Hornsby Shire Council

Hornsby Quarry Rehabilitation Environmental Impact Statement

VOLUME 2 – APPENDICES A to F

February 2019

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Appendix A – Secretary's Environmental Assessment Requirements

NSW GOVERNMENT | Planning & Environment

Planning Services
Resource Assessments
Contact: Tertius Greyling
Phone: 9274 6402
Email: tertius.greyling@planning.nsw.gov.au

Anna Montgomery
GHD Pty Ltd
Level 15, 133 Castlereagh Street
Sydney NSW 2000

Dear Ms Montgomery

Hornsby Quarry Rehabilitation (EAR 1167)
Secretary's Environmental Assessment Requirements

I refer to your request, on behalf of Hornsby Shire Council, for the Secretary's Environmental Assessment Requirements (EARs) for the above development, which is designated local development under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

I have attached a copy of the EARs for the Environmental Impact Statement (EIS) for the development. These requirements have been prepared in consultation with relevant government agencies and are based on the information your company has provided to date. I have also attached the agencies' input into the EARs, which you are advised to consider closely when preparing the EIS.

In your request for EARs, you indicated that the proposal is classified as integrated development under section 91 of the EP&A Act. You are encouraged to consult with the Environment Protection Authority and the Mine Subsidence Board with respect to licence/approval requirements. If further integrated approvals are required, you must undertake your own consultation with the relevant public authorities, and address their requirements in the EIS.

When you lodge your DA with the consent authority, you must provide:
- one hard and one electronic copy of the EIS to the Department;
- one hard and one electronic copy of the EIS to any identified integrated approval authority; and
- a cheque for $320 to each identified integrated approval authority, to offset costs involved in the review of the DA and EIS. No cheque is required for the Department as it is not an approval authority.

If your proposal contains any actions that could have a significant impact on matters of National Environmental Significance, then it will also require approval under the Commonwealth's *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act). This approval is in addition to any approvals required under NSW legislation. If you have any questions about the application of the EPBC Act to your proposal, you should contact the Department of the Environment in Canberra (6274 1111 or www.environment.gov.au).

You should contact the local Mine Safety Operations Branch of the NSW Department of Industry, Division of Resources and Energy in regard to this and other matters relating to compliance with the *Work Health and Safety (Mines and Petroleum Sites) Act 2013.*

If you have any enquiries about these requirements, please contact Tertius Greyling on 9274 6402.

Yours sincerely

Howard Reed

Howard Reed 6.9.17
Director
Resource Assessments
As the Secretary's delegate

Secretary's Environmental Assessment Requirements

Section 78A(8) of the *Environmental Planning and Assessment Act 1979* and Schedule 2 of the *Environmental Planning and Assessment Regulation 2000.*

Designated Development

EAR Number	EAR 1167
Proposal	Rehabilitate the Hornsby Quarry and create a landform suitable for future development as community parkland.
Location	Quarry Road, Hornsby (Lots A, B, C, D and E in DP 318676, Lot 1 DP 926103, Lot 1 DP926449, Lot 1 DP11432, Lots 1 and 2 in DP 169188, Lot 7306 DP 1157797)
Applicant	Hornsby Shire Council
Date of Issue	6 September 2017
Date of Expiry	6 September 2019
General Requirements	The Environmental Impact Statement (EIS) for the development must comply with the requirements in Clauses 6 and 7 of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000.* In particular, the EIS must include: • an executive summary; • a comprehensive description of the development, including: - a detailed site description and brief history of previous quarrying and fill emplacement on the site, including a current survey plan; - the layout of the proposed works and components (including any existing infrastructure that would be used for the development); - an assessment of the potential impacts of the development, as well as any cumulative impacts, including the measures that would be used to minimise, manage or offset these impacts; - a detailed rehabilitation plan for the site; - any likely interactions between the development and any existing/approved developments and land uses in the area, paying particular attention to construction impacts on nearby residential development; - a list of any other approvals that must be obtained before the development may commence; - the permissibility of the development, including identification of the land use zoning of the site; - identification of sensitive receivers likely to be affected by the development using clear maps/plans, including key landform areas, such as conservation areas and waterways; • a conclusion justifying why the development should be approved, taking into consideration: – alternatives; – the suitability of the site; – the biophysical, economic and social impacts of the project, having regard to the principles of ecologically sustainable development; and – whether the project is consistent with the objects of the Environmental Planning and Assessment Act 1979; and • a signed declaration from the author of the EIS, certifying that the information contained within the document is neither false nor misleading.
Consultation	In preparing the EIS for the development, you should consult with relevant local, State or Commonwealth Government authorities, infrastructure and service providers and any surrounding landowners that may be impacted by the development. The EIS must describe the consultation that was carried out, identify the issues raised during this consultation, and explain how these issues have been addressed in the EIS.
Key Issues	The EIS must assess the potential impacts of the proposal at all stages of the development, including the construction, rehabilitation and final land use of the development.

The EIS must address the following specific issues:

- **Noise** – including a quantitative assessment of potential:
  - construction noise impacts of the development in accordance with the *Interim Construction Noise Guideline* and *NSW Industrial Noise Policy* respectively;
  - reasonable and feasible mitigation measures to minimise noise emissions; and
  - monitoring and management measures;
- **Blasting & Vibration** –
  - proposed hours, frequency, methods and impacts; and
  - an assessment of the likely blasting and vibration impacts of the development, having regard to the relevant ANZEC guidelines and paying particular attention to impacts on people, buildings, livestock, infrastructure and significant natural features;
- **Air** – including an assessment of the likely air quality impacts of the development in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*. The assessment is to give particular attention to potential dust impacts on any nearby private receivers due to construction activities;
- **Water** – including:
  - an assessment of any volumetric water licensing requirements, including a description of site water demands, water disposal methods (inclusive of volume and frequency of any water discharges), water supply infrastructure and water storage structures;
  - identification of any licensing requirements or other approvals required under the *Water Act 1912* and/or *Water Management Act 2000*;
  - demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP)
  - a description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant Water Sharing Plan;
  - an assessment of activities, including but not limited to watercourse re-establishment, that could cause erosion or sedimentation, and the proposed measures to prevent or control these impacts;
  - an assessment of any likely flooding impacts of the development; an assessment of potential impacts on the quality and quantity of existing surface and ground water resources, including a detailed assessment of proposed water discharge quantities and quality against receiving water quality and flow objectives; and
  - a detailed description of the proposed water management system, water monitoring program and other measures to mitigate surface and groundwater impacts;
- **Biodiversity** – including:
  - accurate predictions of any vegetation clearing on site;
  - a detailed assessment of the potential biodiversity impacts of the development, paying particular attention to threatened species, populations and ecological communities and groundwater dependent ecosystems;
  - a detailed description of the proposed measures to maintain or improve the biodiversity values of the site in the medium to long term, as relevant; and
  - an assessment of whether a Species Impact Statement is required;
- **Heritage** – including:
  - an assessment of the potential impacts on Aboriginal heritage (cultural and archaeological), including evidence of appropriate consultation with relevant Aboriginal communities/parties and documentation of the views of these stakeholders regarding the likely impact of the development on their cultural heritage; and
  - identification of Historic heritage in the vicinity of the development and an assessment of the likelihood and significance of impacts on heritage items, having regard to the relevant policies and guidelines listed in Attachment 1;
- **Traffic &Transport** – including:
  - accurate predictions of the road traffic generated during construction of the development, including a description of the types of vehicles likely to be used;
  - an assessment of potential traffic impacts on the capacity, condition, safety and efficiency of the local and State road networks, detailing the nature of the traffic generated, transport routes, traffic volumes and potential impacts on local and regional roads;
  - a description of the measures that would be implemented to maintain and/or improve the capacity, efficiency and safety of the road network (particularly the proposed transport routes) over the life of the development;
  - evidence of any consultation with relevant roads authorities, regarding the establishment of agreed contributions towards road upgrades or maintenance; and
  - a description of access roads, specifically in relation to nearby Crown roads and fire trails;
- **Land Resources**– including an assessment of:
  - potential impacts on soils and land capability (including potential erosion and land contamination) and the proposed mitigation, management and remedial measures (as appropriate); and
  - potential impacts on landforms (topography), paying particular attention to the long-term geotechnical stability of any new landforms;

	• **Waste** – including estimates of the quantity and nature of the waste streams that would be generated or received by the development and any measures that would be implemented to minimise, manage or dispose of these waste streams; • **Visual** – including an assessment of the likely visual impacts of the development on private landowners in the vicinity of the development and key vantage points in the public domain, including with respect to any new landforms; • **Social & Economic** – an assessment of the likely social and economic impacts of the development, including consideration of both the significance of the resource and the costs and benefits of the project; and • **Rehabilitation** – including: - a detailed description of the proposed rehabilitation measures that would be undertaken throughout the development; - a detailed rehabilitation strategy, including justification for the proposed final landform and consideration of the objectives of any relevant strategic land use plans or policies; and - the measures that would be undertaken to ensure sufficient financial resources are available to implement the proposed rehabilitation strategy. - a description of the biosecurity measures to prevent the introduction of weeds and pests.
Environmental Planning Instruments	The EIS must take into account all relevant State Government environmental planning instruments, guidelines, policies, and plans. While not exhaustive, Attachment 1 contains a list of some of the environmental planning instruments, guidelines, policies and plans that may be relevant to the environmental assessment of this development. During the preparation of the EIS you must also consult the Department's EIS Guideline – Extractive Industries – Quarries. This guideline is available at http://www.planning.nsw.gov.au/~/media/Files/DPE/Guidelines/extractive-industries-quarries-eis-guideline-1996-10.ashx. In addition, the EIS must assess the development against the Hornsby Local Environmental Plan 2013 and any relevant development control plans/strategies.

ATTACHMENT 1

The following guidelines may assist in the preparation of the Environmental Impact Statement. This list is not exhaustive and not all of these guidelines may be relevant to your proposal.

Many of these documents can be found on the following websites:
http://www.planning.nsw.gov.au
http://www.bookshop.nsw.gov.au
http://www.publications.gov.au

Environmental Planning Instruments, Policies, Guidelines & Plans

Environmental Planning Instruments - General	
	State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007
	State Environmental Planning Policy (State and Regional Development) 2011
	State Environmental Planning Policy (Infrastructure) 2007
	Hornsby Local Environmental Plan 2013
Risk Assessment	
	AS/NZS 4360:2004 Risk Management (Standards Australia)
	HB 203: 203:2006 Environmental Risk Management – Principles & Process (Standards Australia)
Land	
	State Environmental Planning Policy No. 55 – Remediation of Land
	Agricultural Land Classification (DPI)
	Rural Land Capability Mapping (OEH)
	Soil and Landscape Issues in Environmental Impact Assessment (NOW)
	Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites (ANZECC)
	Guidelines for Consultants Reporting on Contaminated Sites (EPA)
	Agricultural Issues for Extractive Industry Development (DPI)
	Guidelines for development adjoining land managed by the OEH (OEH)
Water	
Groundwater	NSW Aquifer Interference Policy 2012 (NOW)
	NSW State Groundwater Policy Framework Document (NOW)
	NSW State Groundwater Quality Protection Policy (NOW)
	NSW State Groundwater Quantity Management Policy (NOW)
	Australian Groundwater Modelling Guidelines 2012 (Commonwealth)
	National Water Quality Management Strategy Guidelines for Groundwater Protection in Australia (ARMCANZ/ANZECC)
	Guidelines for the Assessment & Management of Groundwater Contamination (EPA)
Surface Water	NSW State Rivers and Estuary Policy (NOW)
	NSW Government Water Quality and River Flow Objectives (EPA)
	Using the ANZECC Guideline and Water Quality Objectives in NSW (EPA)
	National Water Quality Management Strategy: Australian Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ)
	National Water Quality Management Strategy: Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC/ARMCANZ)
	Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (EPA)
	Managing Urban Stormwater: Soils & Construction (Landcom) and associated Volume 2E: Mines and Quarries (DECC)
	Managing Urban Stormwater: Treatment Techniques (EPA)
	Managing Urban Stormwater: Source Control (EPA)
	Technical Guidelines: Bunding & Spill Management (EPA)
	A Rehabilitation Manual for Australian Streams (LWRRDC and CRCCH)
	NSW Guidelines for Controlled Activities (NOW)
Flooding	Floodplain Development Manual (OEH)
	Floodplain Risk Management Guideline (OEH)
Biodiversity	

	BioBanking Assessment Methodology (OEH 2014)
	BioBanking Assessment Methodology and Credit Calculator Manual (DECC) 2008
	NSW Guide to Surveying Threatened Plants (OEH 2016)
	Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna – Amphibians (DECC 2009)
	Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft (DEC 2004)
	Threatened Species Assessment Guideline – The Assessment of Significance (DECC 2007)
	OEH principles for the use of biodiversity offsets in NSW
	NSW State Groundwater Dependent Ecosystem Policy (NOW)
Heritage	
	The Burra Charter (The Australia ICOMOS charter for places of cultural significance)
	Guide to investigation, assessing and reporting on Aboriginal cultural heritage in NSW (OEH) 2011
	Draft Guidelines for Aboriginal Cultural Heritage Assessment and Community Consultation (DP&E)
	Aboriginal Cultural Heritage Consultation Requirements for Proponents (OEH)
	Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (OEH)
	Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW (OEH)
	NSW Heritage Manual (OEH)
	Statements of Heritage Impact (OEH)
Noise & Blasting	
	NSW Industrial Noise Policy (EPA)
	Interim Construction Noise Guideline (EPA)
	NSW Road Noise Policy (EPA)
	Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration (ANZEC)
Air	
	Protection of the Environment Operations (Clean Air) Regulation 2002
	Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (EPA)
	Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (EPA)
	Assessment and Management of Odour from Stationary Sources in NSW (DEC)
	National Greenhouse Accounts Factors (Commonwealth)
Transport	
	Guide to Traffic Generating Development (RTA)
	Road Design Guide (RMS) & relevant Austroads Standards
Public Safety	
	State Environmental Planning Policy No. 33 – Hazardous and Offensive Development
	Hazardous and Offensive Development Application Guidelines – Applying SEPP 33
	Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis
Resource	
	Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves 2012 (JORC)
Waste	
	Waste Classification Guidelines (DECC)
	Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes 1999 (EPA)
Rehabilitation	
	Mine Rehabilitation – Leading Practice Sustainable Development Program for the Mining Industry (Commonwealth)
	Mine Closure and Completion – Leading Practice Sustainable Development Program for the Mining Industry (Commonwealth)
	Strategic Framework for Mine Closure (ANZMEC-MCA)

ATTACHMENT 2

AGENCIES' CORRESPONDENCE

NSW GOVERNMENT | Department of Primary Industries

OUT 17/35527

28 August 2017

Tertius Greyling
Senior Environmental Assessment Officer
NSW Department of Planning & Environment
320 Pitt Street | GPO Box 39 | Sydney NSW 2001
T 02 9274 6402
email: tertius.greyling@planning.nsw.gov.au

Dear Mr Greyling

Request for SEARs - Hornsby Quarry Rehabilitation

Thank you for the opportunity to provide comment on the above proposal as per your correspondence dated 15 August 2017.

DPI Agriculture understands the importation of fill is for capping and shaping existing extracted site and rehabilitation works.

DPI Agriculture advises that apart from any fill importation protocol which should include monitoring for any biosecurity animal or plant material hazards, a rehabilitation plan should also include management for weeds and pests.

For further information see http://www.dpi.nsw.gov.au/biosecurity or contact biosecurity@dpi.nsw.gov.au.

For the final landform, the topsoil material needs to be of sufficient depth and enables drainage for plant growth. Information relating to rehabilitation objectives for agriculture is on page 8 onwards of http://www.resourcesandenergy.nsw.gov.au/__data/assets/pdf_file/0008/565955/Exploration-Code-of-Practice-Rehabilitation.pdf

For further information contact Andrew Docking, Resource Management Officer 98428607.

Yours sincerely

Andrew Docking
Resource Management Officer

Tertius Greyling

From: Kirk Dahle <kirk.dahle@dpi.nsw.gov.au>
Sent: Thursday, 17 August 2017 11:22 AM
To: Tertius Greyling
Cc: Scott Carter
Subject: Re: FW: Request for SEARs - Hornsby Quarry Rehabilitation

Thank you for the opportunity to provide comments on the proposed development (Hornsby Quarry Rehabilitation).

DPI Fisheries is responsible for ensuring that fish stocks are conserved and that there is no net loss of key fish habitats upon which they depend. To achieve this, DPI Fisheries ensures that developments comply with the requirements of the *Fisheries Management Act 1994* (FM Act) (namely the aquatic habitat protection and threatened species conservation provisions in Parts 7 and 7A of the Act, respectively), and the associated *Policy and Guidelines for Fish Habitat Conservation and Management (2013)*. DPI Fisheries is also responsible for ensuring the sustainable management of commercial, recreational and Aboriginal cultural fishing, aquaculture, marine parks and aquatic reserves within NSW.

Please ensure the EIS takes into consideration proper isolation measures including water course routing and sediment control measures for the portion of Old Man Creek that will be impacted (reconstructed) by the Quarry Rehabilitation effort.

Old Man Creek is not designated as Key Fish Habitat. However, these measures will minimize sediment input into Watara Creek which is Key Fish Habitat and lies directly downstream from the works location.

Please feel free to contact me if you have any questions.

Kind regards,

Kirk

Kirk Dahle | Fisheries Manager, Aquatic Ecosystems
Fisheries NSW | NSW Department of Primary Industries
Port Stephens Fisheries Institute | Taylors Beach Road | Taylors Beach | NSW 2316
Postal address: Locked Bag 1 | Nelson Bay | NSW 2315
T: 4916 3998 | M: 0419314437 | E: kirk.dahle@dpi.nsw.gov.au

Department of Primary Industries
Water

Contact: Anisul Afsar
Phone: 02 8838 7561
Email: anisul.afsar@dpi.nsw.gov.au

Our ref: V15/2812#91, OUT 17/35921
Your Ref: SEAR 1167

Tertius Greyling
NSW Department of Planning and Environment
GPO Box 39
SYDNEY NSW 2001

30 August 2017

Tertius.Greyling@planning.nsw.gov.au

Dear Tertius Greyling

Re: Hornsby Quarry Rehabilitation EAR ID No. 1167 – SEARs request

Thank you for your email form 15 August 2017 seeking DPI Water's comments on the Secretary's Environmental Assessment Requirements (SEARs) for the above local designated development proposal. DPI Water has reviewed the supporting documentation accompanying the request for SEARs and provides the following comments, and further details in **Attachment A.**

It is recommended that the EIS be required to include:

- Assessment of impacts on surface water, including details of proposed stormwater management systems, having consideration to impacts on Old Mans Creek and all other watercourses and riparian corridors potentially affected by the proposal. The assessment of water quality impacts is to have reference to relevant public health and environmental water quality criteria, including those specified in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ 2000), and any applicable regional, local or site-specific guidelines;
- Assessment of impacts of erosion and sedimentation during earthworks activities and implementation of erosion and sediment control measures in accordance with the requirements of the Managing Urban Stormwater Manual, Volume 1, Soils and Construction (Landcom, 4th Edition, March 2004) and maintain the control measures to prevent sediment and dirty water entering the waterways;
- Assessment of groundwater flows at the proposal site, appropriate management measures for dewatering during site establishment, and ongoing dewatering and site management processes during spoil emplacement works. The assessment must consider: extent of drawdown; impacts to groundwater quality; volume of inflows and water licence requirements; discharge requirements; location and details of groundwater management and implications for groundwater-dependent surface flows, groundwater-dependent ecological communities, and groundwater users. The assessment should be prepared having consideration to the requirements of the *NSW Aquifer Interference Policy*;
- Monitoring of groundwater levels and primary quality in the emplaced fill and in the surrounding bedrock at least North, East and South of the quarry, from

commencement of filling and then quarterly for a period of 3 years following cessation of emplacement;

- A Groundwater Monitoring and Management Plan shall be prepared to the satisfaction of DPI Water to take into account all matters regarding groundwater at the site; with an emphasis on groundwater post filling; and in respect of primary quality assessment, shall be developed to include at least pH, EC, Fe, heavy metals and BTEX measurements in an appropriate timeframe;
- Consideration of relevant policies and guidelines;
- A statement of where each element of the SEARs is addressed in the EIS (i.e. in the form of a table).

For further information please contact Anisul Afsar, Water Regulation Officer at DPI Water (Parramatta office) on **t:** (02) 8838 7561; **e:** Anisul.Afsar@dpi.nsw.gov.au

Yours sincerely

Irene Zinger
Manager Water Regulation – Metro
Water Regulation

Attachment A

DPI Water General Assessment Requirements for general projects

The following detailed assessment requirements are provided to assist in adequately addressing the assessment requirements for this proposal.

For further information visit the DPI Water website, www.water.nsw.gov.au

Key Relevant Legislative Instruments

This section provides a basic summary to aid proponents in the development of an Environmental Impact Statement (EIS), and should not be considered a complete list or comprehensive summary of relevant legislative instruments that may apply to the regulation of water resources for a project.

The EIS should take into account the objects and regulatory requirements of the *Water Act 1912* (WA 1912) and *Water Management Act 2000* (WM Act), and associated regulations and instruments, as applicable.

*Water Management Act 2000 (*WM Act*)*
Key points:

- Volumetric licensing in areas covered by water sharing plans
- Works within 40m of waterfront land
- SSD & SSI projects are exempt from requiring water supply work approvals and controlled activity approvals as a result of the *Environmental Planning & Assessment Act 1979 (EP&A Act)*.
- No exemptions for volumetric licensing apply as a result of the *EP&A Act*.
- Basic landholder rights, including harvestable rights dams
- Aquifer interference activity approval and flood management work approval provisions have not yet commenced and are regulated by the *Water Act 1912*
- Maximum penalties of $ 2.2 million plus $ 264,000 for each day an offence continues apply under the WM Act
- Flood management works

Water Act 1912 (WA 1912)
Key points:

- Volumetric licensing in areas where no water sharing plan applies
- Monitoring bores
- Aquifer interference activities that are not regulated as a water supply work under the WM Act.
- No exemptions apply to licences or permits under the *WA 1912* as a result of the *EP&A Act*.
- Regulation of water bore driller licensing.

Water Management (General) Regulation 2011
Key points:

- Provides various exemptions for volumetric licensing and activity approvals
- Provides further detail on requirements for dealings and applications.

Access Licence Dealing Principles Order 2004

Harvestable Rights Orders

Water Sharing Plans these are considered regulations under the WM Act

It is important that the proponent understands and describes the ground and surface water sharing plans, water sources, and management zones that apply to the project. The relevant water sharing plans can be determined spatially at www.ourwater.nsw.gov.au. Multiple water sharing plans may apply and these must all be described.

The *Water Act 1912* applies to all water sources not yet covered by a commenced water sharing plan.

The EIS is required to:

- Demonstrate how the proposal is consistent with the relevant rules of the Water Sharing Plan including rules for access licences, distance restrictions for water supply works and rules for the management of local impacts in respect of surface water and groundwater sources, ecosystem protection (including groundwater dependent ecosystems), water quality and surface-groundwater connectivity.
- Provide a description of any site water use (amount of water to be taken from each water source) and management including all sediment dams, clear water diversion structures with detail on the location, design specifications and storage capacities for all the existing and proposed water management structures.
- Provide an analysis of the proposed water supply arrangements against the rules for access licences and other applicable requirements of any relevant WSP, including:
    - Sufficient market depth to acquire the necessary entitlements for each water source.
    - Ability to carry out a "dealing" to transfer the water to relevant location under the rules of the WSP.
    - Daily and long-term access rules.
    - Account management and carryover provisions.
- Provide a detailed and consolidated site water balance.
- Further detail on licensing requirements is provided below.

Relevant Policies and Guidelines

The EIS should take into account the following policies (as applicable):

- NSW Guidelines for Controlled Activities on Waterfront Land (NOW, 2012)
- NSW Aquifer Interference Policy (NOW, 2012)
- Risk Assessment Guidelines for Groundwater Dependent Ecosystems (NOW, 2012)
- Australian Groundwater Modelling Guidelines (NWC, 2012)
- NSW State Rivers and Estuary Policy (1993)
- NSW Wetlands Policy (2010)
- NSW State Groundwater Policy Framework Document (1997)
- NSW State Groundwater Quality Protection Policy (1998)
- NSW State Groundwater Dependent Ecosystems Policy (2002)
- NSW Water Extraction Monitoring Policy (2007)

DPI Water policies can be accessed at the following links:
http://www.water.nsw.gov.au/Water-management/Law-and-policy/Key-policies/default.aspx
http://www.water.nsw.gov.au/Water-licensing/Approvals/Controlled-activities/default.aspx

An assessment framework for the NSW Aquifer Interference Policy can be found online at: http://www.water.nsw.gov.au/Water-management/Law-and-policy/Key-policies/Aquifer-interference.

Licensing Considerations

The EIS is required to provide:

- Identification of water requirements for the life of the project in terms of both volume and timing (including predictions of potential ongoing groundwater take following the cessation of operations at the site – such as evaporative loss from open voids or inflows).
- Details of the water supply source(s) for the proposal including any proposed surface water and groundwater extraction from each water source as defined in the relevant Water Sharing Plan/s and all water supply works to take water.
- Explanation of how the required water entitlements will be obtained (i.e. through a new or existing licence/s, trading on the water market, controlled allocations etc.).
- Information on the purpose, location, construction and expected annual extraction volumes including details on all existing and proposed water supply works which take surface water, (pumps, dams, diversions, etc).
- Details on all bores and excavations for the purpose of investigation, extraction, dewatering, testing and monitoring. All predicted groundwater take must be accounted for through adequate licensing.
- Details on existing dams/storages (including the date of construction, location, purpose, size and capacity) and any proposal to change the purpose of existing dams/storages
- Details on the location, purpose, size and capacity of any new proposed dams/storages.
- Applicability of any exemptions under the *Water Management (General) Regulation 2011* to the project.

