Secretary approval (high risk activities)	Are the works approved?		Yes / No
	Name:	Signature:	Date:
	Comments:		





Transport

Roads & Maritime Services

Construction Noise Estimator

Please input information into yellow cells

Please pick from drop-down list in orange cells

Project name		Swamp Under Bore	
Scenario name		NCA 07	
Receiver address		Developed settlements (urban and suburban areas)	
Select area ground type		Urban input	
Select type of background noise level input		Representative noise	
Noise area category		User input	
RBL or Less Background level (dB(A))	Day	35	
	Evening	34	
	Night	36	
Leq(15min) Noise management level (dB(A))	Day	45	
	Day (OOHW)	40	
	Evening	39	
	Night	41	
Is all plant at the same representative distance to the receiver? Y/N		Y	
Representative distance (m)		338	
Type of model plant (See Sources Sheet)		SPL @ 7m (dB(A))	
	37	72	0.5
	105	80	0.25
	32	67	1
	38	73	1
	35	70	0.25
	73	48	3
Total SPL L _{eq} (15min) (dB(A))		36	
Noise Management Level (dB(A))		45	
Day (OOHW)		40	
OOHW Period 2		41	
Standard hours		45	
Day (OOHW)		40	

Steps:

- Enter project name (cell C9).
- Enter scenario name (cell C10).
- Enter receiver address (cell C11).
- Select area ground type (cell C12) - water, undeveloped green fields (e.g. rural areas with isolated dwellings) or developed settlements (e.g. urban and suburban areas).
- Select the type of background noise level input - Representative noise environment (to make assumptions) or user input (where noise monitoring data is available):
 - (a) where representative noise environment is selected - select the appropriate noise area category (cell C16). The worksheet titled 'Representative Noise Environ.' provides a number of examples to help select the noise area category.
 - (b) where user input is selected - enter the measured background noise level for each time period (cells D17 to D19).
- Is all plant at the same representative distance to the receiver? Select Y or N (cell C24):
 - (a) where Y is selected - enter the representative distance in cell C25.
 - (b) where N is selected - go to step #7.
- For the scenario (e.g. shallow excavation), select plant from the drop-down list in cells A28 to A47 (e.g. dump trucks + excavator).
 - (a) enter quantity for each selected plant in cells D28 to D47.
 - (b) where N is selected from step #6 - enter the distance to receiver for each individual plant in cells E28 to E47.
 - (c) is there line of sight to receiver? select from drop-down list in cells F28 to F47. Solid barrier can be in the form of road cutting, solid construction hoarding, acoustic curtain, timber lapped and capped fence, shipping container, site office, etc. Please note that vegetation and trees are not considered to be a form of solid barrier.
- Identify the level above background and/or noise management level (see rows 57 to 62).
- Identify and implement standard mitigation measures where feasible and reasonable. Include any shielding implemented as part of the standard mitigation measures by changing the selection in the 'Is there line of sight to receiver' drop-down list.
- Identify and implement feasible and reasonable additional mitigation measures (see rows 63 to 65).
- Document a summary report detailing:
 - (a) project description (including location, duration, hours of work, construction methodology, plant, potentially impacted receivers, etc.).
 - (b) background noise levels.
 - (c) noise management levels.
 - (d) predicted noise levels for each time period.
 - (e) sleep disturbance affected distance for night works.
 - (f) mitigation measures.
 - (g) team member responsible for implementing mitigation measures and managing noise and vibration.

[illegible]