Water allocation account management rules, total daily extraction limits and rules governing environmental protection and access licence dealings also need to be considered.

The Harvestable Right gives landholders the right to capture and use for any purpose 10 % of the average annual runoff from their property if in the Eastern or Central Divisions. The Harvestable Right has been defined in terms of an equivalent dam capacity called the Maximum Harvestable Right Dam Capacity (MHRDC). The MHRDC is determined by the area of the property (in hectares) and a site-specific run-off factor. The MHRDC includes the capacity of all existing dams on the property that do not have a current water licence. Storages capturing up to the harvestable right capacity are not required to be licensed but any capacity of the total of all storages/dams on the property greater than the MHRDC may require a licence.

For more information on Harvestable Right dams, including a calculator, visit: http://www.water.nsw.gov.au/Water-licensing/Basic-water-rights/Harvesting-runoff/Harvesting-runoff

Dam Safety

Where new or modified dams are proposed, or where new development will occur below an existing dam, the NSW Dams Safety Committee should be consulted in relation to any safety issues that may arise. Conditions of approval may be recommended to ensure safety in relation to any new or existing dams.

See www.damsafety.nsw.gov.au for further information.

Surface Water Assessment

The predictive assessment of the impact of the proposed project on surface water sources should include the following:

- Identification of all surface water features including watercourses, wetlands and floodplains transected by or adjacent to the proposed project.
- Identification of all surface water sources as described by the relevant water sharing plan.
- Detailed description of dependent ecosystems and existing surface water users within the area, including basic landholder rights to water and adjacent/downstream licensed water users.
- Description of all works and surface infrastructure that will intercept, store, convey, or otherwise interact with surface water resources.
- Assessment of predicted impacts on the following:
    - flow of surface water, sediment movement, channel stability, and hydraulic regime,
    - water quality,
    - flood regime,
    - dependent ecosystems,
    - existing surface water users, and
    - planned environmental water and water sharing arrangements prescribed in the relevant water sharing plans.

Groundwater Assessment

To ensure the sustainable and integrated management of groundwater sources, the EIS needs to include adequate details to assess the impact of the project on all groundwater sources.

Where it is considered unlikely that groundwater will be intercepted or impacted (for example by infiltration), a brief site assessment and justification for the minimal impacts may be sufficient, accompanied by suitable contingency measures in place in the event that groundwater is intercepted, and appropriate measures to ensure that groundwater is not contaminated.

Where groundwater is expected to be intercepted or impacted, the following requirements should be used to assist the groundwater assessment for the proposal.

- The known or predicted highest groundwater table at the site.
- Works likely to intercept, connect with or infiltrate the groundwater sources.
- Any proposed groundwater extraction, including purpose, location and construction details of all proposed bores and expected annual extraction volumes.
- Bore construction information is to be supplied to DPI Water by submitting a “Form A” template. DPI Water will supply “GW” registration numbers (and licence/approval

numbers if required) which must be used as consistent and unique bore identifiers for all future reporting.

- A description of the watertable and groundwater pressure configuration, flow directions and rates and physical and chemical characteristics of the groundwater source (including connectivity with other groundwater and surface water sources).
- Sufficient baseline monitoring for groundwater quantity and quality for all aquifers and GDEs to establish a baseline incorporating typical temporal and spatial variations.
- The predicted impacts of any final landform on the groundwater regime.
- The existing groundwater users within the area (including the environment), any potential impacts on these users and safeguard measures to mitigate impacts.
- An assessment of groundwater quality, its beneficial use classification and prediction of any impacts on groundwater quality.
- An assessment of the potential for groundwater contamination (considering both the impacts of the proposal on groundwater contamination and the impacts of contamination on the proposal).
- Measures proposed to protect groundwater quality, both in the short and long term.
- Measures for preventing groundwater pollution so that remediation is not required.
- Protective measures for any groundwater dependent ecosystems (GDEs).
- Proposed methods of the disposal of waste water and approval from the relevant authority.
- The results of any models or predictive tools used.

Where potential impact/s are identified the assessment will need to identify limits to the level of impact and contingency measures that would remediate, reduce or manage potential impacts to the existing groundwater resource and any dependent groundwater environment or water users, including information on:

- Any proposed monitoring programs, including water levels and quality data.
- Reporting procedures for any monitoring program including mechanism for transfer of information.
- An assessment of any groundwater source/aquifer that may be sterilised from future use as a water supply as a consequence of the proposal.
- Identification of any nominal thresholds as to the level of impact beyond which remedial measures or contingency plans would be initiated (this may entail water level triggers or a beneficial use category).
- Description of the remedial measures or contingency plans proposed.
- Any funding assurances covering the anticipated post development maintenance cost, for example on-going groundwater monitoring for the nominated period.

Groundwater Dependent Ecosystems

The EIS must consider the potential impacts on any Groundwater Dependent Ecosystems (GDEs) at the site and in the vicinity of the site and:

- Identify any potential impacts on GDEs as a result of the proposal including:
    - the effect of the proposal on the recharge to groundwater systems;
    - the potential to adversely affect the water quality of the underlying groundwater system and adjoining groundwater systems in hydraulic connections; and
    - the effect on the function of GDEs (habitat, groundwater levels, connectivity).
- Provide safeguard measures for any GDEs.

Watercourses, Wetlands and Riparian Land

The EIS should address the potential impacts of the project on all watercourses likely to be affected by the project, existing riparian vegetation and the rehabilitation of riparian land. It is recommended the EIS provides details on all watercourses potentially affected by the proposal, including:

- Scaled plans showing the location of:
  - wetlands/swamps, watercourses and top of bank;
  - riparian corridor widths to be established along the creeks;
  - existing riparian vegetation surrounding the watercourses (identify any areas to be protected and any riparian vegetation proposed to be removed);
  - the site boundary, the footprint of the proposal in relation to the watercourses and riparian areas; and
  - proposed location of any asset protection zones.
- Photographs of the watercourses/wetlands and a map showing the point from which the photos were taken.
- A detailed description of all potential impacts on the watercourses/riparian land.
- A detailed description of all potential impacts on the wetlands, including potential impacts to the wetlands hydrologic regime; groundwater recharge; habitat and any species that depend on the wetlands.
- A description of the design features and measures to be incorporated to mitigate potential impacts.
- Geomorphic and hydrological assessment of water courses including details of stream order (Strahler System), river style and energy regimes both in channel and on adjacent floodplains.

Landform rehabilitation

Where significant modification to landform is proposed, the EIS must include:

- Justification of the proposed final landform with regard to its impact on local and regional surface and groundwater systems;
- A detailed description of how the site would be progressively rehabilitated and integrated into the surrounding landscape;
- Outline of proposed construction and restoration of topography and surface drainage features if affected by the project; and
- An outline of the measures to be put in place to ensure that sufficient resources are available to implement the proposed rehabilitation.

Consultation and general enquiries

General licensing enquiries can be made to Advisory Services: water.enquiries@dpi.nsw.gov.au, 1800 353 104.

Assessment or state significant development enquiries, or requests for review or consultation should be directed to the Water Regulation Coordination Unit, water.referrals@dpi.nsw.gov.au.

A consultation guideline and further information is available online at: www.water.nsw.gov.au/water-management/law-and-policy/planning-and-assessment

End Attachment A

Tertius Greyling

From: Andrew Helman <andrew.helman@industry.nsw.gov.au>
Sent: Wednesday, 30 August 2017 3:46 PM
To: Tertius Greyling
Cc: Landuse Minerals
Subject: Fwd: Request for SEARs - Hornsby Quarry Rehabilitation

Hi Tertius

DRG does not have requirements for the Hornsby Quarry Rehabilitation proposal.

Kind regards
Andrew

Andrew Helman |Senior Geoscientist | Land Use Assessment | Geological Survey of NSW

NSW Planning & Environment - Division of Resources & Geoscience

516 High Street | Maitland NSW 2320 | PO Box 344 | Hunter Region Mail Centre NSW 2310
T 02 4931 6572

NSW GOVERNMENT | Planning & Environment

NSW Department of Planning & Environment
GPO Box 39
Sydney NSW 2001

Attention: Tertius Greyling

Notice Number 1555676

RE: Hornsby Quarry Rehabilitation (EAR ID NO. 1167)

I refer to your request for the Environment Protection Authority's (EPA) requirements for the environmental assessment (EA) in regards to the proposal to rehabilitate the Hornsby Quarry and create a landform suitable for future development into a community parkland received by EPA on 17 August 2017.

The EPA has considered the details of the proposal as provided by the Department of Planning & Environment (DPE) and has identified the information it requires to issue its general terms of approval in Attachment A. In summary, the EPA's key information requirements for the proposal include an adequate assessment of:

1. Dust (PM 2.5 and PM 10) generated during blasting and excavations, trucks traversing unsealed roads and from exposed surfaces;
2. Noise and vibration generated during blasting and earthworks;
3. Surface water impacts, with respect to Old Mans Creek, and all other drainage lines within the site;
4. Groundwater impacts and aquifer interference activities; and
5. Mitigation and control measures to prevent sediments being tracked onto surrounding roads.

In carrying out the assessment, the proponent should refer to the relevant guidelines as listed in Attachment B and any relevant industry codes of practice and best practice management guidelines.

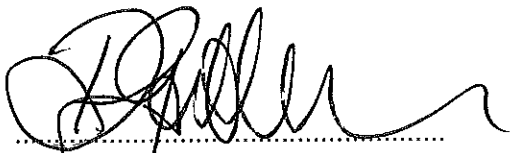
Please note that this response does not cover biodiversity or Aboriginal cultural heritage issues, which are the responsibility of the Office of Environment and Heritage.

As the project would involve processing of approximately up to 1.5 million cubic metres of hard rock materials over two years, an Environment Protection Licence (EPL) would be required under the *Protection of the Environment Operations Act 1997*.

The Proponent should be made aware that any commitments made in the EA may be formalised as approval conditions and may also be placed as EPL conditions.

In addition, as a requirement of an EPL, the EPA will require the Proponent to prepare, test and implement a Pollution Incident Response Management Plan and/or Plans in accordance with Section 153A of the Act.

Yours sincerely



David Gathercole
Unit Head
Metropolitan - Sydney Industry
(by Delegation)

ATTACHMENT A: EIS REQUIREMENTS FOR

HORNSBY QUARRY REHABILITATION

How to use these requirements

The EPA requirements have been structured in accordance with the DIPNR EIS Guidelines, as follows. It is suggested that the EIS follow the same structure:

A. Executive summary

B. The proposal

C. The location

D. Identification and prioritisation of issues

E. The environmental issues

F. List of approvals and licences

G. Compilation of mitigation measures

H. Justification for the proposal

A Executive summary

The executive summary should include a brief discussion of the extent to which the proposal achieves identified environmental outcomes.

B The proposal

1. Objectives of the proposal

- The objectives of the proposal should be clearly stated and refer to:
  a) the size and type of the operation, the nature of the processes and the products, by-products and wastes produced
  b) a life cycle approach to the production, use or disposal of products
  c) the anticipated level of performance in meeting required environmental standards and cleaner production principles
  d) the staging and timing of the proposal and any plans for future expansion
  e) the proposal's relationship to any other industry or facility.

2. Description of the proposal

General

- Outline the production process including:
  a) the environmental "mass balance" for the process – quantify in-flow and out-flow of materials, any points of discharge to the environment and their respective destinations (sewer, stormwater, atmosphere, recycling, landfill etc)
  b) any life-cycle strategies for the products.
- Outline cleaner production actions, including:
  a) measures to minimise waste (typically through addressing source reduction)
  b) proposals for use or recycling of by-products
  c) proposed disposal methods for solid and liquid waste
  d) air management systems including all potential sources of air emissions, proposals to re-use or treat emissions, emission levels relative to relevant standards in regulations, discharge points
  e) water management system including all potential sources of water pollution, proposals for re-use, treatment etc, emission levels of any wastewater discharged, discharge points, summary of options explored to avoid a discharge, reduce its frequency or reduce its impacts, and rationale for selection of option to discharge.
  f) soil contamination treatment and prevention systems.
- Outline construction works including:
  a) actions to address any existing soil contamination
  b) any earthworks or site clearing; re-use and disposal of cleared material (including use of spoil on-site)
  c) construction timetable and staging; hours of construction; proposed construction methods
  d) environment protection measures, including noise mitigation measures, dust control measures and erosion and sediment control measures.

- Include a site diagram showing the site layout and location of environmental controls.

Air

- Identify all sources or potential sources of air emissions from the development.
  Note: emissions can be classed as either:
  - *point (e.g. emissions from stack or vent) or*
  - *fugitive (from wind erosion, leakages or spillages, associated with loading or unloading, conveyors, storage facilities, plant and yard operation, vehicle movements (dust from road, exhausts, loss from load), land clearing and construction works).*
- Provide details of the project that are essential for predicting and assessing air impacts including:
  a) the quantities and physio-chemical parameters (e.g. concentration, moisture content, bulk density, particle sizes etc) of materials to be used, transported, produced or stored
  b) an outline of procedures for handling, transport, production and storage
  c) the management of solid, liquid and gaseous waste streams with potential to generate emissions to air.

Noise and vibration

- Identify all noise sources or potential sources from the development (including both construction and operation phases). Detail all potentially noisy activities including ancillary activities such as transport of goods and raw materials.
- Specify the times of operation for all phases of the development and for all noise producing activities.
- For projects with a significant potential traffic noise impact provide details of road alignment (include gradients, road surface, topography, bridges, culverts etc), and land use along the proposed road and measurement locations – diagrams should be to a scale sufficient to delineate individual residential blocks.

Water

- Provide details of the project that are essential for predicting and assessing impacts to waters including:
  a) the quantity and physio-chemical properties of all potential water pollutants and the risks they pose to the environment and human health, including the risks they pose to Water Quality Objectives in the ambient waters (as defined on http://www.environment.nsw.gov.au/ieo/index.htm, using technical criteria derived from *the Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, ANZECC 2000)
  b) the management of discharges with potential for water impacts
  c) drainage works and associated infrastructure; land-forming and excavations; working capacity of structures; and water resource requirements of the proposal.
- Outline site layout, demonstrating efforts to avoid proximity to water resources (especially for activities with significant potential impacts e.g. effluent ponds) and showing potential areas of modification of contours, drainage etc.

- Outline how total water cycle considerations are to be addressed showing total water balances for the development (with the objective of minimising demands and impacts on water resources). Include water requirements (quantity, quality and source(s)) and proposed storm and wastewater disposal, including type, volumes, proposed treatment and management methods and re-use options.

Waste and chemicals

Provide details of the quantity and type of both liquid waste and non-liquid waste generated, handled, processed or disposed of at the premises. Waste must be classified according to the EPA's *Waste Classification Guidelines 2014 (as amended from time to time)*

- Provide details of liquid waste and non-liquid waste management at the facility, including:
  a) the transportation, assessment and handling of waste arriving at or generated at the site
  b) any stockpiling of wastes or recovered materials at the site
  c) any waste processing related to the facility, including reuse, recycling, reprocessing (including composting) or treatment both on- and off-site
  d) the method for disposing of all wastes or recovered materials at the facility
  e) the emissions arising from the handling, storage, processing and reprocessing of waste at the facility
  f) the proposed controls for managing the environmental impacts of these activities.
- Provide details of spoil disposal with particular attention to:
  a) the quantity of spoil material likely to be generated
  b) proposed strategies for the handling, stockpiling, reuse/recycling and disposal of spoil
  c) the need to maximise reuse of spoil material in the construction industry
  d) identification of the history of spoil material and whether there is any likelihood of contaminated material, and if so, measures for the management of any contaminated material
  e) designation of transportation routes for transport of spoil.
- Provide details of procedures for the assessment, handling, storage, transport and disposal of all hazardous and dangerous materials used, stored, processed or disposed of at the site, in addition to the requirements for liquid and non-liquid wastes.
- Provide details of the type and quantity of any chemical substances to be used or stored and describe arrangements for their safe use and storage.

- Reference should be made to the guidelines: EPA's *Waste Classification Guidelines 2014 (as amended from time to time)*

ESD

- Demonstrate that the planning process and any subsequent development incorporates objectives and mechanisms for achieving ESD, including:
  a) an assessment of a range of options available for use of the resource, including the benefits of each option to future generations

  proper valuation and pricing of environmental resources

  b) identification of who will bear the environmental costs of the proposal.

3. Rehabilitation

- Outline considerations of site maintenance, and proposed plans for the final condition of the site (ensuring its suitability for future uses).

4. Consideration of alternatives and justification for the proposal

- Consider the environmental consequences of adopting alternatives, including alternative:
  a) sites and site layouts
  b) access modes and routes
  c) materials handling and production processes
  d) waste and water management
  e) impact mitigation measures
  f) energy sources
- Selection of the preferred option should be justified in terms of:
  a) ability to satisfy the objectives of the proposal
  b) relative environmental and other costs of each alternative
  c) acceptability of environmental impacts and contribution to identified environmental objectives
  d) acceptability of any environmental risks or uncertainties
  e) reliability of proposed environmental impact mitigation measures
  f) efficient use (including maximising re-use) of land, raw materials, energy and other resources.

C The location

1. General

- Provide an overview of the affected environment to place the proposal in its local and regional environmental context including:
  a) meteorological data (e.g. rainfall, temperature and evaporation, wind speed and direction)
  b) topography (landform element, slope type, gradient and length)
  c) surrounding land uses (potential synergies and conflicts)
  d) geomorphology (rates of landform change and current erosion and deposition processes)
  e) soil types and properties (including erodibility; engineering and structural properties; dispersibility; permeability; presence of acid sulfate soils and potential acid sulfate soils)
  f) ecological information (water system habitat, vegetation, fauna)
  g) availability of services and the accessibility of the site for passenger and freight transport.

2. Air

- Describe the topography and surrounding land uses. Provide details of the exact locations of dwellings, schools and hospitals. Where appropriate provide a perspective view of the study area such as the terrain file used in dispersion models.
- Describe surrounding buildings that may effect plume dispersion.
- Provide and analyse site representative data on following meteorological parameters:
  a) temperature and humidity
  b) rainfall, evaporation and cloud cover
  c) wind speed and direction
  d) atmospheric stability class
  e) mixing height (the height that emissions will be ultimately mixed in the atmosphere)
  f) katabatic air drainage
  g) air re-circulation.

3. Noise and vibration

- Identify any noise sensitive locations likely to be affected by activities at the site, such as residential properties, schools, churches, and hospitals. Typically the location of any noise sensitive locations in relation to the site should be included on a map of the locality.
- Identify the land use zoning of the site and the immediate vicinity and the potentially affected areas.

4. Water

- Describe the catchment including proximity of the development to any waterways and provide an assessment of their sensitivity/significance from a public health, ecological and/or economic perspective. The Water Quality and River Flow Objectives on the website: http://www.environment.nsw.gov.au/ieo/index.htm should be used to identify the agreed environmental values and human uses for any affected waterways. This will help with the description of the local and regional area.

5. Soil Contamination Issues

- Provide details of site history – if earthworks are proposed, this needs to be considered with regard to possible soil contamination, for example if the site was previously a landfill site or if irrigation of effluent has occurred.

D Identification and prioritisation of issues / scoping of impact assessment

- Provide an overview of the methodology used to identify and prioritise issues. The methodology should take into account:
  a) relevant NSW government guidelines
  b) industry guidelines
  c) EISs for similar projects
  d) relevant research and reference material
  e) relevant preliminary studies or reports for the proposal
  f) consultation with stakeholders.
- Provide a summary of the outcomes of the process including:
  a) all issues identified including local, regional and global impacts (e.g. increased/ decreased greenhouse emissions)
  b) key issues which will require a full analysis (including comprehensive baseline assessment)
  c) issues not needing full analysis though they may be addressed in the mitigation strategy
  d) justification for the level of analysis proposed (the capacity of the proposal to give rise to high concentrations of pollution compared with the ambient environment or environmental outcomes is an important factor in setting the level of assessment).

E The environmental issues

1. General

- The potential impacts identified in the scoping study need to be assessed to determine their significance, particularly in terms of achieving environmental outcomes, and minimising environmental pollution.
- Identify gaps in information and data relevant to significant impacts of the proposal and any actions proposed to fill those information gaps so as to enable development of appropriate management and mitigation measures. This is in accordance with ESD requirements.

Note: The level of detail should match the level of importance of the issue in decision making which is dependent on the environmental risk.

Describe baseline conditions

- Provide a description of existing environmental conditions for any potential impacts.

Assess impacts

- For any potential impacts relevant for the assessment of the proposal provide a detailed analysis of the impacts of the proposal on the environment including the cumulative impact of the proposal on the receiving environment especially where there are sensitive receivers.
- Describe the methodology used and assumptions made in undertaking this analysis (including any modelling or monitoring undertaken) and indicate the level of confidence in the predicted outcomes and the resilience of the environment to cope with the predicted impacts.
- The analysis should also make linkages between different areas of assessment where necessary to enable a full assessment of environmental impacts e.g. assessment of impacts on air quality will often need to draw on the analysis of traffic, health, social, soil and/or ecological systems impacts; etc.
- The assessment needs to consider impacts at all phases of the project cycle including: exploration (if relevant or significant), construction, routine operation, start-up operations, upset operations and decommissioning if relevant.
- The level of assessment should be commensurate with the risk to the environment.

Describe management and mitigation measures

- Describe any mitigation measures and management options proposed to prevent, control, abate or mitigate identified environmental impacts associated with the proposal and to reduce risks to human health and prevent the degradation of the environment. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.
- Proponents are expected to implement a 'reasonable level of performance' to minimise environmental impacts. The proponent must indicate how the proposal meets reasonable levels of performance. For example, reference technology based criteria if available, or identify good practice for this type of activity or development. A 'reasonable level of performance' involves adopting and implementing technology and management practices to achieve certain pollutant emissions levels in economically

viable operations. Technology-based criteria evolve gradually over time as technologies and practices change.

- Use environmental impacts as key criteria in selecting between alternative sites, designs and technologies, and to avoid options having the highest environmental impacts.
- Outline any proposed approach (such as an Environmental Management Plan) that will demonstrate how commitments made in the EIS will be implemented. Areas that should be described include:

  a) operational procedures to manage environmental impacts

  b) monitoring procedures

  c) training programs

  d) community consultation

  e) complaint mechanisms including site contacts

  f) strategies to use monitoring information to improve performance

  g) strategies to achieve acceptable environmental impacts and to respond in event of exceedences.

4. Air

Describe baseline conditions

- Provide a description of existing air quality and meteorology, using existing information and site representative ambient monitoring data.

Assess impacts

- Identify all pollutants of concern and estimate emissions by quantity (and size for particles), source and discharge point.
- Estimate the resulting ground level concentrations of all pollutants. Where necessary (e.g. potentially significant impacts and complex terrain effects), use an appropriate dispersion model to estimate ambient pollutant concentrations. Discuss choice of model and parameters with the EPA.
- Describe the effects and significance of pollutant concentration on the environment, human health, amenity and regional ambient air quality standards or goals.
- Describe the contribution that the development will make to regional and global pollution, particularly in sensitive locations.
- For potentially odorous emissions provide the emission rates in terms of odour units (determined by techniques compatible with EPA procedures). Use sampling and analysis techniques for individual or complex odours and for point or diffuse sources, as appropriate.

  Note: With dust and odour, it may be possible to use data from existing similar activities to generate emission rates.

- Reference should be made to *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (EPA, 2016) and *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW* (DEC, 2007).

Describe management and mitigation measures

- Outline specifications of pollution control equipment (including manufacturer's performance guarantees where available) and management protocols for both point and fugitive emissions. Where possible, this should include cleaner production processes.

5. Human Health Risk Assessment

- A human health risk assessment must be undertaken in conjunction with the air quality and odour impact assessment.
- The human health risk assessment must be undertaken in accordance with *Environmental Health Risk Assessment: Guidelines for assessing human health risks from environmental hazards* (enHealth) and must include:
  - the inhalation of criteria pollutants and exposure from all pathways i.e., inhalation, ingestion and dermal to specific air toxics; and
  - a demonstration of how the waste to energy facility would be operated in accordance with best practice measures to manage air emissions with consideration of the *Environment Protection Authority's NSW Energy from Waste Policy Statement.*

6. Noise and vibration

Describe baseline conditions

- Determine the existing background (LA90) and ambient (LAeq) noise levels in accordance with the *NSW Industrial Noise Policy.*
- Determine the existing road traffic noise levels in accordance with the *NSW Environmental Criteria for Road Traffic Noise*, where road traffic noise impacts may occur.
- The noise impact assessment report should provide details of all monitoring of existing ambient noise levels including:
  a) details of equipment used for the measurements
  b) a brief description of where the equipment was positioned
  c) a statement justifying the choice of monitoring site, including the procedure used to choose the site, having regards to the definition of 'noise sensitive locations(s)' and 'most affected locations(s)' described in Section 3.1.2 of the *NSW Industrial Noise Policy*
  d) details of the exact location of the monitoring site and a description of land uses in surrounding areas
  e) a description of the dominant and background noise sources at the site
  f) day, evening and night assessment background levels for each day of the monitoring period
  g) the final Rating Background Level (RBL) value
  h) graphs of the measured noise levels for each day should be provided

i) a record of periods of affected data (due to adverse weather and extraneous noise), methods used to exclude invalid data and a statement indicating the need for any re-monitoring under Step 1 in Section B1.3 of the *NSW Industrial Noise Policy*

j) determination of LAeq noise levels from existing industry.

Assess impacts

- Determine the project specific noise levels for the site. For each identified potentially affected receiver, this should include:
  a) determination of the intrusive criterion for each identified potentially affected receiver
  b) selection and justification of the appropriate amenity category for each identified potentially affected receiver
  c) determination of the amenity criterion for each receiver
  d) determination of the appropriate sleep disturbance limit.
- Maximum noise levels during night-time period (10pm-7am) should be assessed to analyse possible affects on sleep. Where LA1(1min) noise levels from the site are less than 15 dB above the background LA90 noise level, sleep disturbance impacts are unlikely. Where this is not the case, further analysis is required. Additional guidance is provided in Appendix B of the *NSW Environmental Criteria for Road Traffic Noise*.
- Determine expected noise level and noise character (e.g. tonality, impulsiveness, vibration, etc) likely to be generated from noise sources during:
  a) site establishment
  b) construction
  c) operational phases
  d) transport including traffic noise generated by the proposal
  e) other services.

  Note: The noise impact assessment report should include noise source data for each source in 1/1 or 1/3 octave band frequencies including methods for references used to determine noise source levels. Noise source levels and characteristics can be sourced from direct measurement of similar activities or from literature (if full references are provided).
- Determine the noise levels likely to be received at the most sensitive locations (these may vary for different activities at each phase of the development). Potential impacts should be determined for any identified significant adverse meteorological conditions. Predicted noise levels under calm conditions may also aid in quantifying the extent of impact where this is not the most adverse condition.
- The noise impact assessment report should include:
  a) a plan showing the assumed location of each noise source for each prediction scenario
  b) a list of the number and type of noise sources used in each prediction scenario to simulate all potential significant operating conditions on the site
  c) any assumptions made in the predictions in terms of source heights, directivity effects, shielding from topography, buildings or barriers, etc

d) methods used to predict noise impacts including identification of any noise models used. Where modelling approaches other than the use of the ENM or SoundPlan computer models are adopted, the approach should be appropriately justified and validated

e) an assessment of appropriate weather conditions for the noise predictions including reference to any weather data used to justify the assumed conditions

f) the predicted noise impacts from each noise source as well as the combined noise level for each prediction scenario under any identified significant adverse weather conditions as well as calm conditions where appropriate

g) for developments where a significant level of noise impact is likely to occur, noise contours for the key prediction scenarios should be derived

h) an assessment of the need to include modification factors as detailed in Section 4 of the *NSW Industrial Noise Policy*.

- Discuss the findings from the predictive modelling and, where relevant noise criteria have not been met, recommend additional mitigation measures.
- The noise impact assessment report should include details of any mitigation proposed including the attenuation that will be achieved and the revised noise impact predictions following mitigation.
- Where relevant noise/vibration criteria cannot be met after application of all feasible and cost effective mitigation measures the residual level of noise impact needs to be quantified by identifying:

  a) locations where the noise level exceeds the criteria and extent of exceedence

  b) numbers of people (or areas) affected

  c) times when criteria will be exceeded

  d) likely impact on activities (speech, sleep, relaxation, listening, etc)

  e) change on ambient conditions

  f) the result of any community consultation or negotiated agreement.

- For the assessment of existing and future traffic noise, details of data for the road should be included such as assumed traffic volume; percentage heavy vehicles by time of day; and details of the calculation process. These details should be consistent with any traffic study carried out in the EIS.
- Where blasting is intended an assessment in accordance with the *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZECC, 1990) should be undertaken. The following details of the blast design should be included in the noise assessment:

  a) bench height, burden spacing, spacing burden ratio

  b) blast hole diameter, inclination and spacing

  c) type of explosive, maximum instantaneous charge, initiation, blast block size, blast frequency.

Describe management and mitigation measures

- Determine the most appropriate noise mitigation measures and expected noise reduction including both noise controls and management of impacts for both construction and operational noise. This will include selecting quiet equipment and construction methods, noise barriers or acoustic screens, location of stockpiles, temporary offices, compounds and vehicle routes, scheduling of activities, etc.

- For traffic noise impacts, provide a description of the ameliorative measures considered (if required), reasons for inclusion or exclusion, and procedures for calculation of noise levels including ameliorative measures. Also include, where necessary, a discussion of any potential problems associated with the proposed ameliorative measures, such as overshadowing effects from barriers. Appropriate ameliorative measures may include:
  a) use of alternative transportation modes, alternative routes, or other methods of avoiding the new road usage
  b) control of traffic (eg: limiting times of access or speed limitations)
  c) resurfacing of the road using a quiet surface
  d) use of (additional) noise barriers or bunds
  e) treatment of the façade to reduce internal noise levels buildings where the night-time criteria is a major concern
  f) more stringent limits for noise emission from vehicles (i.e. using specially designed 'quite' trucks and/or trucks to use air bag suspension
  g) driver education
  h) appropriate truck routes
  i) limit usage of exhaust breaks
  j) use of premium muffles on trucks
  k) reducing speed limits for trucks
  l) ongoing community liaison and monitoring of complaints
  m) phasing in the increased road use.

4. Water

Describe baseline conditions

- Describe existing surface and groundwater quality – an assessment needs to be undertaken for any water resource likely to be affected by the proposal and for all conditions (e.g. a wet weather sampling program is needed if runoff events may cause impacts).

  Note: Methods of sampling and analysis need to conform with an accepted standard (e.g. Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (DEC 2004) *or be approved and analyses undertaken by accredited laboratories).*

- Provide site drainage details and surface runoff yield.
- State the ambient Water Quality and River Flow Objectives for the receiving waters. These refer to the community's agreed environmental values and human uses endorsed by the Government as goals for the ambient waters. These environmental values are published on the website: http://www.environment.nsw.gov.au/ieo/index.htm. The EIS should state the environmental values listed for the catchment and waterway type relevant to your proposal. NB: A consolidated and approved list of environmental values are not available for groundwater resources. Where groundwater may be affected the EIS should identify appropriate groundwater environmental values and justify the choice.
- State the indicators and associated trigger values or criteria for the identified environmental values. This information should be sourced from the ANZECC 2000 *Guidelines for Fresh and Marine Water Quality* (http://www.environment.gov.au/water/publications/quality/nwqms-guidelines-4-vol1.html) (Note that, as at 2004, the NSW Water Quality Objectives booklets and website contain technical criteria derived from the 1992 version of the ANZECC Guidelines. The Water Quality Objectives remain as Government Policy, reflecting the community's environmental values and long-term goals, but the technical criteria are replaced by the more recent ANZECC 2000 Guidelines). NB: While specific guidelines for groundwater are not available, the ANCECC 2000 Guidelines endorse the application of the trigger values and decision trees as a tool to assess risk to environmental values in groundwater.
- State any locally specific objectives, criteria or targets, which have been endorsed by the government e.g. the Healthy Rivers Commission Inquiries or the NSW Salinity Strategy (DLWC, 2000) (http://www.environment.nsw.gov.au/salinity/government/nswstrategy.htm).
- Where site specific studies are proposed to revise the trigger values supporting the ambient Water Quality and River Flow Objectives, and the results are to be used for regulatory purposes (e.g. to assess whether a licensed discharge impacts on water quality objectives), then prior agreement from the EPA on the approach and study design must be obtained.
- Describe the state of the receiving waters and relate this to the relevant Water Quality and River Flow Objectives (i.e. are Water Quality and River Flow Objectives being achieved?). Proponents are generally only expected to source available data and information. However, proponents of large or high risk developments may be required to collect some ambient water quality / river flow / groundwater data to enable a suitable level of impact assessment. Issues to include in the description of the receiving waters could include:

  a) lake or estuary flushing characteristics

  b) specific human uses (e.g. exact location of drinking water offtake)

  c) sensitive ecosystems or species conservation values

  d) a description of the condition of the local catchment e.g. erosion levels, soils, vegetation cover, etc

e) an outline of baseline groundwater information, including, but not restricted to, depth to watertable, flow direction and gradient, groundwater quality, reliance on groundwater by surrounding users and by the environment

f) historic river flow data where available for the catchment.

Assess impacts

- No proposal should breach clause 120 of the *Protection of the Environment Operations Act* 1997 (i.e. pollution of waters is prohibited unless undertaken in accordance with relevant regulations).
- Identify and estimate the quantity of all pollutants that may be introduced into the water cycle by source and discharge point including residual discharges after mitigation measures are implemented.
- Include a rationale, along with relevant calculations, supporting the prediction of the discharges.
- Describe the effects and significance of any pollutant loads on the receiving environment. This should include impacts of residual discharges through modelling, monitoring or both, depending on the scale of the proposal. Determine changes to hydrology (including drainage patterns, surface runoff yield, flow regimes, wetland hydrologic regimes and groundwater).
- Describe water quality impacts resulting from changes to hydrologic flow regimes (such as nutrient enrichment or turbidity resulting from changes in frequency and magnitude of stream flow).
- Identify any potential impacts on quality or quantity of groundwater describing their source.
- Identify potential impacts associated with geomorphological activities with potential to increase surface water and sediment runoff or to reduce surface runoff and sediment transport. Also consider possible impacts such as bed lowering, bank lowering, instream siltation, floodplain erosion and floodplain siltation.
- Identify impacts associated with the disturbance of acid sulfate soils and potential acid sulfate soils.
- Containment of spills and leaks shall be in accordance with EPA's guidelines section 'Bunding and Spill Management' at http://www.epa.nsw.gov.au/mao/bundingspill.htm and the most recent versions of the Australian Standards referred to in the Guidelines. Containment should be designed for no-discharge.
- The significance of the impacts listed above should be predicted. When doing this it is important to predict the ambient water quality and river flow outcomes associated with the proposal and to demonstrate whether these are acceptable in terms of achieving protection of the Water Quality and River Flow Objectives. In particular the following questions should be answered:

  a) will the proposal protect Water Quality and River Flow Objectives where they are currently achieved in the ambient waters; and

  b) will the proposal contribute towards the achievement of Water Quality and River Flow Objectives over time, where they are not currently achieved in the ambient waters.

- Consult with the EPA as soon as possible if a mixing zone is proposed (a mixing zone could exist where effluent is discharged into a receiving water body, where the quality of the water being discharged does not immediately meet water quality objectives. The mixing zone could result in dilution, assimilation and decay of the effluent to allow water quality objectives to be met further downstream, at the edge of the mixing zone). The EPA will advise the proponent under what conditions a mixing zone will and will not be acceptable, as well as the information and modelling requirements for assessment.

  Note: The assessment of water quality impacts needs to be undertaken in a total catchment management context to provide a wide perspective on development impacts, in particular cumulative impacts.

- Where a licensed discharge is proposed, provide the rationale as to why it cannot be avoided through application of a reasonable level of performance, using available technology, management practice and industry guidelines.
- Where a licensed discharge is proposed, provide the rationale as to why it represents the best environmental outcome and what measures can be taken to reduce its environmental impact.

Describe management and mitigation measures

- Outline stormwater management to control pollutants at the source and contain them within the site. Also describe measures for maintaining and monitoring any stormwater controls.
- Outline erosion and sediment control measures directed at minimising disturbance of land, minimising water flow through the site and filtering, trapping or detaining sediment. Also include measures to maintain and monitor controls as well as rehabilitation strategies.
- Describe waste water treatment measures that are appropriate to the type and volume of waste water and are based on a hierarchy of avoiding generation of waste water; capturing all contaminated water (including stormwater) on the site; reusing/recycling waste water; and treating any unavoidable discharge from the site to meet specified water quality requirements.
- Outline pollution control measures relating to storage of materials, possibility of accidental spills (e.g. preparation of contingency plans), appropriate disposal methods, and generation of leachate.
- Describe hydrological impact mitigation measures including:
  a) site selection (avoiding sites prone to flooding and waterlogging, actively eroding or affected by deposition)
  b) minimising runoff
  c) minimising reductions or modifications to flow regimes
  d) avoiding modifications to groundwater.
- Describe groundwater impact mitigation measures including:
  a) site selection
  b) retention of native vegetation and revegetation
  c) artificial recharge
  d) providing surface storages with impervious linings
  e) monitoring program.
- Describe geomorphological impact mitigation measures including:
  a) site selection
  b) erosion and sediment controls
  c) minimising instream works
  d) treating existing accelerated erosion and deposition
  e) monitoring program.
- Any proposed monitoring should be undertaken in accordance with the *Approved Methods for the Sampling and Analysis of Water Pollutants in NSW* (DEC 2004).

5. Soils and contamination

Describe baseline conditions

- Provide any details (in addition to those provided in the location description - Section C) that are needed to describe the existing situation in terms of soil types and properties and soil contamination.

Assess impacts

- Identify any likely impacts resulting from the construction or operation of the proposal, including the likelihood of:
  a) disturbing any existing contaminated soil
  b) contamination of soil by operation of the activity
  c) subsidence or instability
  d) soil erosion
  e) disturbing acid sulfate or potential acid sulfate soils.

Describe management and mitigation measures

- Describe and assess the effectiveness or adequacy of any soil management and mitigation measures during construction and operation of the proposal including:
  a) erosion and sediment control measures
  b) proposals for site remediation – see *Managing Land Contamination, Planning Guidelines SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning and Environment Protection Authority, 1998)
  c) proposals for the management of these soils – see *Acid Sulfate Soil Manual* (Acid Sulfate Soil Advisory Committee 1998) and *Acid Sulfate Soils Assessment Guidelines* (Acid Sulfate Soil Advisory Committee 1998).

6. Waste and chemicals

Describe baseline conditions

- Describe any existing waste or chemicals operations related to the proposal.

Assess impacts

- Assess the adequacy of proposed measures to minimise natural resource consumption and minimise impacts from the handling, transporting, storage, processing and reprocessing of waste and/or chemicals.
- Reference should be made to: the EPA's *Waste Classification Guidelines 2014 (as in force from time to time)*

- If the proposal is an energy from waste facility it must:
  - demonstrate that the proposed operation will comply with the NSW EPA's Energy from Waste Policy Statement;
  - describe of the classes and quantities of waste that would be thermally treated at the facility;
  - demonstrate that waste used as a feedstock in the waste to energy plant would be the residual from a resource recovery process that maximises the recovery of material;
  - detail procedures that would be implemented to control the inputs to the waste to energy plant, including contingency measures that would be implemented if inappropriate materials are identified;
  - detail the location and size of stockpiles of unprocessed and processed recycled waste at the site;
  - demonstrate any waste material (e.g. biochar, ash) produced from the waste to energy facility for land application is fit-for-purpose and poses minimal risk of harm to the environment in order to meet the requirements for consideration of a resource recovery order and /or exemption by the EPA;
  - detail procedures for the management of other solid, liquid and gaseous waste streams;
  - describe how waste would be treated, stored, used, disposed and handled on site, and transported to and from the site, and the potential impacts associated with these issues, including current and future offsite waste disposal methods; and
  - identify the measures that would be implemented to ensure that the development is consistent with the aims, objectives and guidance in the *NSW Waste Avoidance and Resource Recovery Strategy 2014-21*.

Describe management and mitigation measures

- Outline measures to minimise the consumption of natural resources.
- Outline measures to avoid the generation of waste and promote the re-use and recycling and reprocessing of any waste.
- Outline measures to support any approved regional or industry waste plans.

7. Cumulative impacts

- Identify the extent that the receiving environment is already stressed by existing development and background levels of emissions to which this proposal will contribute.
- Assess the impact of the proposal against the long term air, noise and water quality objectives for the area or region.
- Identify infrastructure requirements flowing from the proposal (e.g. water and sewerage services, transport infrastructure upgrades).
- Assess likely impacts from such additional infrastructure and measures reasonably available to the proponent to contain such requirements or mitigate their impacts (e.g. travel demand management strategies).

F. List of approvals and licences

- Identify all approvals and licences required under environment protection legislation including details of all scheduled activities, types of ancillary activities and types of discharges (to air, land, water).

G. Compilation of mitigation measures

- Outline how the proposal and its environmental protection measures would be implemented and managed in an integrated manner so as to demonstrate that the proposal is capable of complying with statutory obligations under EPA licences or approvals (e.g. outline of an environmental management plan).
- The mitigation strategy should include the environmental management and cleaner production principles which would be followed when planning, designing, establishing and operating the proposal. It should include two sections, one setting out the program for managing the proposal and the other outlining the monitoring program with a feedback loop to the management program.

H. Justification for the Proposal

- Reasons should be included which justify undertaking the proposal in the manner proposed, having regard to the potential environmental impacts.

ATTACHMENT B: GUIDANCE MATERIAL

Title	Web address
Relevant Legislation	
Contaminated Land Management Act 1997	http://www.legislation.nsw.gov.au/#/view/act/1997/140
Environmentally Hazardous Chemicals Act 1985	http://www.legislation.nsw.gov.au/#/view/act/1985/14
Environmental Planning and Assessment Act 1979	http://www.legislation.nsw.gov.au/#/view/act/1979/203
Protection of the Environment Operations Act 1997	http://www.legislation.nsw.gov.au/#/view/act/1997/156
Water Management Act 2000	http://www.legislation.nsw.gov.au/#/view/act/2000/92
Licensing	
Guide to Licensing	www.epa.nsw.gov.au/licensing/licenceguide.htm
Air Issues	
Air Quality	
Approved methods for modelling and assessment of air pollutants in NSW (2016)	http://www.epa.nsw.gov.au/air/appmethods.htm
POEO (Clean Air) Regulation 2010	http://www.legislation.nsw.gov.au/#/view/regulation/2010/428
Noise and Vibration	
Interim Construction Noise Guideline (DECC, 2009)	http://www.epa.nsw.gov.au/noise/constructnoise.htm
Assessing Vibration: a technical guideline (DEC, 2006)	http://www.epa.nsw.gov.au/noise/vibrationguide.htm
Industrial Noise Policy Application Notes	http://www.epa.nsw.gov.au/noise/applicnotesindustnoise.htm
Environmental Criteria for Road Traffic Noise (EPA, 1999)	http://www.epa.nsw.gov.au/resources/noise/roadnoise.pdf
Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects (DECC,	http://www.epa.nsw.gov.au/noise/railinfranoise.htm

2007)	
Environmental assessment requirements for rail traffic-generating developments	http://www.epa.nsw.gov.au/noise/railnoise.htm
Human Health Risk Assessment	
Environmental Health Risk Assessment: Guidelines for assessing human health risks from environmental hazards (enHealth, 2012)	http://www.eh.org.au/documents/item/916
Waste, Chemicals and Hazardous Materials and Radiation	
Waste	
Environmental Guidelines: Solid Waste Landfills (EPA, 2016)	http://www.epa.nsw.gov.au/waste/landfill-sites.htm
Draft Environmental Guidelines - Industrial Waste Landfilling (April 1998)	http://www.epa.nsw.gov.au/resources/waste/envguidlns/industrialfill .pdf
EPA's Waste Classification Guidelines 2014	http://www.epa.nsw.gov.au/wasteregulation/classify-guidelines.htm
Resource recovery orders and exemptions	http://www.epa.nsw.gov.au/wasteregulation/orders-exemptions.htm
European Union's Waste Incineration Directive 2000	http://ec.europa.eu/environment/archives/air/stationary/wid/legislation.htm
EPA's Energy from Waste Policy Statement	http://www.epa.nsw.gov.au/wastestrategy/energy-from-waste.htm
NSW Waste Avoidance and Resource Recovery Strategy 2014-2021	http://www.epa.nsw.gov.au/wastestrategy/warr.htm
Chemicals subject to Chemical Control Orders	
Chemical Control Orders (regulated through the EHC Act)	http://www.epa.nsw.gov.au/pesticides/CCOs.htm
National Protocol - Approval/Licensing of Trials of Technologies for the Treatment/Disposal of Schedule X Wastes - July 1994	Available in libraries
National Protocol for Approval/Licensing of Commercial Scale Facilities for the Treatment/Disposal of Schedule X Wastes - July 1994	Available in libraries
Water and Soils	
Acid sulphate soils	

Coastal acid sulfate soils guidance material	http://www.environment.nsw.gov.au/acidsulfatesoil/ and http://www.epa.nsw.gov.au/mao/acidsulfatesoils.htm
Acid Sulfate Soils Planning Maps	http://www.environment.nsw.gov.au/acidsulfatesoil/riskmaps.htm
Contaminated Sites Assessment and Remediation	
Managing land contamination: Planning Guidelines – SEPP 55 Remediation of Land	http://www.epa.nsw.gov.au/clm/planning.htm
Guidelines for Consultants Reporting on Contaminated Sites (EPA, 2000)	http://www.epa.nsw.gov.au/resources/clm/20110650consultantsglines.pdf
Guidelines for the NSW Site Auditor Scheme - 2nd edition (DEC, 2006)	http://www.epa.nsw.gov.au/resources/clm/auditorglines06121.pdf
Sampling Design Guidelines (EPA, 1995)	http://www.epa.nsw.gov.au/resources/clm/95059sampgdlne.pdf
National Environment Protection (Assessment of Site Contamination) Measure 1999 (or update)	http://www.scew.gov.au/nepms/assessment-site-contamination
Soils – general	
Managing land and soil	http://www.environment.nsw.gov.au/soils/landandsoil.htm
Managing urban stormwater for the protection of soils	http://www.environment.nsw.gov.au/stormwater/publications.htm
Landslide risk management guidelines	http://australiangeomechanics.org/admin/wp-content/uploads/2010/11/LRM2000-Concepts.pdf
Site Investigations for Urban Salinity (DLWC, 2002)	http://www.environment.nsw.gov.au/resources/salinity/booklet3sitei nvestigationsforurbansalinity.pdf
Local Government Salinity Initiative Booklets	http://www.environment.nsw.gov.au/salinity/solutions/urban.htm
Water	
Water Quality Objectives	http://www.environment.nsw.gov.au/ieo/index.htm
ANZECC (2000) Guidelines for Fresh and Marine Water Quality	http://www.environment.gov.au/water/publications/quality/nwqms-guidelines-4-vol1.html
Applying Goals for Ambient Water Quality Guidance for Operations Officers – Mixing Zones	Contact the EPA on 131555
Approved Methods for the Sampling and Analysis of Water Pollutant in NSW (2004)	http://www.environment.nsw.gov.au/resources/legislation/approved methods-water.pdf


NSW
EPA

NSW GOVERNMENT | Office of Environment & Heritage

DOC17/431342
EAR 1167

Mr Tertius Greyling
Senior Environmental Assessment Officer
NSW Department of Planning & Environment
GPO Box 39
SYDNEY NSW 2001

Dear Mr Greyling

Request for SEARs - Hornsby Quarry Rehabilitation (EAR 1167)

I refer to your email received 15 August 2017, by the Office of Environment and Heritage (OEH) requesting requirements for the preparation of an Environmental Impact Statement (EIS) for the above proposal. OEH understands that the proposal involves:

- Major stabilisation works to both the north and south faces of the Hornsby Quarry void to make them safe.
- Earthworks across other parts of Hornsby Park in order to rehabilitate the site.
- Placement of material from stabilisation works and other earthworks in the quarry void to create a final landform suitable for future development into a community parkland.

OEH recommends that the EIS include an assessment of potential impacts on biodiversity and OEH estate (Attachment 1).

If you have any further questions about this matter please contact Dana Alderson on 8837 6304 or dana.alderson@environment.nsw.gov.au.

Yours sincerely

S. Harrison 31/08/17

SUSAN HARRISON
Senior Team Leader Planning
Greater Sydney

PO Box 644 Parramatta NSW 2124
Level 6, 10 Valentine Ave Parramatta NSW 2150
Tel: (02) 9995 5000 Fax: (02) 9995 6900
ABN 30 841 387 271
www.environment.nsw.gov.au

ATTACHMENT 1 – Office of Environment and Heritage - Hornsby Quarry Rehabilitation (EAR 1167)

1. Biodiversity

OEH data indicates the presence of the critically endangered Blue Gum High Forest vegetation community. It is therefore recommended the EARs include a biodiversity assessment to be undertaken in accordance with the draft *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (November 2004)* and the *NSW Guide to Surveying Threatened Plants (February 2016).* These guidelines and other information on threatened species surveys and assessments, can be downloaded from the OEH website at: www.environment.nsw.gov.au/threatenedspecies/surveyassessmentgdlns.htm.

OEH further recommends that the proposal be designed to avoid and minimise impacts on biodiversity and offset remaining direct and indirect biodiversity impacts. In determining an appropriate offset package it is recommended that the EIS:

a. Accord with the 13 OEH offsetting principles available at http://www.environment.nsw.gov.au/biodivoffsets/oehoffsetprincip.htm.
b. Use the BioBanking Assessment Methodology (OEH, 2014) to determine the quantum of offsets required to compensate for those remaining biodiversity impacts.
c. Identify the conservation mechanisms to be used to ensure the in-perpetuity protection and management of proposed offset sites.
d. Include a specific Statement of Commitments for the proposed offset package which is informed by a., b. and c. above and by any consultation with OEH.

With regard to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, the EIS should identify any relevant Matters of National Environmental Significance and whether the proposal has been referred to the Commonwealth or already determined to be a controlled action.

2. Impacts on OEH Estate

As the development adjoins Berowra Valley Regional Park, the EIS must address the matters to be considered as outlined in the *Guidelines for developments adjoining land managed by the OEH* (OEH, 2013) which include:

a. erosion and sediment control;
b. stormwater runoff;
c. wastewater;
d. management implications relating to pests, weeds and edge effects;
e. fire and the location of asset protection zones;
f. boundary encroachments and access through OEH lands;
g. visual, odour, noise, vibration, air quality and amenity impacts;
h. threats to ecological connectivity and groundwater dependent ecosystems; and
i. cultural heritage.

(END OF SUBMISSION)

NSW RURAL FIRE SERVICE

The Secretary
Department of Planning & Environment
GPO Box 39
Sydney NSW 2001

Your reference: 1167
Our reference: D17/2818
DA17081808822 KV

25 August 2017

Attention: Tertius Greyling

Dear Sir/Madam,

Proposed Development for Hornsby Quarry Rehabilitation

Reference is made to correspondence dated 17 August 2017 seeking input regarding the preparation of Secretary's environmental assessment requirements for the above State Significant Development in accordance with the *Environmental Planning and Assessment Act 1979.*

The New South Wales Rural Fire Service (NSW RFS) has reviewed the information provided and advises that no specific concerns related to bush fire protection are raised regarding the proposal which involves the rehabilitation of Hornsby quarry including partial backfilling, stabilisation and reshaping of the site for future use as a community parkland.

The aim and objectives of *Planning for Bushfire Protection 2006* should be considered in any subsequent development of the subject site for its intended use as a community parkland.

In this regard, the bush fire management measures outlined in *Plan of Management for Hornsby Park (POM): Hornsby Shire Council (2015) Hornsby Park Plan of Management (including Hornsby Quarry and Old Mans Valley)* shall be implemented for the monitoring and management of fuel loads within bush fire prone vegetation, particularly at the park interface. The roads and fire trails servicing the future parkland need to provide suitable access to areas of bush fire hazard for fire fighting and hazard mitigation purposes and evacuation routes for fire fighters and public during bush fire emergencies in accordance with *Planning for Bushfire Protection 2006*.

If you have any queries regarding this advice, please contact Kalpana Varghese, Development Assessment and Planning Officer, on 1300 NSW RFS.

Yours sincerely,

Nika Fomin
Manager, Planning and Environment Services (East)

Postal address
NSW Rural Fire Service
Records Management
Locked Bag 17
GRANVILLE NSW 2141

Street address
NSW Rural Fire Service
Planning and Environment Services (East)
42 Lamb Street
GLENDENNING NSW 2761

T 1300 NSW RFS
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Transport
Roads & Maritime
Services

23 August 2017

Our Reference: SYD17/01104
Dept Ref: SEAR 1167

Senior Environmental Assessment Officer
Industry Assessments
Department of Planning & Environment
GPO Box 39 SYDNEY NSW 2001

Attention: Tertius Greyling

Dear Sir/Madam,

SEARS REQUEST FOR HORNSBY QUARRY REHABILITATION
QUARRY ROAD, DURAL STREET, PEATS FERRY ROAD, HORNSBY

Reference is made to your email dated 15 August 2017 requesting Roads and Maritime Services (Roads and Maritime) to provide details of key issues and assessment requirements regarding the abovementioned development for inclusion in the Secretary's Environmental Assessment Requirements (SEARs).

Roads and Maritime require the following issues to be included in the transport and traffic impact assessment of the proposed development:

1. Daily and peak traffic movements likely to be generated by the proposed development including the impact on nearby intersections and the need/associated funding for upgrading or road improvement works (if required).

   The key intersections to be examined / modelled include:

   - Dural Street/Peats Ferry Road

2. Details of the proposed accesses and the parking provisions associated with the proposed development including compliance with the requirements of the relevant Australian Standards (ie: turn paths, sight distance requirements, aisle widths, etc).

3. Proposed number of car parking spaces and compliance with the appropriate parking codes.

4. Details of service vehicle movements (including vehicle type and likely arrival and departure times).

5. Roads and Maritime requires the Environmental Assessment report to assess the implications of the proposed development for non-car travel modes (including public transport use, walking and cycling); the potential for implementing a location-specific sustainable travel plan (eg 'Travelsmart' or other travel behaviour change initiative); and the provision of facilities to increase the non-car mode share for travel to and from the site. This will entail an assessment of the accessibility of the development site by public transport.

Should you have any further inquiries in relation to this matter, please do not hesitate to contact Hans Pilly Mootanah on telephone 8849 2076 or by email at development.sydney@rms.nsw.gov.au

Yours sincerely,

23/8/17

Mary Whalan
Director Network North Precinct

Appendix B – Consultation material

Memorandum

05 November 2018

To	Hornsby Shire Council		
Copy to			
From	Reem Finkelde	Tel	+61 2 9239 7423
Subject	Engagement Outcomes	Job no.	2126457

1 Introduction

Hornsby Quarry is a former breccia hard rock quarry that was operated by private business from the early 1900s and ceased in the late 1990s. The quarry is considered a safety risk and has therefore been closed to the public since that time.

Hornsby Shire Council (Council) acquired the site in 2002 and has since undertaken a number of investigations and studies with regard to the future use of the site and the environmental and technical constraints that the site poses. Through these studies, Council identified the need to:

- stabilise the quarry
- manage the site in a safe and environmentally sustainable manner, and
- actively seek opportunities to fill the quarry void with spoil arising from major infrastructure projects in the region

Council also resolved to ultimately develop the site into a community parkland.

In 2016 approval was granted to Roads and Maritime Services, to beneficially reuse up to 1.5 million cubic metres of excavated rock and soil from the construction of the NorthConnex tunnel to partially fill the Hornsby Quarry ('2016 Planning Approval'). Filling has commenced at the site under this approval and will conclude in 2019.

Following completion of filling by NorthConnex, Council is proposing to rehabilitate and reshape the site in a suitable way to ensure public safety and allow future development into a parkland for community use (the project).

Future development of the parkland including landscaping and installation of recreational facilities is a separate project and will be subject to a separate approval process. Further community consultation is occur to inform the design of the parkland. The new Hornsby Park is expected to be opened to the public in 2023.

GHD Pty Ltd (GHD) has been engaged by Council to prepare an Environmental Impact Statement (EIS) to support a development application for approval of the project.

2 Purpose of this memorandum

This memo provides a summary of the consultation activities undertaken by GHD during preparation of the Hornsby Quarry Rehabilitation EIS. This memo presents:

- Activities undertaken as part of the consultation process
- Stakeholders engaged as part of the consultation process
- Feedback and comments raised by community regarding the project

Council also engaged Elton Consulting to provide an expanded EIS consultation program. Details of this program and outcomes are provided in Elton Consulting (2018) 'Outcomes Report: Hornsby Park EIS Communication and Engagement'.

3 Engagement activities undertaken

Hornsby Council is committed to meeting the reasonable needs and the desires of the community for information and considering its views on the project. The objective of the early engagement was to:

- Provide targeted information to the community and stakeholders on the progress of the project and future construction activities, including the likely impacts and benefits;
- Ensure community and stakeholder feedback and issues are considered in the decision-making process;
- Ensure issues relating to project delivery are identified early and managed effectively;
- Manage stakeholder feedback and complaints in a timely, respectful way;
- Build stakeholder and community confidence in Hornsby Shire Council and its decisions

These objectives formed the basis of the Community and Stakeholder Engagement Plan which guided the engagement activities as described in Table 1 below.

Approximately 600 households around the Quarry site were directly notified of the project by a letter and fact sheet that were distributed by Australia Post. This letter and fact sheet are appended, as is the distribution map.

Table 1 Engagement activities

Activity	Date	Target Stakeholder	Stakeholders engaged
1300 Telephone line	Ongoing from 1 October	Local residents	Two phone calls
Community Information Email	Ongoing from 1 October	Local residents	No responses received
Letter and fact sheet	11 October 2018	Local residents	600 households

Activity	Date	Target Stakeholder	Stakeholders engaged
Community drop in sessions Hornsby Shire Council, Administration Centre, Peats Ferry Road, Hornsby	17 October 2018 22 October 2018	Local residents	Six attendees
Meeting Hornsby Shire Council, Administration Centre, Peats Ferry Road, Hornsby	1 November 2018	Local residents	Two attendees

4 Consultation outcomes

Throughout the Engagement Period, comments were received from 8 stakeholders. Two of the stakeholders attended drop in sessions as well as calling the information line. The comments made are documented below. The comments have been categorised into themes, with the two predominant themes relating to safety and noise.

Concerns regarding safety (particularly the regarding the gradient of the site)

- Steep road into site
- Both north and south sides of the site are unstable
- Safety cannot be driven by the community, safety is paramount
- Mayor lied when he said the quarry was unsafe

Concerns regarding noise on the site

- New works will be less noisy and lower impact than current works but might be worse for others
- EIS didn't involve local receivers of noise
- Noise and Vibration – no requirements to do dilapidation reports. Why only public buildings?

Other comments

Other comments received covered a variety of topics:

- EIS didn't involve local receivers of dust
- Intrigued by the changing shape of the quarry
- Happy that wildlife impacts have been taken into account

- Found the letter scary, wants to know what is being hidden.
- Upset about the existing engagement process for the project.
- The Hornsby Advocate (Newspaper) is no longer delivered to their area and we are concerned we have been excluded from the entire process.

The cumulative impact of other projects in the area had an influence on the engagement.

Some of the comments relate to the existing project (filling of the site with spoil from the NorthConnex project), whilst others relate to the future park design and use (which is communicated on the Council website). These comments were provided to Council for review/action.

11 October 2018

«Owner»
«Mailing_Add_1»
«Mailing_Add_2»
«Mailing_Add_3»

Dear Sir/Madam

The Hornsby Park Rehabilitation Project
Environmental Impact Statement Notification

Hornsby Shire Council has engaged GHD to complete environmental assessments for the rehabilitation of Hornsby Quarry. These assessments will feed into the preparation of the Environmental Impact Statement (EIS) for the Project.

The Hornsby Park Rehabilitation Project and the preparation of an EIS

The Hornsby Park Rehabilitation Project involves works to the existing Hornsby Quarry and adjoining Old Mans Valley to make the site safe for the public. The earthworks include reshaping to create a landform that will allow future development of a parkland. Once the quarry has been rehabilitated and reshaped, it will be repurposed into a recreation area for community use.

Now that partial filling of the quarry by NorthConnex spoil is nearing completion, an EIS needs to be prepared to support a Development Application seeking approval to undertake the rehabilitation and reshaping works. The EIS is being prepared to ensure the environmental, social and economic impacts of the project are considered.

How to get involved

The EIS will be on public exhibition in the coming months. For more information about the environmental assessments GHD is undertaking, the EIS process, or how you can make a submission, please see the information in the attached newsletter.

GHD staff will be available at the Council offices for two days on the following dates to answer any questions you may have about the EIS:

Date	Time	Location
Wednesday 17 October	9.00am to 5.00pm	Hornsby Shire Council Administration Centre, 296 Peats Ferry Road
Monday 22 October	9.00am to 5.00pm	Hornsby Shire Council Administration Centre, 296 Peats Ferry Road

To speak with a member of our project team, please contact our community information line on 1800 810 680 or email community.input@ghd.com.

Sincerely
GHD Hornsby Park Rehabilitation Project Team

GHD Pty Ltd ABN 39 008 488 373
Level 15 133 Castlereagh Street Sydney New South Wales 2000 Australia
T +61 2 9239 7100 **F** +61 2 9239 7199 **E** sydmail@ghd.com **W** www.ghd.com

Hornsby Park Rehabilitation Project – EIS Newsletter

Hornsby Park Rehabilitation Project

Hornsby Quarry (the western portion of Hornsby Park) is a former hard rock quarry that operated from the early 1900s to the 1990s. In 2002, Hornsby Council acquired the site from CSR. The quarry site has been closed to the public for many years due to safety concerns. Hornsby Council undertook a number of studies with regard to the potential future use of the site as well as the technical and environmental site constraints. Plans are now underway to transform the site into a publicly accessible park.

To begin this process, the Department of Planning and the Environment (DP&E) issued an approval to place up to 1.5 million cubic metres of spoil from the NorthConnex tunnel into the Hornsby Quarry void. This will be completed in the coming months.

Once the NorthConnex filling is complete, Council proposes to rehabilitate and reshape the site in a suitable way to ensure public safety and allow future development into a park for community use.

Hornsby Council engaged GHD to complete the environmental impact statement (EIS) for the next phase of the project: earth and landform shaping and stabilisation works. The EIS together with these earth works underpins later plans to create a park at the site.

What is an EIS?

An Environmental Impact Statement (EIS) is a document that provides information on a project, including its potential environmental impacts (both positive and negative). An EIS is used to inform development consent decisions. The EIS is developed in accordance with NSW Government expectations described in the Department of Planning and Environment Secretary's Environmental Assessment Requirements (SEARs). The process involves completing a number of specialist studies (being undertaken by GHD) as well as community and government agency consultation.

Specialist studies

GHD is completing environmental assessments as part of preparing the EIS. These specialist studies include:

- noise
- air quality
- water
- biodiversity
- cultural and heritage
- traffic
- visual amenity
- land resources
- waste
- rehabilitation

Recommendations will be made in the EIS about how to best protect the natural environment of the site. The EIS will be on exhibition in the coming months.

If you live in the vicinity of the quarry, you may notice these assessments occurring. For more information on what is involved with these assessments, feel free to contact our community relations team on 1800 810 680 or email community.input@ghd.com

How can you get involved?

As part of the assessment process, the EIS will be on exhibition for comment.

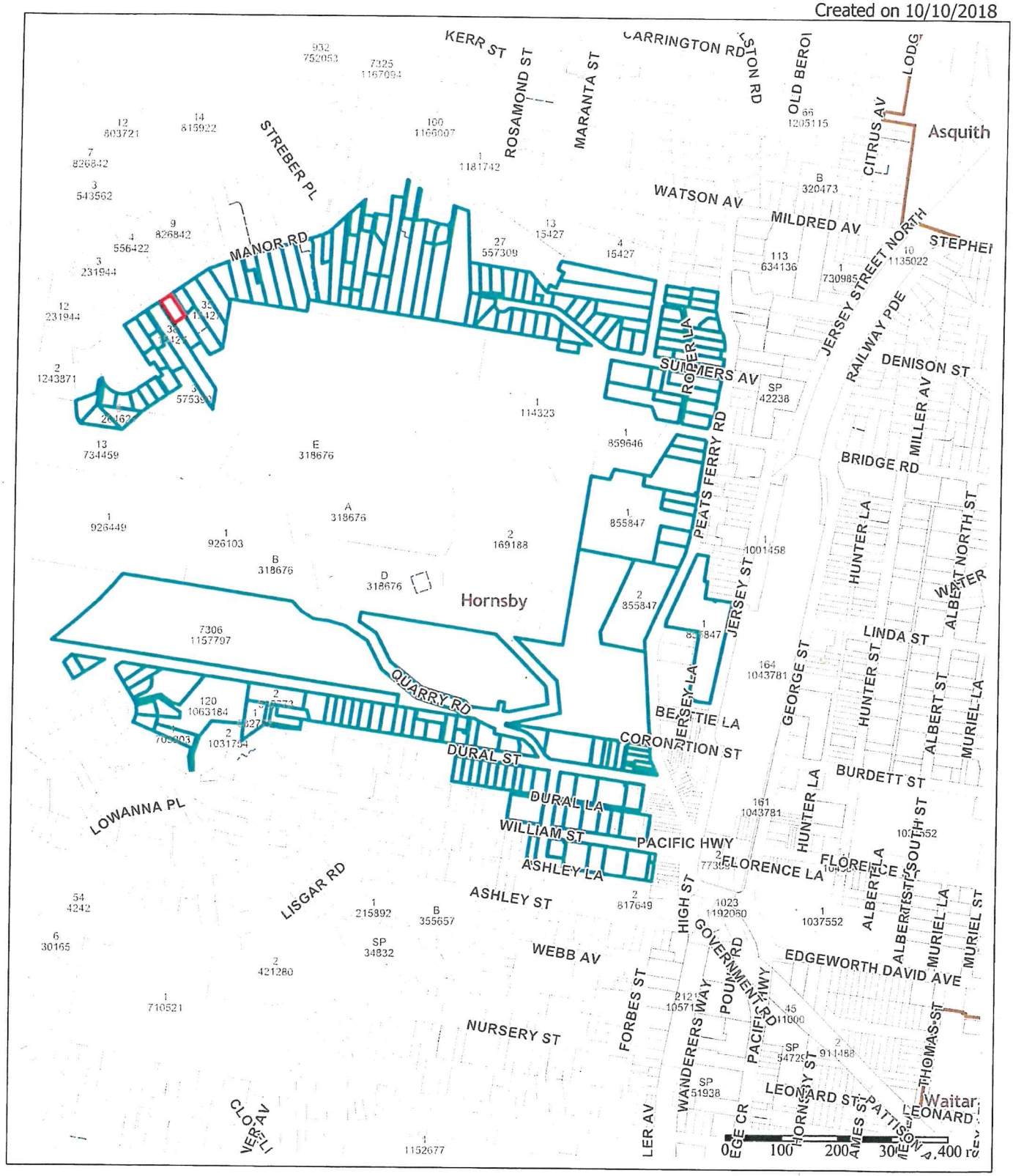
Further information on the park proposals can be found at the Council website: hornsbypark.com.au

Contact us

Phone: 1800 810 680
Email: community.input@ghd.com

GHD Pty Ltd ABN 39 008 488 373
Level 15 133 Castlereagh Street Sydney New South Wales 2000 Australia
T +61 2 9239 7100 **F** +61 2 9239 7199 **E** sydmail@ghd.com **W** www.ghd.com

Created on 10/10/2018



HORNSBY SHIRE COUNCIL	Location of notified properties	Map Scale: 1:9028 at A4 Portrait		
Hornsby Shire Council 296 Peats Ferry Road HORNSBY NSW 2077 Telephone: 02 9847 6666 Email: hsc@Hornsby.nsw.gov.au	*Important Notice!* **Dimensions, location of features and boundaries are indicative only, their actual position has not been surveyed. Aerial photography may not align with cadastral boundaries. Hornsby Shire Council accepts no responsibility for any incident arising from any inaccuracy.** 	**Projection:**	GDA94 / MGA zone 56	
		Date:	10/10/2018 9:53 AM	

22 January 2018

<Contact>
<Title>
<AGENCY>
<Street>
Suburb NSW Postcode

Our ref: 2126457-19413
Your ref:

Dear <Sir/Madam>

Hornsby Quarry Rehabilitation EIS
Request for comment

Hornsby Shire Council (Council) is proposing works to the Hornsby Quarry site located off Dural Street and Bridge Road in Hornsby. Council's objectives are to rehabilitate and reshape the site in a suitable way to ensure public safety and allow future development into a parkland for community use. The future parkland development would be subject to a separate approval. A brief project outline and context for the project is attached to this letter.

The project is considered development for the purpose of recreational area, which is permissible with consent requiring submission of a new development application to Council. The project also involves processing of materials for recycling and reuse and therefore is considered to trigger designated development provisions for crushing grinding and separating works, requiring an environmental impact statement (EIS) to be prepared to support the development application. Accordingly an EIS is being prepared subject to determination under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

As the project also has a capital investment value of more than $5 million, it is also defined as regional development under Clause 4 of Schedule 4A of the EP&A Act. The project will therefore be notified and assessed by Council, however the consent authority is the Sydney North Planning Panel.

The EIS is being prepared based on the Secretary of the Secretary's Environmental Assessment Requirements (SEARs) No 1167.

Consultation is an integral component of the project as it allows relevant government agencies to be informed of the project and provides an opportunity for you to provide your feedback.

As part of this process, we are now seeking comments from relevant agencies and authorities. It would be appreciated if you could advise of any issues that you feel should be addressed in the EIS by no later than **16 February 2018**.

Should you have any further queries, please do not hesitate to contact Anna Montgomery on 02 9239 7379.

Sincerely
GHD Pty Ltd

Anna Montgomery
Senior Environmental Engineer
+61 2 9239 7379

Attachments:

- Description of the project and context
- Sketch SK206 Extent of works (preliminary)

Description of the project and context

Hornsby Quarry is a former breccia hard rock quarry that was operated by private business from the early 1900s and ceased in the late 1990s. The quarry is considered a safety risk and has therefore been closed to the public since that time.

Council acquired the site in 2002 and has since undertaken a number of investigations and studies with regard to the future use of the site and the environmental and technical constraints that the site poses. Through these studies, Council identified the need to:

- stabilise the quarry
- manage the site in a safe and environmentally sustainable manner, and
- actively seek opportunities to fill the quarry void with spoil arising from major infrastructure projects in the region

Council also resolved to ultimately develop the site into a community parkland.

In 2016 approval was granted to Roads and Maritime Services (RMS), to beneficially reuse up to 1.5 million cubic metres of excavated rock and soil (spoil) from the construction of the NorthConnex tunnel to partially fill the Hornsby Quarry. Filling is well progressed at the site under this approval.

Following completion of filling by NorthConnex, Council is proposing to rehabilitate and reshape the site in a suitable way to ensure public safety and allow future development into a parkland for community use (the project). Key features of the project include:

- Stabilisation works to the both the north and south faces of the Hornsby Quarry void to make them safe
- Earthworks across other parts of Hornsby Park in order to rehabilitate the site
- Placement of material from stabilisation works and other earthworks in the quarry void to create a final landform generally in accordance with Option 1 in the Clouston Associates (2014) *Recreation Potential Study for Hornsby Quarry and Old Mans Valley Lands*.

Up to one million cubic metres of spoil is expected to be generated from the stabilisation of the north and southern faces as well as obtained from nearby onsite earthworks. This material would be placed on the NorthConnex spoil to create a landform that generally slopes from the proposed lake up to the top of the western quarry face and would allow for the creation of a new parkland to be constructed within the quarry void. The landform would include a lake directly below the exposed eastern face of the quarry.

No spoil would be imported or transported off the site.

A conceptual design for the proposed reshaping and stabilisation works has been developed by Council. The final design would be developed as the planning for the proposed future parkland progresses and final required parkland landform is refined as a result of further definition of site constraints and consultation with the community.

The attached sketch (SK206) shows the proposed extent of works on the site.

The project is expected to take approximately two years to complete.

Description of the project and context

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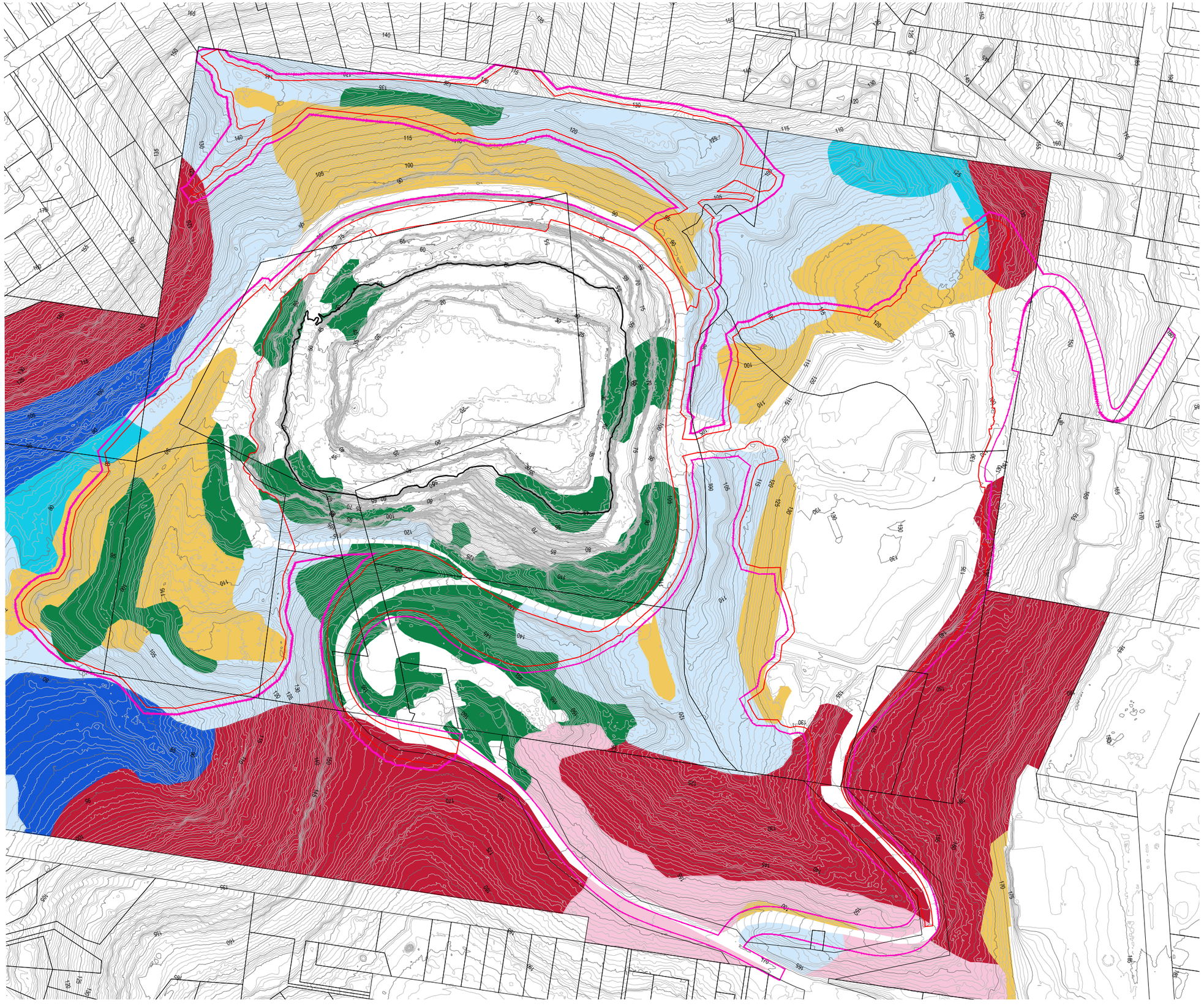
The attached sketch (SK206) shows the proposed extent of works on the site.

The project is expected to take approximately two years to complete.



LEGEND

- CADASTRE
- ASSUMED EXISTING SURFACE
- PIT FILLING EXTENT
- EARTHWORKS DESIGN EXTENT
- STUDY AREA

VEGETATION COMMUNITY (FROM KLEINFELDER 6 MARCH 2017)

- BLUE GUM DIATREME FOREST (MODERATE-GOOD_HIGH)
- BLUE GUM DIATREME FOREST (MODERATE-GOOD_MEDIUM)
- BLUE GUM DIATREME FOREST (MODERATE-GOOD_POOR)
- BLACKBUTT GULLY FOREST (MODERATE-GOOD_HIGH)
- BLACKBUTT GULLY FOREST (MODERATE-GOOD_POOR)
- NATIVE REHABILITATION / REGENERATION
- EXOTIC VEGETATION

0 30 60 90m
SCALE 1:3000 AT ORIGINAL SIZE

N

PRELIMINARY

rev	description	app'd	date
C	REVISED		15.11.17
B	REVISED		08.11.17

HORNSBY SHIRE COUNCIL
HORNSBY QUARRY REHABILITATION EIS

EXTENT OF WORKS

Level 15, 133 Castlereagh Street, Sydney NSW 2000 Australia
T 61 2 9239 7100 **F** 61 2 9239 7199
E sydmail@ghd.com **W** www.ghd.com

scale	1:3000 for A3	job no.	2126457
date	NOV 2017	rev no.	C

approved (PD) SK206

Plot Date: 15 November 2017 - 8:22 PM Plotted by: Alison Horlyck Cad File No: G:\21\26457\CADD\Drawings\21-26457-SK206.dwg

Outcomes Report

Hornsby Park EIS Communication and Engagement

Client: Hornsby Shire Council
Date: 20 November 2018

A Veris Company

Contact:

Calli Brown
calli.brown@elton.com.au

SYDNEY
02 9387 2600

Level 6, 332 - 342 Oxford Street
Bondi Junction NSW 2022

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consulting@elton.com.au
Sydney | Brisbane | Canberra | Darwin | Melbourne | Perth
ABN 56 003 853 101

Prepared by	Calli Brown
Reviewed by	Malia Corry
Date	20 November 2018
Version	Final

Contents

1 Project Background

Hornsby Quarry is located within a picturesque bushland setting less than a kilometre away from Hornsby's thriving CBD. The quarry, which is 100 metres deep with steep sides, has been fenced off and disused for decades. As a result, very few have had the opportunity to appreciate its astonishing beauty. In 2015, Hornsby Council announced that they would transform the quarry and surrounding area into a parkland. Importantly, Council also committed to ensuring it would be "designed, owned, used and loved by residents". In 2017, the community was asked to "Plan Your Parkland" by providing their blue sky aspirations for the site. The high level results of the engagement are captured in the graphic below:

Most popular activities and attractions requested by the community

Walking tracks

Picnic areas and open spaces

Mountain biking

Environmental

Cafés / restaurants

Arts / community / historical facilities

2 Project Context

At the conclusion of the 'Plan Your Parkland' round of engagement, Council embarked on preparing an EIS (Environmental Impact Statement) and Development Application.

An EIS is a publicly available document that provides information on the proposal to create a landform for the parkland. The EIS will address environmental impacts and mitigation measures of the proposal and is used to inform development consent decisions.

The Hornsby Park EIS has been investigating the site's environmental constraints, and will outline the earthworks that will be needed to create landforms and spaces that are safe and flexible for a range of recreational uses. An important aspect of the EIS is to make some recommendations about how to best protect the natural environment of the site, including the Critically Endangered Ecological Communities (CEEC) found on the site.

The EIS will also:

» investigate environmental constraints and outline the extent of earthworks required to be undertaken to create the landform and space that will be safe and flexible for future regeneration and recreation purposes

» recommend how to best protect the natural environment of the site, including the CEEC (Critically Endangered Ecological Communities)

» inform Council investigations into the types of recreation or other activities that may be conceived in various parts of the site and how these sites will be accessible and connected, and

» inform Council in the development of a parkland that respects and celebrates the unique geology, landform and magnificent bushland surrounds.

3 Engagement Snapshot

As part of the EIS and Development Application process, Council is required to consult immediate neighbours. However, Council has expanded engagement to also include the following activities:

Communication channels:

» Email blast to 40,000 residents

» Letters and emails to stakeholders

» Project website updated

» Community Deliberative Forum & Stakeholder meeting presentations

» Information boards at Hornsby Mall community Swing-By

» Social media posts, media release

Engagement Activities:

» Presentation to Hornsby Shire Council

» Reconvene the Community Deliberative Forum

» Stakeholder meeting with Environmental and Bushwalking Stakeholder groups

» Community Swing-By Session in the Mall

4 Engagement Outcomes

As part of the EIS engagement, briefings were given to stakeholders about the EIS process. These briefings consisted of a presentation, followed by a question and answer session. Attendees were also encouraged to ask questions during the presentation. The details of each activity are outlined below

4.1 Councillor Briefing

Hornsby Shire Council Chambers

Wednesday 3 October, 5:30pm– 7pm

5 Councillors in attendance

Presentation:

The presentation included the following information:

» Recap of 'Plan your Parkland'

» Site landform overview

» What type of Park are we creating?

» Environmental Impact Statement – what is it?

» Geotechnical Investigations – balancing safety and CEEC

» The way forward & Next Steps

» Community Consultation

» Open discussion and questions

Open discussion and questions:

During the presentation and following it, the following points were raised by the Councillors:

Geotechnical investigations

» Councillors were interested in understanding in more detail the types of engineering interventions that would be used

Consultation

» Councillors requested to see the Communications and Engagement strategy

Future design

» Councillors were keen to start thinking about what type of activities could be enjoyed at each of the Park's location

4.2 Community Deliberative Forum

Hornsby Shire Council Chambers

Saturday 27 October, 11am – 1pm

6 CDF members in attendance

The Mayor and 2 Councillors in attendance

The Community Deliberative Forum consisted of a presentation where attendees were encouraged to ask questions throughout, followed by an open discussion plus a dedicated questions and answer session. Attendees were very interested in hearing about the work that has been undertaken, and asked many questions throughout.

Presentation:

The presentation included the following information:

» Recap of 'Plan your Parkland'

» Site landform overview

» What type of Park are we creating?

» Environmental Impact Statement – what is it?

» Geotechnical Investigations – balancing safety and CEEC

» The way forward & Next Steps

» Community Consultation

» Open discussion and questions

Open discussion and questions:

During the presentation and following it, the following points were raised by attendees:

Filling of the quarry

» Participants were curious about the type of fill, when it will be finished and the visibility of the diatreme

Accessible path

» Support was expressed for the accessible path and there was a general discussion about its proposed route

The EIS

» One participant asked for clarification regarding the studies that are being undertaken

Environmental considerations

» One participant was interested to know if the impact on the EEC will be managed through an offset program. Council staff confirmed this would be the case, but the details are yet to be worked out.

General Comments

» All participants were very supportive of the work that has been undertaken as part of the EIS process

» All participants are enthusiastic about the next steps of designing the park and being actively involved through their membership of the CDF

» One participant noted that communication through Social media is very important to promote all engagement activities

» It was suggested that Hornsby South Public School would be a good place to engage with the community during drop off and pick up times as there are a lot of people around.

» A general reflection was made by all participants of the long term nature of the project, and how it will be funded.

4.3 Stakeholder Briefing – Environmental and Bushwalking groups

Hornsby Shire Council Chambers

Tuesday 30 October, 6:30pm – 7:30pm

6 participants in attendance

The Mayor and one Councillor in attendance

Presentation:

The presentation included the following information:

» Recap of 'Plan your Parkland'

» Site landform overview

» What type of Park are we creating?

» Environmental Impact Statement – what is it?

» Geotechnical Investigations – balancing safety and CEEC

» The way forward & Next Steps

» Community Consultation

» Open discussion and questions

Open discussion and questions:

During the presentation and following it, the following points were raised by attendees:

Geotechnical investigations

» Attendees were curious about both local and global stability resulting from mining operations and were satisfied with the investigations that have been undertaken as part of the EIS

Environmental factors

» Attendees were interested to know that the blue gum forest that needs to be removed for safety reasons is of low quality. They were also interested to hear about the amount and location of the mapped blue gum forest. A question was raised about the likelihood of environmental offsets, and the group were told that this would probably be the case, but details are yet to be finalised.

Access

» All attendees were very interested and supportive in the accessible pathway and how it will link with other pathways, and look outs

Earthworks

» Attendees were interested to hear that the earth works will be starting in 2020 and are expected to last for almost two years. They were also happy to hear that the diatreme wall will still be exposed

Funding

» Attendees were interested in how the park will be funded over time and were pleased to hear the state governments initial $50 million is available for the park's development.

Car parking

» Attendees were keen to start thinking about car access to the future park and the areas where cars will be able to parks

4.4 Swing-By Session

Hornsby Mall

Saturday 3 November

11am - 2pm

220 people engaged

The Mayor and one Councillor in attendance

To engage and inform as many Hornsby residents as possible about the EIS, an informal Swing-By Session was held in the mall. The Swing-By was attended by three members of the project team, and two Elton Consulting staff who actively spoke to people explaining the EIS process. A number of AO presentation boards were on easels displaying information about the project and acted as a cue for further questions and discussion with team members. Copies of these boards are included in the appendix.

The Swing-By was promoted to residents through Councils communications channels, including:

» Email to 40,000 residents

» Social media posts

» Messaging on the Hornsby Station Footbridge digital display

» Media coverage in the Hornsby Advocate dated Thursday 1st November 2018

The overwhelming majority of people engaged were very supportive of the proposed EIS, and excited about the future of the park. Of the 220 people actively engaged, less than 5 people expressed a negative reaction. These were not about the EIS itself, but rather the site's vexed history.

The following comments reflect the general sentiment expressed by the vast majority of people engaged:

"That's a good idea"

"It's a great use of the land"

"As long as it can be multi-purpose"

"Walkways and bushwalks"

"So many people will be able to enjoy this"

"I'm glad I'm not the only one who wants spaces to relax and hang out"

"It's good that something is finally being done, so people can use the space"

"Link it with other trails" (the earthworks to create the paths)

"Great for the younger generation of Hornsby"

"That's great to hear you will be creating an amphitheatre"

"How much fill…. so it's almost completed"

"The accessible path is cool!"

"Thanks for the explanation"

4.5 Consultation with Neighbours

GHD's EIS project team established communication channels with the residents surrounding the quarry site to inform them about the EIS studies being undertaken, and the EIS process moving forward.

Communication channels

A letter with an accompanying fact sheet was distributed to approximately 600 immediate neighbours. This was a statutory requirement before the EIS is finalised. The letter provided a number of communication channels for the local community to discuss the project with the EIS project team. This included an email address and telephone number, and advertised two information drop in days at Council Offices. These drop in days provided an opportunity for residents to discuss the work with the EIS project team in person. These community drop in days were held at Hornsby Council Offices on Wednesday 17 and Monday 22 October 2018. In addition to these sessions, two residents also requested a meeting which was conducted with the project team on 1 November 2018.

During this consultation period, the project team received feedback from 10 individuals. This feedback was collected via the following channels:

- Community drop in sessions – 6 individuals
- Meeting – 2 individuals
- Phone calls – 2 individuals
- Emails – none received

Comments collected

Comments gathered during this period have been collated together below. Similar to the Swing-By Session held at Hornsby Mall, many of the comments and feedback provided did not apply directly to the EIS or the earthworks project but rather to the future park or earlier NorthConnex works. Of the comments provided and identified to specific sections of the greater project, 22 related to NorthConnex, 25 to the concept design and operation of the future park, and only 13 to the Earthworks for rehabilitating the park.

We have listed the comments relating to the EIS below by topic:

Visual amenity

- "Intrigued by the changing shape of the Quarry"

Vegetation and Environment

- "Happy that wildlife impacts have been taken into account"

Noise

- "New works will be less noisy and lower impact than current works but might be worse for others"
- "EIS didn't involve local receivers of noise"
- "Noise and Vibration – no requirements to do dilapidation report. Why only public buildings?"

Safety

- "Steep road into site"
- "Both north and south sides of the site are unstable"
- "Safety cannot be driven by the community, Safety is paramount"

Inadequate consultation

- "Found letter scary, wants to know what is being hidden"
- "Upset about the existing engagement process for the project"

- "Advocate (Newspaper) is no longer delivered to their areas – concerns they have been excluded from the entire process"

Dust and air pollution

- "EIS didn't involve local receivers of Dust"

elton consulting

www.**elton**.com.au

DOC18/78974

Ms Anna Montgomery
Senior Environmental Engineer
GHD Pty Ltd
Level 15, 133 Castlereagh St
Sydney NSW 2000

Dear Ms Montgomery

By Electronic Mail

Hornsby Quarry Rehabilitation EIS Request for Comment

I refer to your letter dated 25 January 2018 requesting comment on matters to be included in the Hornsby Quarry Rehabilitation Environmental Impact Assessment ("EIS"), which was received by the Environment Protection Authority ("EPA") on the 30 January 2018.

Based on the information provided, the proposal will involve crushing, grinding and separation works processing of more than 150 tonnes of materials per day, which constitutes a Scheduled Activity under Schedule 1(16) of the *Protection of the Environment Operations Act 1997* ("POEO Act"). Therefore, the EPA considers that this proposal will require an Environment Protection Licence ("EPL") under the POEO Act.

The EPA has identified the following matters to be included in the EIS:

- A detailed map of the proposed project location including topography and landscape identifying the sensitive receptors, natural water bodies, wetlands, environmentally protected areas and location of ground water monitoring bores in the surrounding environment;
- Justification of the site suitability for the project including soil analysis reports before commencement of any rehabilitation works;
- Detailed assessments of the potential impacts of the rehabilitation works to all sensitive receptors and the receiving environment including air, water, land, vegetation, noise, wastes and flora & fauna; and
- Detailed information on the mitigation measures proposed to manage the above impacts to attain the required environmental goals and/or guidelines.

If you have any questions relating to this matter, please contact Lilian De Torres on (02) 9995 5059 or Lilian.DeTorres@environment.nsw.gov.au.

Yours sincerely

Mark Carey
Acting Unit Head – Sydney Industry
Environment Protection Authority

15 February 2018

Planning Services
Resource Assessments
Name: Tertius Greyling
Phone: 9274 6402
Email: tertius.greyling@planning.nsw.gov.au

Dr Kirsten Crosby
GHD Pty Ltd
Level 15, 133 Castlereagh Street
Sydney NSW 2000

Dear Dr Crosby

Hornsby Quarry Rehabilitation (EAR 1167)
Biodiversity Assessment Methodology

I refer to the Environmental Assessment Requirements (EARs) issued on 6 September 2017 (EAR 1167) and your subsequent request on 24 May 2018 for exemption from the application of the Biodiversity Assessment Method (BAM) under the *Biodiversity Conservation Act 2016 (BC Act)*.

The Department received your application for EARs on 11 August 2017. EAR 1167 require the application of the Biobanking Assessment Methodology (BBAM) and associated *Threatened Biodiversity Survey and Assessment Guidelines for Developments and Activities (November 2004)* and *NSW Guide to Surveying Threatened Plants (February 2016)*. However, on 25 August 2017, the BC Act commenced, thereby introducing requirements to undertake biodiversity impact assessment in accordance with the BAM instead of the BBAM.

In accordance with clause 27(1)(d) of the *Biodiversity Conservation (Savings and Transitional) Regulation 2017*, if the Department determines in writing that substantial environmental assessment commenced before 25 August 2017, then transitional arrangements for the development application would apply. In that case, the environmental assessment could continue in accordance with the BBAM but the assessment must be submitted within 18 months of the date of the determination. This interim provision was confirmed by the Office of Environment and Heritage in correspondence on 24 April 2018 (see attached).

On 24 May 2018, you submitted evidence of the environmental assessment activities which had been undertaken prior to 25 August 2017, including detailed vegetation mapping (eg delineation of vegetation zones in accordance with the BBAM and survey of a number of BBAM plot/transects) of the Hornsby Quarry and Old Man's Valley lands by Kleinfelder, dated 6 March 2017. You also pointed out that the Environmental Impact Statement (EIS) would build on detailed biodiversity assessment undertaken at the site in 2015, in accordance with the Framework for Biodiversity Assessment, to support the approved Hornsby Quarry Project for Northconnex.

Accordingly, the Department determines that substantial environmental assessment had commenced prior to 25 August 2017 and that the environmental assessment may continue in accordance with the BBAM.

Please submit the EIS within 18 months of the date of this letter or before the expiry of the EARs, whichever occurs first.

If you have any enquiries about this matter, please contact Tertius Greyling on 9274 6402.

Yours sincerely

Howard Reed 15·6·18
Director
Resource Assessments
As delegate of the Secretary

CC: Office of Environment and Heritage
Hornsby Shire Council

NSW GOVERNMENT | Office of Environment & Heritage

DOC18/236461
EAR 1167

Mr Tertius Greyling
NSW Department of Planning and Environment
GPO Box 39
SYDNEY NSW 2001

Dear Mr Greyling

OEH comments on SEARs – Hornsby Quarry Rehabilitation – local designated development (EAR 1167) – biodiversity assessment advice

I refer to the Office of Environment and Heritage (OEH) submission of 31 August 2017 on the environmental assessment requirements (EARs) for the Hornsby Quarry Rehabilitation local designated development.

On 21 March 2018, OEH received an email from GHD which sought to confirm the methodology for the biodiversity assessment for this project. GHD also requested a meeting with OEH and Hornsby Council to discuss the approach to determining the number and type of offset credits required.

As critically endangered Blue Gum High Forest vegetation community occurs at the site, OEH advised in its EARs submission that the EARs include a biodiversity assessment to be undertaken in accordance with the draft Threatened Biodiversity Survey and Assessment: guidelines for Developments and Activities (November 2004) and the NSW Guide to Surveying Threatened Plants (February 2016).

The EARS were issued on 6 September 2017 and include a copy of the OEH response as an attachment. The EARs require for biodiversity:

- accurate predictions of any vegetation clearing on site
- a detailed assessment of the potential biodiversity impacts of the development, paying particular attention to threatened species, populations and ecological communities and groundwater dependent ecosystems
- a detailed description of the proposed measures to maintain or improve the biodiversity values of the site in the medium to long term, as relevant and
- an assessment of whether a species impact statement (SIS) is required.

Following the query by GHD, OEH revisited the provisions for biodiversity assessment introduced by the commencement of Biodiversity Conservation Act 2016 (BC Act) on 25 August 2017. As the application had not yet been made, the correct biodiversity assessment pathway would require the proponent to assess the development in accordance with the BC Act 2016 and the biodiversity assessment method.

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However, if the Department of Planning and Environment determines in writing that substantial environmental assessment was undertaken for the EIS before 25 August 2017, then Clause 27(1)(d) *pending or interim planning application* of the BC Savings and Transitional Regulation may apply. The application must be made within 18 months of that determination for the saving and transitional provisions to apply. Such a determination would allow for the former planning provisions to apply (Clause 28(1)) and the EARs for biodiversity issued on 6 September 2017 would remain appropriate for this development.

As the project is a local designated development, OEH has no further need to be involved in the assessment of this project unless it is determined that a SIS is required.

If you have any queries regarding this matter, please contact Janne Grose on **t** :8837 6017 or **e**: janne.grose@environment.nsw.gov.au

Yours sincerely

S. Harrison 24/04/18

SUSAN HARRISON
Senior Team Leader Planning
Greater Sydney
Regional Operations

CC: Danielle Williams – GHD
Kath Chesnut - GHD

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Appendix C – Noise and vibration assessment

Hornsby Shire Council

Hornsby Quarry Rehabilitation EIS

Noise and Vibration Impact Assessment

November 2018

Executive summary

Hornsby Shire Council proposes to rehabilitate the Hornsby Quarry void to create a landform suitable for future development as community parkland, which will require filling and stabilisation. The landform would include a lake directly below the exposed eastern face of the quarry. This Biodiversity Impact Assessment has been prepared in accordance with the Secretary's Environmental Assessment Requirements to describe the biodiversity values present in the study area and assess impacts of the project, and in particular assess whether the project is likely to have a significant impact.

The project site operated as a hard rock quarry from the early 1900s to the late 1990s. The quarry void has been closed to the public as it poses a potential risk to public safety due to its depth and steep exposed sides. The quarry pit is approximately 300 m wide and prior to the commencement of filling by NorthConnex was more than 100 m deep.

This report assesses the potential noise and vibration impacts from the proposed construction activities at Hornsby Quarry (the Project).

Noise and vibration impacts - Interim Construction Noise Guideline (ICNG)

Noise levels are predicted to exceed the construction noise management levels (NMLs) at most of the sensitive receivers within the study area during recommended standard hours. Noise levels are not predicted to exceed the highly noise affected criteria at any residential receivers.

It is typical for construction projects to exceed the construction noise management levels. Any impacts due to construction works will be temporary during the construction period and would not represent a continuous impact on the community and surrounding environment due to changes in activities and plant used. The predicted noise levels are generally considered conservative and would likely only be experienced for limited periods during construction. Potential impacts would be reduced through the introduction of feasible and reasonable mitigation measures which have been recommended within this report.

Safe working distances for vibration activities have been identified for structural damage to standard/heritage structures and for human comfort. No adverse structural damage impacts to buildings are anticipated as a result of the project. One building within Hornsby TAFE has been identified within the safe working distance for human comfort. Mitigation measures have been recommended to reduce potential construction vibration impacts.

Noise impacts – Noise Policy for Industry (NPI)

Noise levels are predicted to exceed the project trigger noise levels (PTNLs) during the daytime period at most of the sensitive receivers within the study area.

Note should be made that the Noise Policy for Industry (NPI) is generally used to assess permanent noise impacts to sensitive receivers due to the operation of industrial premises or developments. Construction activities are excluded from the NPI as they are temporary in nature. Section 1.5 of the NPI make specific reference to activities and facilities that are excluded from the policy, one of these being construction activities. Never-the-less, potential noise impacts have been assessed against the NPI and ICNG criteria to adequately satisfy the acoustic requirements detailed within the Secretary's Environmental Assessment Requirements (SEARs 1167).

Mitigation measures have been recommended to reduce potential noise impacts. Subsequent to the incorporation of these mitigation measures, the residual noise impact is predicted to still exceed the PTNLs at the nearest sensitive receivers.

Construction road traffic noise

Traffic noise levels resulting from construction vehicle movements are predicted to meet the *Road Noise Policy* (DECCW, 2011) noise criteria when assessed at residences adjacent to Bridge Road, Peats Ferry Road, Dural Street and Quarry Road.

Mitigation measures

Mitigation measures have been recommended to reduce potential noise impacts at sensitive receivers during the construction works. The following is a summary of the mitigation measures:

- Management measures (times of operation, respite periods, community consultation, provision of a noise monitoring program etc.)
- Control at the source (substitutions for quieter equipment, modification of existing equipment, use and siting of plant, regular maintenance of equipment and alternative construction methods)
- Control in transmission (noise barriers have been assessed and modelled and are not considered as a reasonable and feasible mitigation option)
- Receiver controls (not a reasonable and feasible mitigation option as the works are temporary and will result in a benefit to the community when the works are completed)

Glossary

Term	Definition
Adverse meteorology	Meteorological effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time.
Calm	Where noise enhancing meteorological conditions do not occur at a site for a significant period of time.
dB	Decibel is the unit used for expressing the sound pressure level (SPL) or power level (SWL) in acoustics.
dBA	Decibel expressed with the frequency weighting filter used to measure 'A-weighted' sound pressure levels, which conforms approximately to the human ear response, as our hearing is less sensitive at low and high frequencies.
$L_{Aeq(period)}$	Equivalent sound pressure level: the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
$L_{A90(period)}$	The sound pressure level that is exceeded for 90 per cent of the measurement period.
$L_{Aeq(15hr)}$	The L_{Aeq} noise level for the period 7:00 to 22:00 hours.
$L_{Aeq(9hr)}$	The L_{Aeq} noise level for the period 22:00 to 7:00 hours.
L_{Amax}	The maximum A-weighted sound pressure level occurring in a specified time period.
Noise sensitive receiver	A noise modelling term used to describe a map reference point where noise is predicted. They consist of areas or places potentially affected by noise or vibration including: • a residential dwelling • an educational institution, library, childcare centre or kindergarten • a hospital, surgery or other medical institution • an active (for example sports field, golf course) or passive (for example national park) recreational area • commercial or industrial premises • a place of worship.
Peak particle velocity	Peak particle velocity is the maximum vector sum of three orthogonal time-synchronized velocity components regardless of whether these component maxima occurred simultaneously.
Rating background level	The overall single-figure background noise level representing each assessment period (day/evening/night) over the whole monitoring period.
Tonality	Noise containing a prominent frequency or frequencies characterised by definite pitch.
VDV	Vibration dose value - As defined in BS6472 – 2008, VDV is given by the fourth root of the integral of the fourth power of the frequency weighted acceleration.
Vibration	The variation of the magnitude of a quantity which is descriptive of the motion or position of a mechanical system, when the magnitude is alternately greater and smaller than some average value or reference. Vibration can be measured in terms of its displacement, velocity or acceleration. The common units for velocity are millimetres per second (mm/s).

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1. Introduction

1.1 Overview

Hornsby Quarry is a former breccia hard rock quarry that was operated by private business from the early 1900s and ceased in the late 1990s. The quarry is considered a safety risk and has therefore been closed to the public since that time.

Hornsby Shire Council (Council) acquired the site in 2002 and has since undertaken a number of investigations and studies with regard to the future use of the site and the environmental and technical constraints that the site poses. Through these studies, Council identified the need to:

- stabilise the quarry
- manage the site in a safe and environmentally sustainable manner, and
- actively seek opportunities to fill the quarry void with spoil arising from major infrastructure projects in the region

Council also resolved to ultimately develop the site into a community parkland.

In 2016 approval was granted to Roads and Maritime Services, to beneficially reuse up to 1.5 million cubic metres of excavated rock and soil (spoil) from the construction of the NorthConnex tunnel to partially fill the Hornsby Quarry (the '2016 Planning Approval'). Filling has been undertaken at the site under this approval.

Following completion of filling by NorthConnex, Council is proposing to rehabilitate and reshape the site in a suitable way to ensure public safety and allow future development into a parkland for community use (the project).

1.2 Purpose of this report

GHD Pty Ltd (GHD) has been engaged by Council to prepare documentation to support a development application for approval of the project under Part 4 of the New South Wales (NSW) *Environmental Planning and Assessment Act 1979* (the EP&A Act). The Environmental Impact Statement (EIS) is being prepared in accordance with the provisions of the EP&A Act.

This report has been prepared by GHD to provide an impact assessment of noise and vibration as an input to the EIS. This report addresses the Secretary of the NSW Department of Planning and Environment's Environmental Assessment Requirements (EAR 1167) dated 6 September 2017.

1.3 Project location

The project is located in the Hornsby local government area (LGA), approximately 21 kilometres (km) to the north west of the Sydney central business district. The site is accessible via Quarry Road (off Dural Street and other local roads) from the south east and from Bridge Road (off the Peats Ferry Road from the north east.

Figure 1 shows the location of the site and the surrounding planning zones.

1.4 Project overview

Key features of the project include:

- Rehabilitation, stabilisation and geotechnical safety management works around various parts of the site

- Earthworks and placement of material won from within the site to create a final landform similar to Option 1 in the Clouston Associates (2014) 'Recreation Potential Study for Hornsby Quarry and Old Mans Valley Lands' (p.88).

Approximately 500,000 m^3 of spoil is expected to be generated from stabilisation of the northern face as well as obtained from nearby onsite earthworks. Much of this material would be placed on the NorthConnex spoil to create a landform that generally slopes from the proposed lake up to the top of the western quarry face and would allow for the creation of a new parkland to be constructed within the quarry void. The landform would include a lake directly below the exposed eastern face of the quarry. There would also be cut and fill works on Old Mans Valley to create a landform suitable for future development into playing fields and other recreational activities.

It is expected that a combination of ripping, rock breaking and rock sawing will be required to shift the material. Rock fragments would be crushed onsite using a mobile crusher or rock breaker prior to placement as fill.

No additional spoil is proposed to be imported to the site for filling purposes nor would the excavated material be transported off the site.

The project is expected to take approximately two years to complete.

1.5 The proponent

The proponent is Hornsby Shire Council.

Hornsby Shire is a local government area in the northern region of Sydney that manages the area of land called Hornsby Shire Council, an area of approximately 500 square kilometres (km^2) extending from Brooklyn in the north, to Wisemans Ferry and Glenorie/Dural in the west, Wahroonga and Ku-ring-gai Chase National Park in the east and the M2 motorway in the south.

Hornsby Shire was incorporated in March 1906 and after the May 2016 proclamation administers the Shire on behalf of an estimated resident population of 151,000 residents and ratepayers.

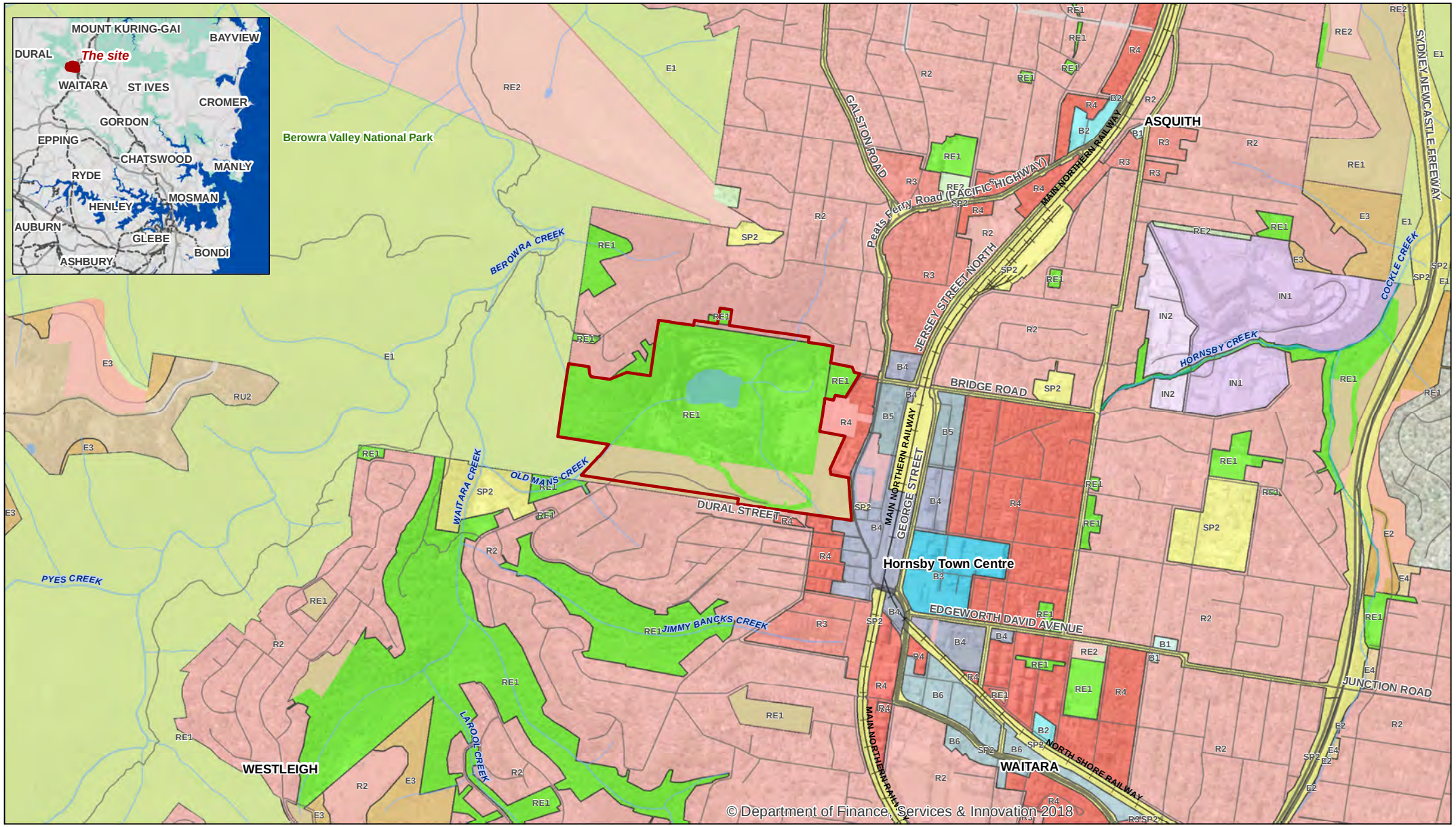
1.6 Definitions

The following terms are used within this report:

- The 'site' refers to the entirety of:
  - Lots A, B, C, D and E in Deposited Plan (DP) 318676
  - Lot 1 DP 926103
  - Lot 1 DP 926449
  - Lot 1 DP 114323
  - Lots 1 and 2 in DP 169188
  - Lot 7306 DP 1157797
  - Lot 1 DP 859646
  - Lot 1 DP 926449
  - Lot 13 DP 734459
  - Lot 114 DP 749606
  - Lot 213 DP 713249
  - Summers Avenue, Hornsby partly formed
  - Old Mans Valley Trail

The boundary of the site is shown on Figure 1.

- The ‘extent of works’ refers to both the quarry pit filling extent and the earthworks design extent plus an additional 2 to 5 m outside these areas to allow for construction fencing, etc. The boundary of the extent of works is shown on Figure 2.
- The ‘study area’ refers to the sensitive receiver locations identified within Figure 4.



Paper Size A4

0 200 400 800

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Legend

- The site
- Watercourses
- Parks and reserves
- Crown parcel
- Crown road
- Crown waterway

Hornsby Shire Council
Hornsby Quarry Rehabilitation

Job Number 21-26457
Revision A
Date 09 Nov 2018

Site location, surrounding land uses and zoning

Figure 1

N:\AU\Sydney\Projects\21\26457\GIS\Maps\Deliverables\21_26457_Z001_SMA.mxd (SMA record: 1)

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: NSW LPI (DTDB), Topographic base data, 2012; NSW LPI (DCDB), Topographic base data, 2015. Created by:jwatson2

1.7 Secretary's Environmental Assessment Requirements (SEARs) and agency requirements

The specific SEARs and agency requirements addressed in this report are summarised in Table 1-1.

Table 1-1 Secretary's Environmental Assessment Requirements and agency requirements (extract)

Assessment requirements	Where addressed in report
Legislation, policies and guidelines	
Relevant legislation • *Protection of the Environment Operations Act 1997* • *Secretary's Environmental Assessment Requirements*	 Section 4.1.1 Section 4.1.2
Relevant policies and Guidelines • *NSW Industrial Noise Policy* (EPA, 2000). Note: This has been superseded by the *NSW Policy for Industry* (EPA, 2017) • *Interim Construction Noise Guideline* (DECC, 2009) • *NSW Road Noise Policy* (EPA, 2011) • *Assessing Vibration: a Technical Guideline* (DEC, 2006) • *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration* (ANZEC 1990)	 Section 6.2 Section 6.1 Section 6.4 Section 6.5 N/A (No blasting is proposed)
Noise	
• construction noise impacts of the proposal in accordance with the *Interim Construction Noise Guideline* (DECC, 2009) and *NSW Industrial Noise Policy* (EPA, 2000) respectively. Note:This has been superseded by the *NSW Policy for Industry* (EPA, 2017) • reasonable and feasible mitigation measures to minimise noise emissions • monitoring and management measure.	Section 6 Section 7 Section 7
Blasting and Vibration	
• proposed hours, frequency, methods and impacts • an assessment of the likely blasting and vibration impacts of the development having regard to the relevant ANZEC guidelines and paying particular attention to impacts on people, buildings, livestock, infrastructure and significant natural features.	N/A (No blasting is proposed) N/A (No blasting is proposed)

1.8 Scope of work and structure of the report

1.8.1 Scope of report

GHD conducted a noise impact assessment to assess the potential impacts of noise from machinery and equipment on-site and the light and heavy vehicle movements at sensitive receptors. The assessment involved the following tasks:

- conduct an initial desktop review to identify environmental noise and vibration sensitive receivers from aerial photography
- utilise previous background noise monitoring at four (4) noise receiver locations identified as being indicative of the local ambient noise environment.
- establish construction noise management levels and project specific noise trigger levels and vibration criteria for the operation of the quarry with consideration to the guidelines and standards mentioned below.
- identify the likely principal noise and vibration sources during the proposed construction.
- undertake noise modelling to predict construction noise levels at the nearest identified noise receivers to the quarry.
- calculate the noise level at the nearest receptors due to noise generating equipment and plant movements at the site during the early and later stages of the project
- the scope of work above has been conducted with consideration to the following guidelines:
  - *Noise Policy for Industry* (NPI) (EPA, 2017)
  - *Interim Construction Noise Guideline* (ICNG) (DECC, 2009)
  - *Road Noise Policy* (RNP) (DECCW 2011)
  - Assessing Vibration: A Technical Guideline (DEC 2006).
- provide reasonable and feasible mitigation measures to reduce potential noise and vibration impacts at sensitive receivers
- assess noise impacts from the increase in traffic movements associated with material transport on Bridge Road, Peats Ferry Road, Dural Street and Quarry Road. The potential noise impacts associated with the traffic movements were assessed with consideration of the *Road Noise Policy* (NSW DECCW, 2011).

1.8.2 Structure of report

This report is structured as follows:

- **Chapter 1 – Introduction:** introduces the project and describes the site
- **Chapter 2 – Project description:** describes the details, method and timing of the proposed construction works
- **Chapter 3 – Existing environment:** summarises the existing environmental noise conditions and details the noise monitoring methodology
- **Chapter 4 – Regulatory requirements:** outlines the relevant Commonwealth and State legislation and any guidelines and assessment criteria relevant to construction and operation.
- **Chapter 5 – Methodology:** outlines the modelling methodology for construction noise, construction vibration and construction traffic noise.

- **Chapter 6 – Impact assessment:** presents a summary of the noise and vibration modelling and identifies potential noise and vibration impacts during the proposed works
- **Chapter 7 – Management and mitigation measures:** Provides an overview of the proposed noise and vibration mitigation measures during the construction phase of the project
- **Chapter 8 – Conclusion:** presents a summary of the potential noise and vibration impacts and sets out the principal conclusions for the assessment.
- **Chapter 9 – References:** presents a list of documents that have been used or referenced within this report

1.9 Limitations

This report: has been prepared by GHD for Hornsby Shire Council and may only be used and relied on by Hornsby Shire Council for the purpose agreed between GHD and the Hornsby Shire Council.

GHD otherwise disclaims responsibility to any person other than Hornsby Shire Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Hornsby Shire Council and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

2. Project description

2.1 Overview

Key features of the project include:

- Rehabilitation, stabilisation and geotechnical safety management works around various parts of the site
- Earthworks and placement of material won from within the site to create a final landform similar to Option 1 in the Clouston Associates (2014) 'Recreation Potential Study for Hornsby Quarry and Old Mans Valley Lands' (p88).

Approximately 500,000 m^3 of spoil is expected to be generated onsite from earthworks. Much of this material would be placed on the NorthConnex spoil to create a landform that generally slopes from the proposed lake up to the top of the western quarry face and would allow for the creation of a new parkland to be constructed within the quarry void. The landform would include a lake directly below the exposed eastern face of the quarry. There would also be cut and fill works on Old Mans Valley to create a landform suitable for future development into playing fields.

It is expected that a combination of ripping, rock breaking and rock sawing will be required to shift the material. Rock fragments would be crushed onsite using a mobile crusher or rock breaker prior to placement as fill.

No additional spoil is proposed to be imported to the site for filling purposes nor would the excavated material be transported off the site.

The project is expected to take approximately two years to complete.

The following sections describe the project in further detail.

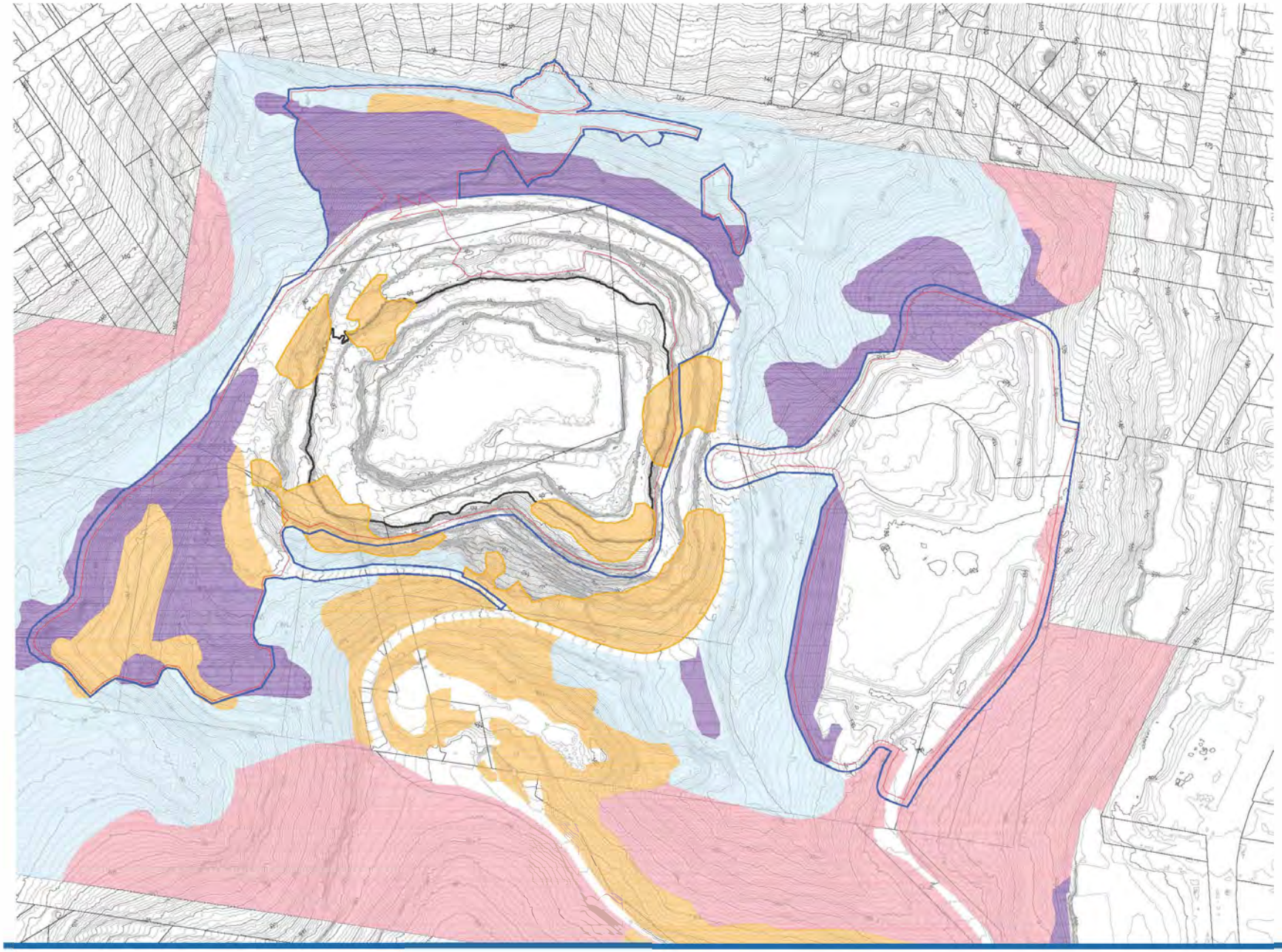
2.2 Proposed works

A conceptual design for the proposed reshaping and stabilisation works has been developed by Council. The design has been developed in parallel with the planning for the proposed future parkland. The conceptual design has been developed through an extended iterative process, taking into consideration the various requirements for the future parkland, site safety, geological and geotechnical challenges, constructability and environmental constraints.

Figure 2 shows the proposed extent of works on the site.

The 'extent of works' refers to both the quarry pit filling extent and the earthworks design extent plus an additional 2 to 5 m outside these areas to allow for construction fencing, etc. This can be considered the proposed disturbance footprint. It incorporates site access and internal roads/tracks.

Figure 3 shows the proposed concept design surface along with the extents of cut and fill works.



LEGEND

- CADASTRE
- ASSUMED EXISTING SURFACE
- PIT FILLING EXTENT
- EARTHWORKS DESIGN EXTENT
- EXTENT OF WORKS

VEGETATION COMMUNITY

- SYDNEY BLUE GUM - BLACKBUTT SMOOTH-BARKED APPLE MOIST SHRUBBY OPEN FOREST (CEEC TSC Act) (MODERATE/GOOD - POOR)
- BLACKBUTT GULLY FOREST (POOR)
- BLACKBUTT GULLY FOREST (MODERATE/GOOD - HIGH)
- BLACKBUTT GULLY FOREST (MODERATE/GOOD - POOR)

0 30 60 90m

SCALE 1:3000 AT ORIGINAL SIZE

N

GHD

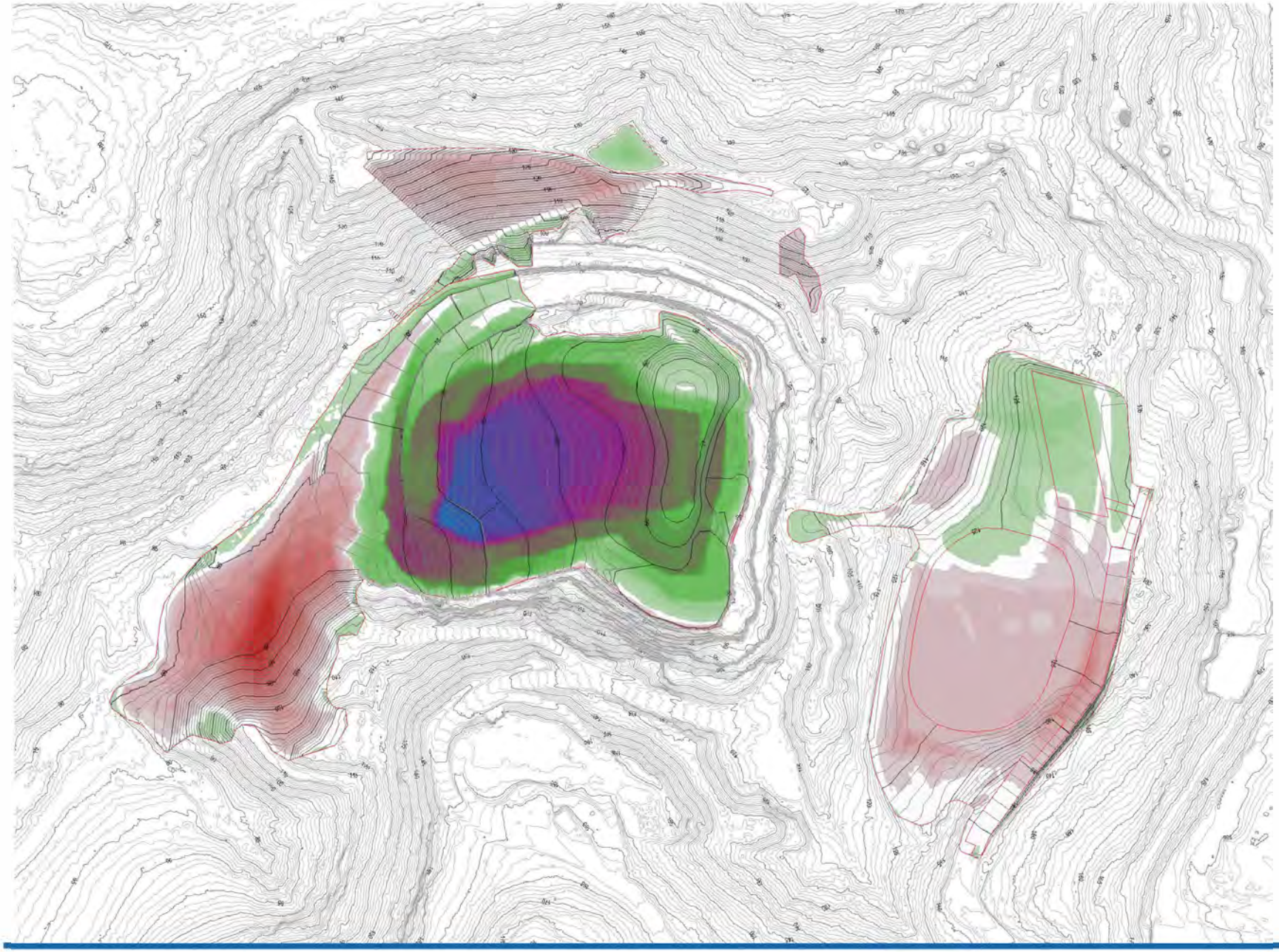
HORNSBY SHIRE COUNCIL
HORNSBY QUARRY REHABILITATION
EXTENT OF WORKS

Job Number 21-26457
Revision A
Date SEP 2018

Figure 2

Level 15, 133 Castlereagh Street, Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Plot Date: 12 November 2018 - 9:00 AM Plotted by: Radhidh Grewal Cad File No: G:\21\26457\CADD\Drawings\21-26457-FIG6.1.dwg



LEGEND

ASSUMED EXISTING SURFACE

PIT AREA DESIGN SURFACE

VOLUME CALCULATION BOUNDARY

CUT FILL DEPTH RANGE

25m CUT
22.5m
20m
17.5m
15m
12.5m
10m
7.5m
5m
2.5m
0
2.5m
5m
7.5m
10m
12.5m
15m
17.5m FILL

17.5m FILL
20m
22.5m
25m
27.5m
30m
32.5m
35m
37.5m
40m
42.5
45m
47.5m
50m
52.5m
55m
57.5m
60m FILL

VOLUMES

AREA	CUT (m³)	FILL (m³)
QUARRY VOID AND SW FILL AREA	273,000	1,346,600
OLD MANS VALLEY	176,300	32,700
NORTHERN SPOIL MOUND	63,800	6,400
TOTAL	513,900	1,385,700

0 30 60 90m

SCALE 1:3000 AT ORIGINAL SIZE

N

HORNSBY SHIRE COUNCIL
HORNSBY QUARRY REHABILITATION
PROJECT FINAL LANDFORM

CONCEPT DESIGN SURFACE

Job Number 21-26457
Revision A
Date SEP 2018

Figure 3

Level 15, 133 Castlereagh Street, Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Plot Date: 12 November 2018 - 10:26 AM Plotted by: Rashnith Grewal Cad File No: G:\21\26457\CADD\Drawings\21-26457-F006.2.dwg

2.3 Construction overview

2.3.1 Construction method

A combination of excavation techniques would be required to shift the material in accordance with the proposed design. The majority of cut material from the north, south and west cuts would be won by mechanical excavation. The east cut may require some drill and blast prior to excavation.

The cut/fill operation can be undertaken in two different ways:

- Conventional load and haul with mid-size dump trucks; and
- Conveyor transfer.

The construction method would be determined by the construction contractor. For the purpose of the EIS it is assumed that a conventional load and haul operation would be undertaken, as this is the more likely scenario. For the purpose of impact assessment, this is also considered to be a conservative assumption. Similar equipment would be required for a conveyor transfer method, but fewer items of plant would be required for the load and haul to the conveyor feed hopper.

2.3.2 Plant and equipment

The predicted plant anticipated to be used as part the works include:

- Excavators – with rippers or rock-breakers
- Rock saw
- Vibratory roller/compactor
- Bulldozers
- Loader
- Articulated dump truck
- Mobile screen
- Mobile crusher
- Fuel truck
- Off-road -water cart
- Tub grinder and mulcher

2.3.3 Construction workforce

The peak construction workforce is expected to be 25-30 including supervising personnel.

2.3.4 Traffic management and access

Construction traffic would access the site via Peats Ferry Road and Bridge Road and will consist of approximately 60 light vehicle movements per day associated with construction personnel accessing the site (30 in the morning and 30 in the afternoon). No spoil material is expected to be delivered to the site or transported off the site with the use of heavy vehicles.

There would be an initial delivery of heavy plant and equipment to site and off-site via Dural Street and Quarry Road. This would be approximately 52 heavy vehicle movements over a week period or approximately 10 heavy vehicles per day which equates to approximately one heavy vehicle movement per hour (15 hour daytime period between 7 am and 10 pm as per the

RNP). The delivery of oversized plant during the night-time period may be necessary for safety reasons and has been assessed against the RNP.

Construction traffic would be managed through a construction traffic management plan that would form part of the construction environmental management plan for the works.

2.3.5 Hours of construction

The proposed works would be carried out during the following standard construction times:

- Monday to Friday 7 am to 6 pm
- Saturday 8 am to 1 pm
- No work on Sundays or public holidays

While no works are anticipated to occur outside of standard hours there may be circumstances where out-of-hours activities associated with the project are necessary. Activities which may be undertaken outside of standard daytime hours (in accordance with Section 2.3 of the Interim Construction Noise Guideline (ICNG) (DECC, 2009) would include the following circumstances:

- The delivery of materials or oversized plant as required by the Police or other authorities for safety reasons.
- Where it is required to avoid the loss of lives, property and / or to prevent environmental harm in an emergency.
- Activities which are determined to comply with the relevant Noise Management Level (NML) at the most affected sensitive receiver, excluding activities associated with the transport and handling of spoil. Such activities may include refuelling of plant and equipment maintenance.
- Where agreement is reached with affected receivers.

2.3.6 Staging/timing

The project is expected to take approximately two years to complete. However the majority of key earthworks activities are expected to be completed in an approximate 60 week period.

2.3.7 Rehabilitation and future use

Any temporary project facilities such as construction compounds and plant and equipment would be removed from site. Erosion and sediment controls would be kept in place until the site is stabilised and/or retained for future development works.

The final rehabilitation and development of the site to recreational land use does not form part of this project and would be subject to a separate planning approval. The landform that would be created as part of this project has been designed to be suitable for this future development.

3. Existing noise environment

3.1 Project location

The site is located in the Hornsby local government area (LGA), approximately 21 kilometres (km) to the north-west of the Sydney central business district. The site is accessible via Quarry Road (off Dural Street and other local roads) from the south east and from Bridge Road (off the Peats Ferry Road from the north east). The majority of the site access will be through Bridge Road.

The noise environment surrounding the project site is dominated by the local road network, including Peats Ferry Road and other transport infrastructure such as Hornsby railway station and the Northern Railway Line.

3.2 Noise catchment areas

The surrounding study area was divided into four representative noise catchment areas (NCAs) based on their similar acoustic environment. Noise monitoring was undertaken in 2018 within each NCA to measure the existing background and ambient noise levels to determine the project specific noise criteria. It should be noted that the noise levels measured in 2018 contain extraneous noise from the NorthConnex works at Hornsby Quarry and are not representative of background and ambient noise environment when construction works are not being undertaken at the Hornsby Quarry site. As such, for the purpose of this assessment, background noise levels for each NCA have been sourced from the *Hornsby Quarry – Road Construction Spoil Management Project EIS Chapter 6.2* (RMS & AECOM 2015) when there were no construction works at the Hornsby Quarry site.

Table 3-1 Noise catchment areas

Sensitive Receivers	Direction from Hornsby Quarry site	Residential planning zones within NCA
NCA1	North / Northwest	R2 – Low Density Residential
NCA2	Northeast / East / Southeast	R3 – Medium Density Residential
NCA3	South	R2 – Low Density Residential
NCA4	Southwest	R2 – Low Density Residential

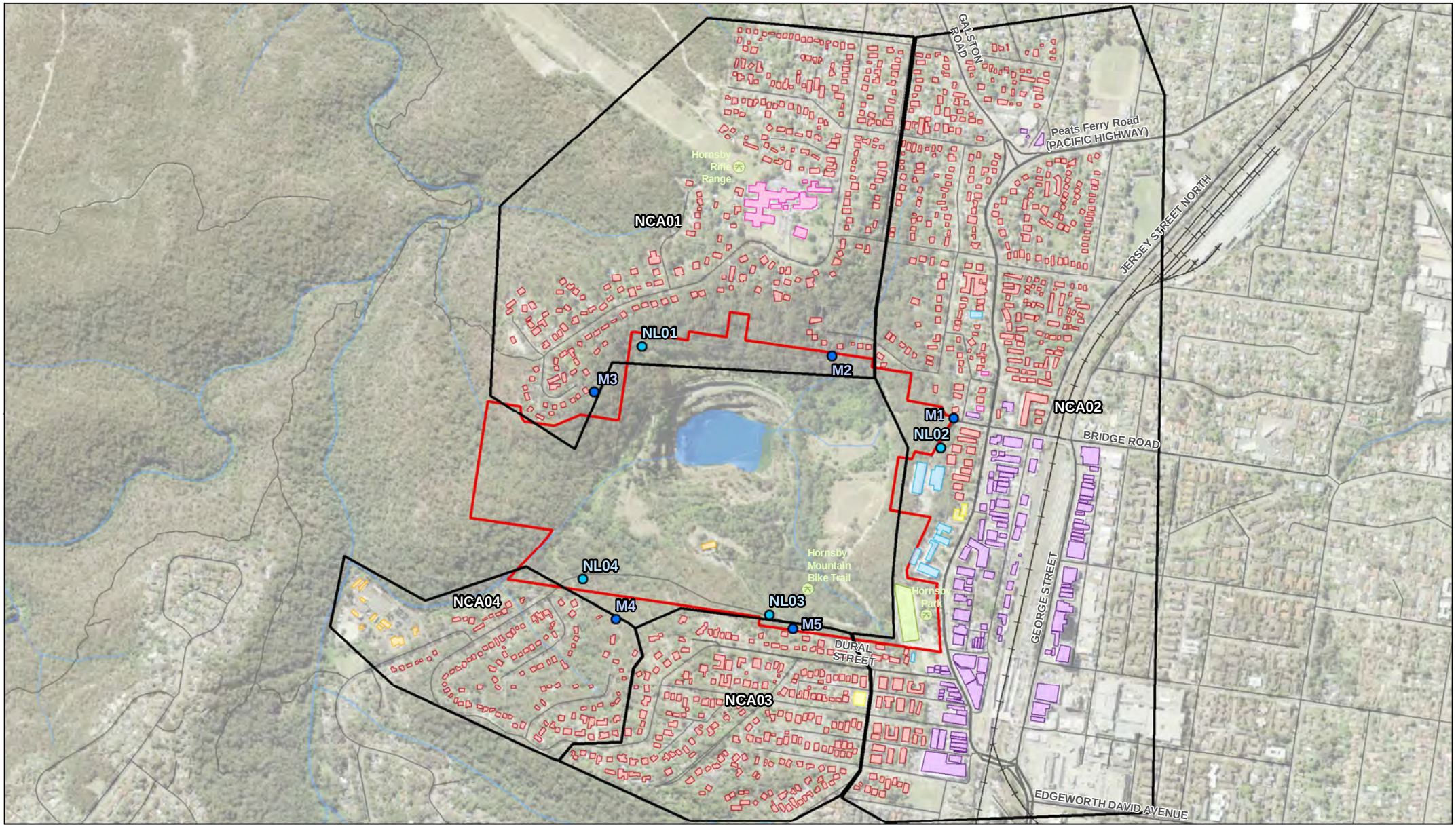
The extents of the NCAs are shown in Figure 4.

3.3 Sensitive receivers and land uses

Noise sensitive receivers are defined based upon the type of occupancy and the activities performed within the land parcel. The receivers are classified within the following categories:

- residential premises
- educational institutions
- hospitals and medical facilities
- places of worship
- passive and active recreation areas
- commercial premises and industrial premises.

A summary of the number of sensitive receivers is presented in Table 3-2 with all sensitive receivers listed in Appendix A. The location of the site, the noise sensitive receivers, the noise catchment areas and the background noise monitoring locations are presented in Figure 4.



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

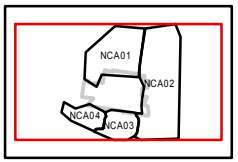
N

LEGEND

- Project Site
- Noise Catchment Areas
- Cadastre
- Noise Monitoring Locations – 2015
- Noise Monitoring Locations – 2018
- Active Recreation Areas

Sensitive Receiver Buildings

- Active Recreation
- Commercial
- Educational Institute
- Industrial
- Medical Facility
- Residential
- Place of Worship



Hornsby Shire Council
Hornsby Quarry Rehabilitation

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Site location, NCAs, noise monitoring locations and sensitive receivers - Overview

Figure 4.1

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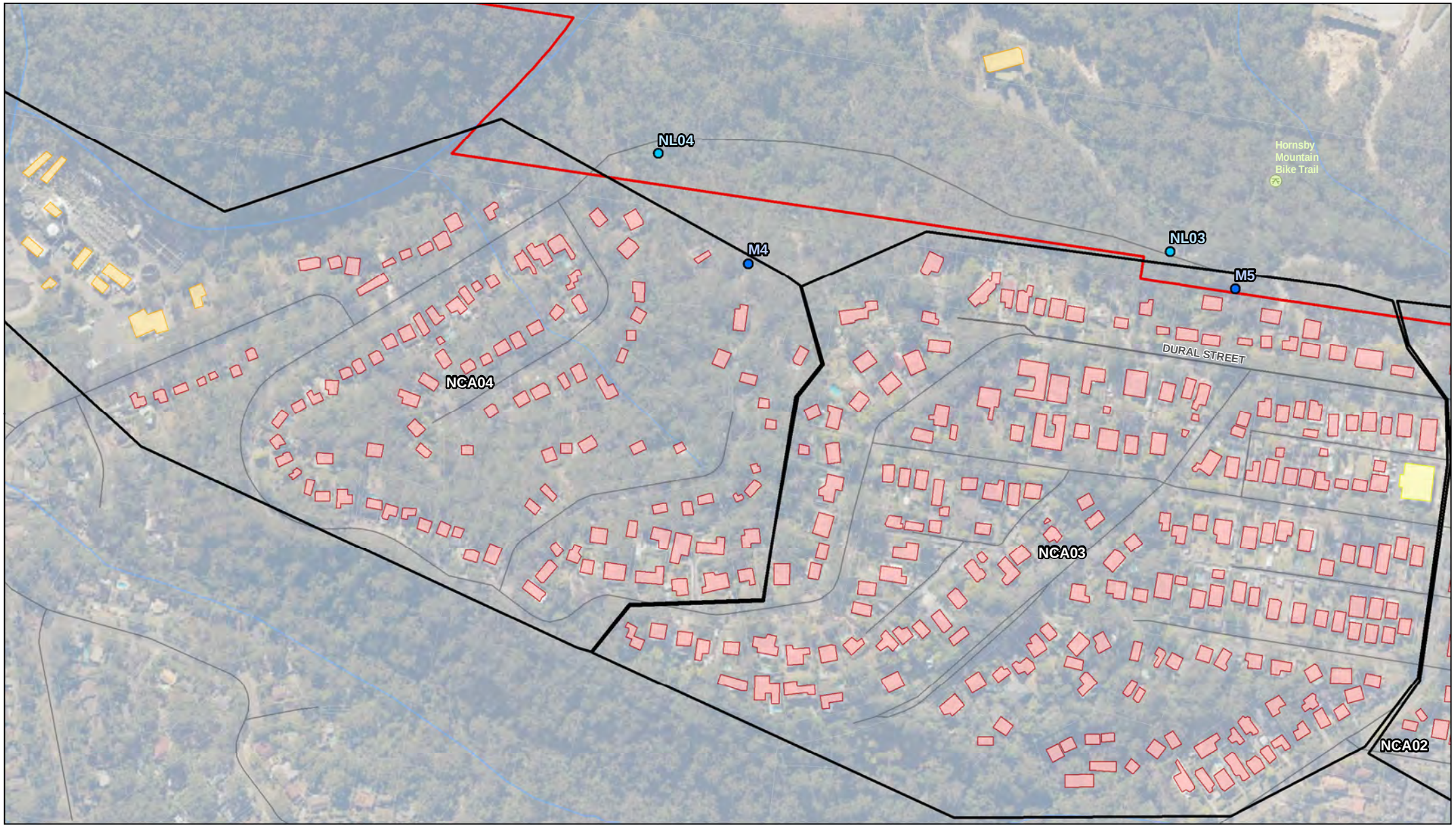
Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: NSW LPI (DTDB), Topographic base data, 2012; NSW LPI (DCDB), Topographic base data, 2015. Created by:jrbacani



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

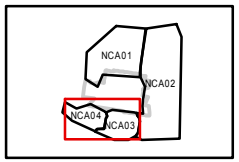
N

LEGEND

- Project Site
- Noise Catchment Areas
- Cadastre
- Noise Monitoring Locations – 2015
- Noise Monitoring Locations – 2018
- Active Recreation Areas

Sensitive Receiver Buildings

- Industrial
- Residential
- Place of Worship



Hornsby Shire Council
Hornsby Quarry Rehabilitation

Job Number 21-26457
Revision A
Date 13 Nov 2018

Site location, NCAs, noise monitoring locations and sensitive receivers - South west

Figure 4.2

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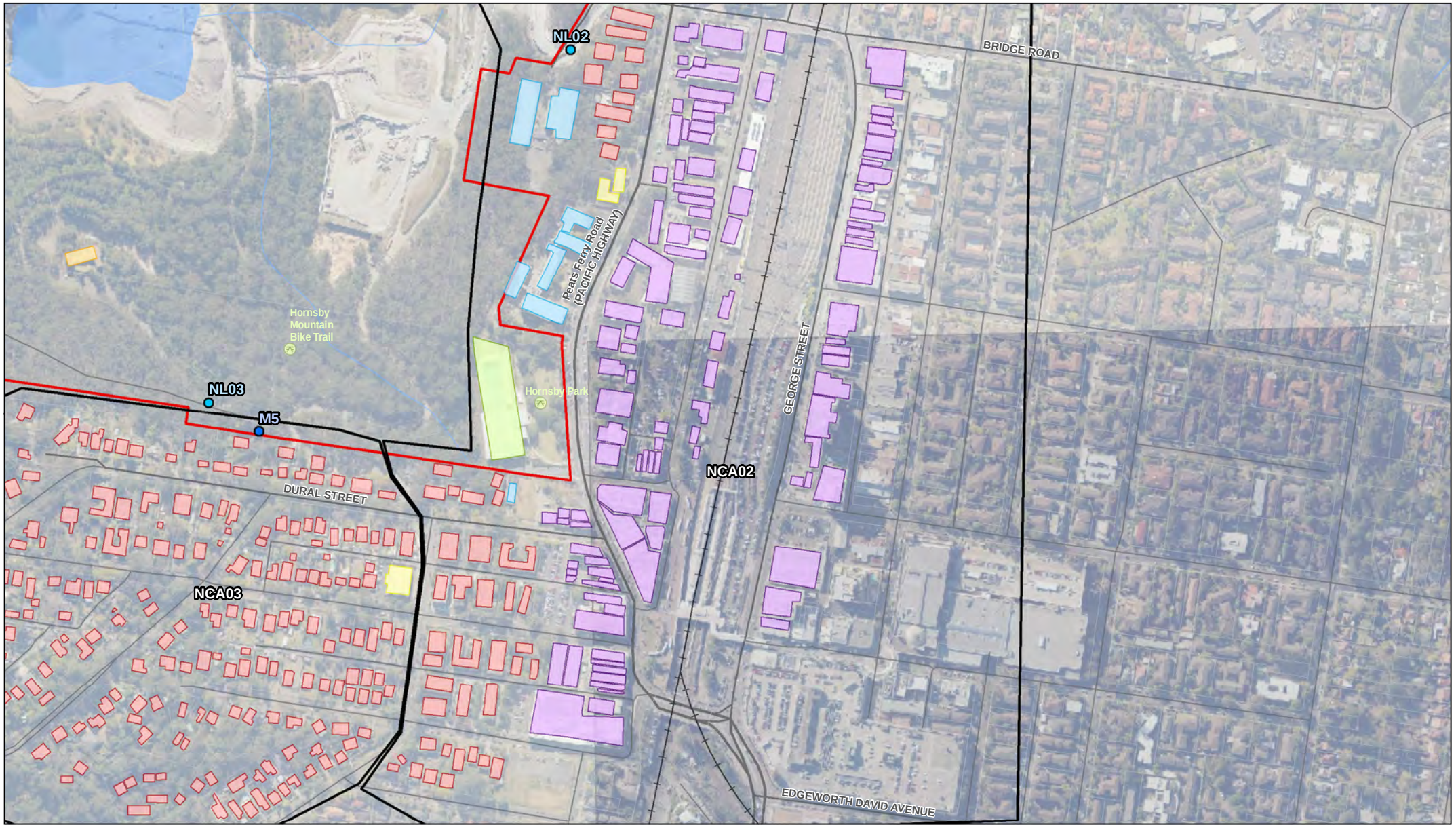
Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: NSW LPI (DTDB), Topographic base data, 2012; NSW LPI (DCDB), Topographic base data, 2015. Created by:jrbacani



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Map Projection: Transverse Mercator
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Grid: GDA 1994 MGA Zone 56

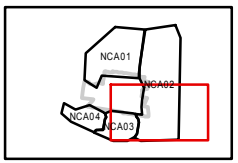
N

LEGEND

- Project Site
- Noise Catchment Areas
- Cadastre
- Noise Monitoring Locations – 2015
- Noise Monitoring Locations – 2018
- Active Recreation Areas

Sensitive Receiver Buildings

- Active Recreation
- Commercial
- Educational Institute
- Industrial
- Residential
- Place of Worship



Hornsby Shire Council
Hornsby Quarry Rehabilitation

Job Number 21-26457
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Date 13 Nov 2018

Site location, NCAs, noise monitoring locations and sensitive receivers - South east

Figure 4.3

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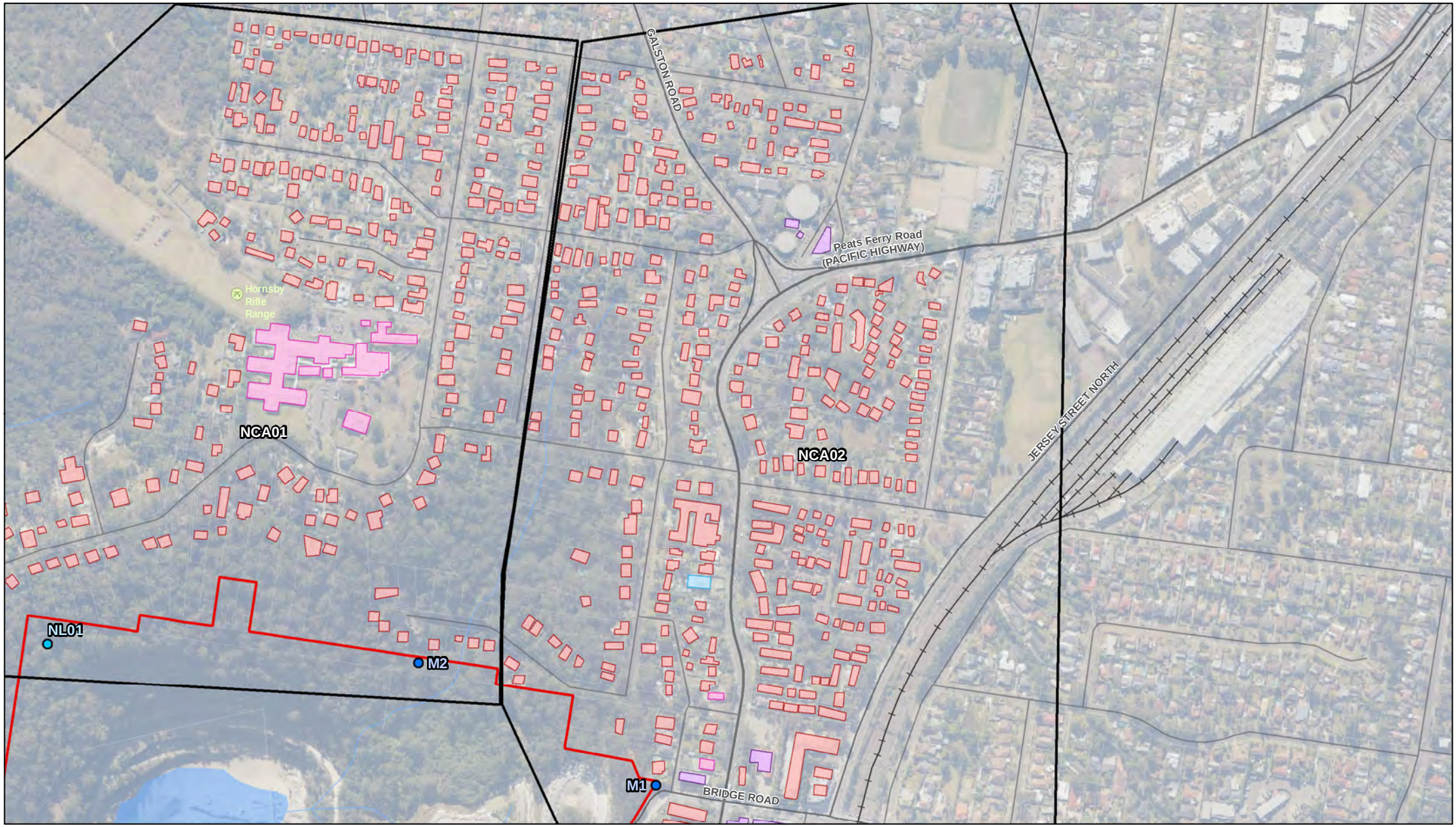
Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: NSW LPI (DTDB), Topographic base data, 2012; NSW LPI (DCDB), Topographic base data, 2015. Created by:jrbacani



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Map Projection: Transverse Mercator
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Grid: GDA 1994 MGA Zone 56

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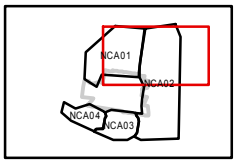
LEGEND

- Project Site
- Noise Catchment Areas
- Cadastre
- Noise Monitoring Locations – 2015
- Noise Monitoring Locations – 2018
- Active Recreation Areas
- Residential

Sensitive Receiver Buildings

- Commercial
- Educational Institute
- Medical Facility



Hornsby Shire Council
Hornsby Quarry Rehabilitation

Job Number 21-26457
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Date 13 Nov 2018

Site location, NCAs, noise monitoring locations and sensitive receivers - North east

Figure 4.4

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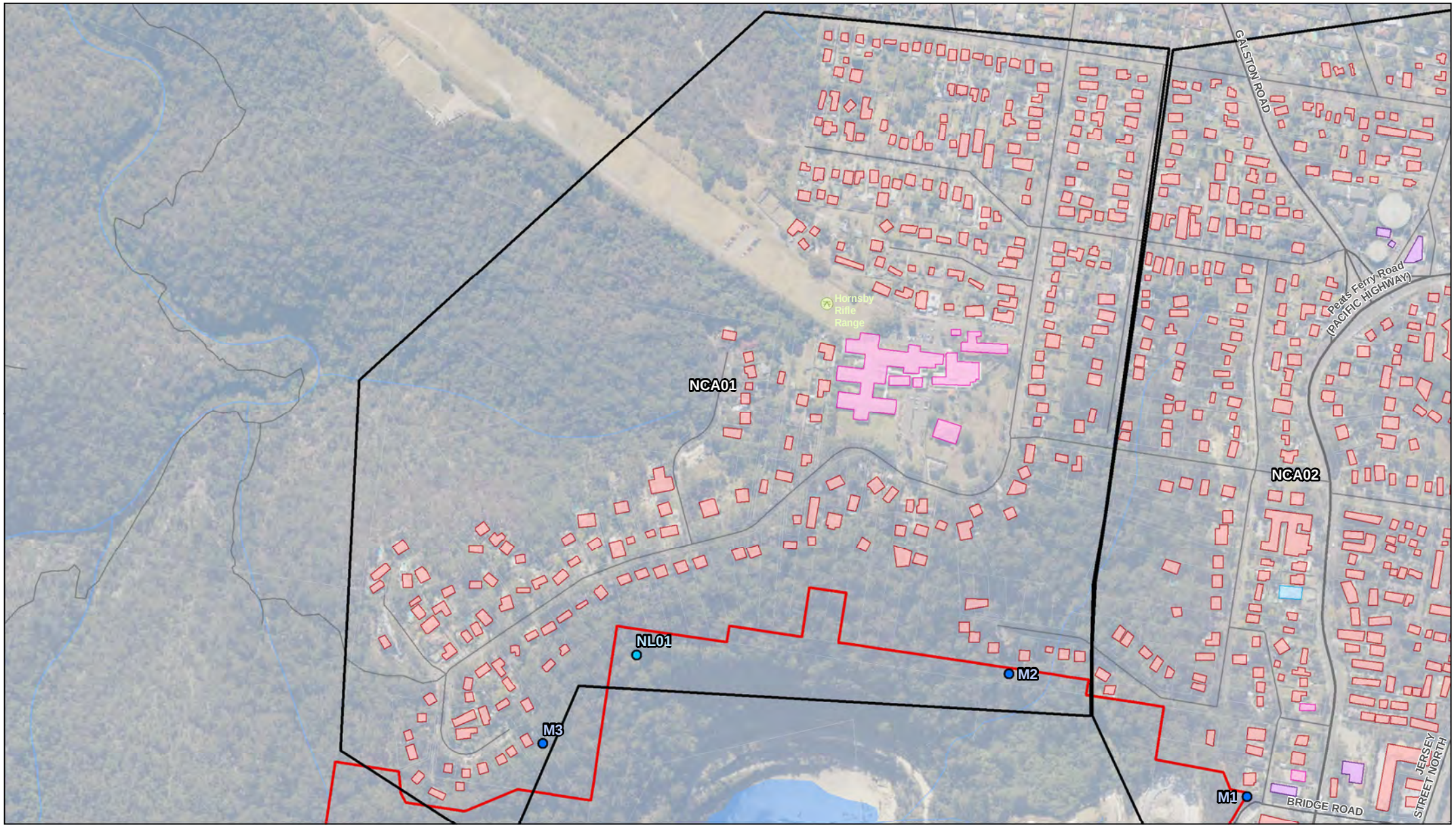
Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: NSW LPI (DTDB), Topographic base data, 2012; NSW LPI (DCDB), Topographic base data, 2015. Created by:jrbacani



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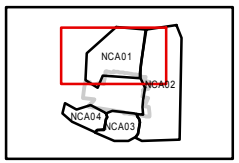
Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Project Site
- Noise Catchment Areas
- Cadastre
- Noise Monitoring Locations – 2015
- Noise Monitoring Locations – 2018
- Active Recreation Areas
- **Sensitive Receiver Buildings**
- Commercial
- Educational Institute
- Medical Facility
- Residential



Hornsby Shire Council
Hornsby Quarry Rehabilitation

Job Number 21-26457
Revision A
Date 13 Nov 2018

Site location, NCAs, noise monitoring locations and sensitive receivers - North west

Figure 4.5

G:\21\26457\GIS\Maps\Deliverables\21_26457_Z008_NOISE_Figure4.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: NSW LPI (DTDB), Topographic base data, 2012; NSW LPI (DCDB), Topographic base data, 2015. Created by:jrbacani

Table 3-2 Identified noise sensitive receivers

Sensitive Receivers	Number of sensitive receiver buildings in study area
NCA01 - Residential	281
NCA02 - Residential	382
NCA03 - Residential	215
NCA04 - Residential	118
Residential (total)	998
Commercial	118
Industrial	11
Educational institute	9
Medical facility	9
Place of worship	4
Active recreation areas	4
Total no. of sensitive receivers	**1151**

3.3.1 Residential receivers

Residential receivers in the streets listed in Table 3-3 were identified near the project site and may experience noise impacts from the construction activity at Hornsby Quarry.

Table 3-3 Residential receiver locations

Residential street	Approximate distance from quarry centre
Clarinda Street	1 km north
Rosamond Street	550 m north
Manor Road	390 m north
Stewart Avenue	840 m north
Carrington Road	820 m north
Kerr Street	750 m north
Maranta Street	640 m north-east
Bridge Road	570 m east
Galston Road	1 km north-east
Old Berowra Road	1 km north-east
Fern Tree Close	360 m north-east
Silvia Street	545 m north-east
Peats Ferry Road	620 m east
Roper Lane	575 m east
Summers Avenue	500 m north east
Mildred Avenue	800 m north-east
Jersey Street	720 m east
Citrus Avenue	975 m north-east
Quarry Road	495 m south
Dural Street	510 m south
Lisgar Road	565 m south
Frederick Street	670 south-east
Dural Lane	620 south
Rosemead Road	510 m south
William Street	620 m south
Lisgar Lane	630 m south
Lowanna Place	650 m south-west

Residential street	Approximate distance from quarry centre
Lockinvar Place	580 m south-west
Valley Road	790 m south-west
Watson Avenue	650 m north-west

3.3.2 Other sensitive land uses

The majority of commercial receivers are located along Pacific Highway with pockets of light industrial areas scattered throughout the study area. Active recreational areas, a hospital and educational establishments are also located throughout the study area. These non-residential sensitive land uses have been listed below in Table 3-4.

Table 3-4 Non-residential sensitive receiver locations

Description	Address	Receiver type	Approximate distance from quarry centre
Hornsby Mountain Bike Trail	Quarry Road	Active Recreation	250 m
Hornsby Rifle Range	Rosamond Street	Active Recreation	650 m
Hornsby Park	Peats Ferry Road	Active Recreation	600 m
Hornsby Aquatic and Leisure Centre	Peats Ferry Road	Active Recreation	650 m
Metro Petroleum Hornsby	Pacific Highway	Commercial	1 km
Caring 4 Kids	Peats Ferry Road	Commercial	675 m
Service NSW	Peats Ferry Road	Commercial	650 m
St Vincent de Paul Society Vinnies	Jersey Street	Commercial	390 m
Commercial Precinct	Peats Ferry Road, from High Street to Bridge Road	Commercial	285 m
Commercial Precinct	George Street, from Florence Street to Bridge Road	Commercial	545 m
Tom Mallon Motor Service	Galston Road	Commercial	1 km
TAFE NSW Hornsby Campus	Peats Ferry Road	Educational Institute	230 m
MindChamps Early Learning	Peats Ferry Road	Educational Institute	650 m
Montessori Pre-school	Dural Street	Educational Institute	700 m
West Hornsby Wastewater Treatment Plant	Valley Road	Industrial	810 m
Mt Wilga Private Rehabilitation Hospital	Rosamond Street	Medical facility	550 m
Summers Avenue Family Medical Practice	Summers Avenue	Medical facility	460 m
Dr Peter Frederiksen	Peats Ferry Road	Medical facility	640 m
Hornsby Uniting Church	William Street	Place of Worship	450 m
St Peter's Anglican Church	Peats Ferry Road	Place of Worship	550 m
Community Church Hornsby	Jersey Street	Place of Worship	650 m

3.4 Unattended noise monitoring – 2018

3.4.1 Purpose of noise monitoring

Noise monitoring of the existing noise conditions at 5 sensitive receiver locations was undertaken to measure background and ambient noise levels during the NorthConnex construction works at the Hornsby Quarry site. The dominant noise sources were due to earthmoving equipment within the quarry site, the screener transporting material from the spoil site to the quarry and heavy vehicle movements to and from the site.

3.4.2 Noise monitoring methodology

The methodology for the noise monitoring program included the following:

- Identification of the sensitive receivers including residences and other sensitive land uses in the vicinity of the project
- Noise logging was conducted from Monday 17 September 2018 to Thursday 27 September 2017.
- A calibration check was performed on the noise monitoring equipment using a sound level calibrator with a sound pressure level of 94 dBA at 1 kHz. At completion of the measurements, the meter's calibration was re-checked to ensure the sensitivity of the noise monitoring equipment had not varied. The noise loggers were found to be within the acceptable tolerance of ± 0.5 dBA
- Noise monitoring was undertaken using four Svan 977 environmental noise loggers and one Rion NL-52 environmental noise logger. The noise logger was programmed to accumulate L_{A90}, L_{A10}, and L_{Aeq} noise descriptors continuously over the entire monitoring period. Details of the noise monitoring equipment are provided in Table 3-5
- The data collected by the logger was downloaded and analysed, and any invalid data removed. Invalid data generally refers to periods of time where average wind speeds were greater than 5 m/s, or when rainfall occurred. Meteorological data was sourced from the Bureau of Meteorology's Terrey Hills weather station (number 066059) and is located within 30 kilometres of the noise monitoring site in accordance with the NPI.

All noise monitoring activities were undertaken and processed in accordance with the NPI long-term monitoring method. All noise logger settings and descriptors used were based on this method.

3.5 Summary of noise monitoring results

Details of the noise monitoring equipment and location are provided in Table 3-5. Noise logger data results are summarised in Table 3-6. Noise monitoring charts are presented in Appendix B.

Table 3-5 Unattended noise monitoring details

Location (GDA94 Z56)	Equipment photo	Equipment details	Equipment settings
M1 – Near Bridge Road / Roper Lane X: 323652 Y: 6269815		Svan 977 SN: 36872	A-weighted Fast time response 15 minute intervals Pre to post calibration variance: -0.08 dB
M2 – 9 Fern Tree Close X: 323356 Y: 6269969		Svan 977 SN: 45744	A-weighted Fast time response 15 minute intervals Pre to post calibration variance: +0.65 dB
M3 – 98 Manor Road X: 322775 Y: 6269882		Svan 977 SN:36871	A-weighted Fast time response 15 minute intervals Pre to post calibration variance: -0.56 dB
M4 – 30 Lowanna Place X: 322828 Y: 6269326		Svan 977 SN: 45743	A-weighted Fast time response 15 minute intervals Pre to post calibration variance: +0.12 dB

Location (GDA94 Z56)	Equipment photo	Equipment details	Equipment settings
M5 – Quarry Road X: 323260 Y: 6269303		Rion NL-52 SN:131629	A-weighted Fast time response 15 minute intervals Pre to post calibration variance: -0.2 dB

Table 3-6 Summary of noise monitoring results, dBA

Location	Background noise descriptors $L_{A90(Period)}$			Ambient noise descriptors $L_{Aeq(period)}$		
	Day	Evening	Night	Day	Evening	Night
M1 – Nr Bridge Rd / Roper Ln	46	38	31	63	47	47
M2 - 9 Fern Tree Close	42	34	31	52	47	43
M3 - 98 Manor Rd	42	36	31	52	45	42
M4 – 30 Lowanna Pl	36	30	29	49	46	43
M5 – Quarry Rd	40	34	30	51	46	47

3.6 Unattended noise monitoring – 2015

3.6.1 Methodology

Unattended background noise monitoring was carried out at four locations throughout the study areas as part of *Hornsby Quarry – Road Construction Spoil Management Project EIS Chapter 6.2* (RMS & AECOM 2015). The background noise levels measured at the four noise monitoring locations surrounding the Hornsby Quarry site provide the basis for the project noise trigger levels and construction noise management levels for each of the four Noise Catchment Areas (NCAs).

3.6.2 Noise monitoring results

Noise logger data results from Table 6-15 of the *Hornsby Quarry – Road Construction Spoil Management Project EIS Chapter 6.2* (RMS & AECOM, 2015) are summarised in Table 3-7.

Table 3-7 Summary of noise monitoring results, dBA

Noise Catchment Area (NCA)	Noise Measurement Location (NL)	Background noise descriptors $L_{A90(Period)}$		
		Day	Evening	Night
NCA1	NL04	35[1]	34	31
NCA2	NL02	39	33	33
NCA3	NL03	37	37	32

Noise Catchment Area (NCA)	Noise Measurement Location (NL)	Background noise descriptors $L_{A90(Period)}$		
		Day	Evening	Night
NCA4	NL04	35[1]	34	31

Note: 1) Measured level is 34 dBA, however the minimum rating background noise level for the day (35 dBA) has been used in accordance with the Noise Policy for Industry (NPI)

The background noise levels presented in Table 3-7 have been used to determine the noise criteria for this assessment (see section 4).

3.7 Local meteorology

Meteorology data was obtained from the Bureau of Meteorology's Terrey Hills Automatic Weather Station (066059) for this assessment, situated approximately 12.3 km to the east of the site.

3.8 Temperature inversions

Construction works are proposed from 7.00 am to 6:00 pm weekdays. The noise predictions are considered conservative as the model takes into account a moderate temperature inversion (ISO 9613-2).

3.9 Wind effects

Noise propagation can be enhanced by wind conditions. The NPI states that when there is greater than a 30% occurrence of wind of up to 3 m/s, in any period (day, evening, night) in any season, from source to receiver, wind should be considered in noise prediction calculations.

Wind conditions at the Hornsby Quarry site are based on weather data obtained from Terrey Hills AWS. The proposed operations will occur during the daytime period only. Figure 5 presents annual wind roses during the daytime periods for 2012 - 2017 at the Hornsby Quarry site. Analysis of the seasonal wind rose data indicates that winds up to 3 m/s do not occur more than 30% of the time in the direction of the nearest sensitive receivers, being all directions except for the east (Note: The NPI specifies for a 16-direction wind compass to use the arithmetic sum of the direction being reported and the four closest directions)

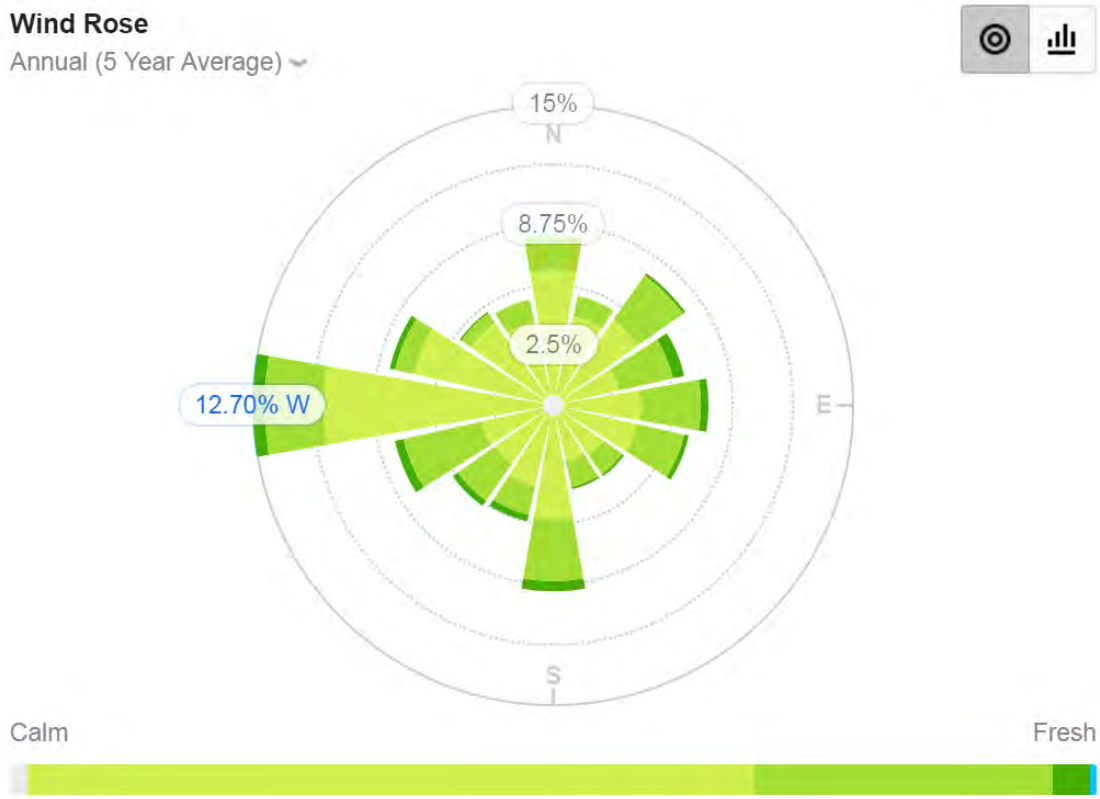


Figure 5 Annual daytime wind roses at Hornsby Quarry site

4. Regulatory requirements

4.1 Legislative requirements

4.1.1 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* is the key piece of environment protection legislation to control noise emission on the environment.

4.1.2 Secretary's Environmental Assessment Requirements (SEARs 1167)

Noise – including a quantitative assessment of potential:

- Construction noise impacts of the development in accordance with the *Interim Construction Noise Guideline* (ICNG) and the NSW *Industrial Noise Policy* (INP) respectively
- Reasonable and feasible mitigation measures to minimise noise emissions; and
- Monitoring and management measures.

Blasting & Vibration

- Proposed hours, frequency, methods and impacts; and
- An assessment of the likely blasting and vibration impacts of the development having regard to the relevant ANZEC guidelines and paying particular attention to impacts on people, buildings, livestock, infrastructure and natural features

Note should be made that no blasting is proposed as part of the project.

The acoustic requirements outlined within the SEARs are consistent with the compliance criteria detailed below.

4.2 Construction noise

The ICNG (DECC, 2009) recommends standard hours for construction activities as Monday to Friday: 7 am to 6 pm, Saturday: 8 am to 1 pm and no work on Sundays or public holidays. These hours are not mandatory and the ICNG acknowledges that the following activities have justification to be undertaken outside the recommended standard construction hours assuming that all reasonable and feasible mitigation measures are implemented to minimise the impacts to the surrounding sensitive land uses:

- the delivery of oversized plant or structures that police or other authorities determine to require special arrangements to transport along public roads
- emergency work to avoid the loss of life or damage to property, or to prevent environmental harm
- works where a proponent demonstrates and justifies a need to operate outside the recommended standard construction hours
- works which maintain noise levels at sensitive receivers to below the noise management levels outside of the recommended standard construction hours.

4.2.1 Proposed construction hours

The proposed works at Hornsby Quarry are to be conducted between the following standard hours for construction activities:

- Monday to Friday: 7:00 am to 6:00 pm

- Saturday: 8:00 am to 1:00 pm
- No work on Sundays or Public Holidats

4.2.2 Construction noise management levels

Construction noise management levels at sensitive residential receivers are provided in Table 4-1. The construction noise management levels during recommended standard hours represent a noise level that, if exceeded, would require management measures including:

- reasonable and feasible work practices
- contact with the residences to inform them of the nature or works to be carried out, the expected noise levels and durations and contact details.

The management measures are aimed at reducing noise impacts at the residential receivers. However, it may not be reasonable and feasible to reduce noise levels to below the noise affected management level. The noise affected construction noise management levels during recommended standard hours is not intended as a noise limit but rather a level where noise management is required and as such should not be included as a noise limit in the environmental protection license or Consent Condition.

Table 4-1 Residential construction noise management levels, dBA

Time of day	Noise management level, $L_{Aeq(15\ min)}$	Application notes
Recommended standard hours	Noise affected: RBL + 10 dBA	The noise affected level represents the point above which there may be some community reaction to noise. • where the predicted or measured $L_{Aeq(15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level • the proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected: 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: • times identified by the community when they are less sensitive to noise (such as before and after school, or mid-morning or mid-afternoon for works near residences) • if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours[1]	Noise affected: RBL + 5 dBA	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level.

Time of day	Noise management level, $L_{Aeq(15\ min)}$	Application notes
		Where all feasible and reasonable measures have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community.

Notes:

1. It must be noted that no works are scheduled outside standard construction hours

4.2.3 Sleep disturbance

The NPI (EPA 2017) recommends a detailed maximum noise level event assessment be undertaken where night-time noise levels from a development exceed the following levels when assessed externally at the nearest residential location:

- $L_{Aeq(15min)}$ 40 dBA or the prevailing RBL + 5 dBA (whichever is greater); and/or
- L_{AFmax} 52 dBA or the prevailing RBL + 15 dBA (whichever is greater)

Sleep disturbance is not anticipated from the project as construction works are not expected to generate noise between 10:00 pm and 7:00 am.

4.2.4 Project noise management levels

A summary of the construction noise management levels are presented in Table 4-2.

Table 4-2 Project construction noise management levels, dBA

Receiver type	Construction noise management levels, $L_{Aeq(15\ min)}$				
	Standard construction hours		Outside standard construction hours[1]		
	Noise affected	Highly noise affected	Day	Evening	Night
Residential (NCA1)	45	75	40	39	36
Residential (NCA2)	49	75	44	38	38
Residential (NCA3)	47	75	42	42	37
Residential (NCA4)	45	75	40	39	36
Commercial	70 (external)				
Industrial	75 (external)				
Educational Facility	55 (external)[2] or 45 (internal)				
Hospitals / Medical	55 (external)[2] or 45 (internal)				
Place of Worship	55 (external)[2] or 45 (internal)				
Active Recreation	65 (external)				

Notes:

1. It must be noted that no works are scheduled outside standard construction hours
2. External noise management level is based on a 10 dB noise reduction through an open window

4.3 Operational noise criteria

4.3.1 Project noise trigger levels

The NPI provides guidance on the assessment of operational noise impacts. The guideline includes both intrusiveness and project amenity noise levels that are designed to protect receivers from noise significantly louder than the background level, and to limit the total noise level from industry near a receiver. Construction activities are excluded from the NPI as they are temporary in nature. Section 1.5 of the NPI make specific reference to activities and facilities that are excluded from the policy, one of these being construction activities. Never-the-less, potential noise impacts have been assessed against the NPI criteria to adequately satisfy the acoustic requirements detailed within the SEARs 1167.

The NPI project noise trigger levels provide an objective for assessing a project and are not mandatory limits required by legislation. The project noise trigger levels assist the regulatory authorities to establish licensing conditions. Where project noise trigger levels are predicted to be exceeded, feasible and reasonable noise mitigation strategies should be considered. In circumstances where noise criteria cannot be achieved, residual noise impacts are used to assess noise impacts and manage noise from the site in negotiation between the regulatory authority and community. The regulatory authority then sets statutory compliance levels that reflect the achievable and agreed noise limits from the development.

The intrusiveness noise level controls the relative audibility of operational noise compared to the background level at residential receivers. The amenity noise level limit the total level of extraneous noise for all receiver types. Both levels are calculated and the lower of the two in each time period is set as the project noise trigger level. The intrusiveness noise level is assessed over a 15 minute period however the amenity noise level is assessed over the day, evening or night time period. For the purposes of assessment to standardise the approach the NPI recommends that the $L_{Aeq(15min)} = L_{Aeq(period)} + 3$ dBA unless an alternative approach can be justified.

4.3.2 Intrusiveness noise level

The intrusiveness noise level is determined by a 5 dB addition to the measured or adopted background noise level with a minimum intrusiveness noise level of 35 dBA for the evening and night period and 40 dBA for the day period. The NPI recommends that the intrusiveness noise level for the evening and day period should not exceed the daytime period. The intrusiveness noise levels are only applicable to residential receivers.

4.3.3 Project amenity noise level

The recommended amenity noise level applies to all industrial noise in the area which when combined should remain below the recommended amenity noise level. The recommended amenity noise level represents the total industrial noise at a receiver location and a Project Amenity Noise Level is set at 5 dBA below the recommended amenity noise level.

Residential receiver areas are characterised into ‘urban’, ‘suburban’, ‘rural’ or other categories based on land uses and the existing level of noise from industry and road traffic. With consideration to the NPI ‘noise amenity area’ classification, the residential receivers identified for this assessment are located in R1 – Low Density Residential and R2 – Medium Density planning zones as per the Hornsby Shire Council Local Environmental Plan 2013 and classified as ‘Suburban Residential’.

4.3.4 Summary of project noise trigger levels – residential receivers

For residential receivers, the project noise trigger levels are provided in Table 4-3. The project noise trigger levels reflect the most stringent noise level requirements derived from the intrusiveness and project amenity noise level. Daytime project noise trigger levels (PNTLs) should aim to be achieved as the construction works at the quarry are proposed during this time period.

Table 4-3 – Project noise trigger levels – residential noise receivers, dBA

NCA	PNTL $L_{Aeq(15min)}$ at residential receivers		
	Intrusive $L_{Aeq(15min)}$ noise level (Day)	Project amenity $L_{Aeq(15min)}$ noise level (Day – Suburban Residential)	Project $L_{Aeq(15min)}$ noise trigger level (Day)
NCA01	40	53	**40**
NCA02	44	53	**44**
NCA03	42	53	**42**
NCA04	40	53	**40**

Notes:

- The NPI defines Day as 7 am to 6 pm Monday to Friday and 8 am to 1 pm Sunday & Public Holidays
- Noise from the site is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of the dwelling where the dwelling is more than 30 metres from the boundary, to determine compliance with the project noise trigger levels, except where otherwise specified below.
- To standardise the time periods for the intrusiveness and amenity noise levels, the NPI assumes that the $L_{Aeq,15min}$ is be equal to $L_{Aeq,\ period}$ + 3 dBA
- The project noise trigger levels have been determined based on the background noise logging undertaken in 2015 by AECOM

4.3.5 Summary of project noise trigger levels – non-residential receivers

For non-residential receivers, the project noise trigger levels are provided in Table 4-4.

Table 4-4 Project noise trigger levels – non-residential receivers

Type of receiver	Time of day	Non-residential receivers		
		Assessment Location (NPI)	NPI trigger level L_{Aeq}, dBA	Adopted external trigger level L_{Aeq}, dBA
Commercial premises	When in use	External	65	65
Educational facility	Noisiest 1-hour period when in use	Internal	35	55[1]
Hospitals / Medical	Noisiest 1-hour period when in use	External	50	50
Place of worship	When in use	Internal	40	50[1]
Industrial	When in use	External	70	70
Passive recreation	When in use	External	50	50
Active recreation	When in use	External	55	55

Notes:

1) External noise management level is based on a 20 dB noise reduction through a closed window

4.3.6 Modifying factor adjustments

The NPI requires that modifying factor adjustments are applied if the noise sources contain tonal, intermittent or low frequency characteristics, which have the potential to increase annoyance. The modifying factor adjustments are detailed in Table 4-5.

Table 4-5 Modifying factor adjustments

Factor	Assessment/ measurement	When to apply	Correction[1,2]
Tonal noise	One-third octave or narrow band analysis	Level of one-third octave band exceeds the level of the adjacent bands on both sides by: • 5 dB or more if the centre frequency of the band containing the tone is above 400 Hz • 8 dB or more if the centre frequency of the band containing the tone is 160 to 400 Hz inclusive • 15 dB or more if the centre frequency of the band containing the tone is below 160 Hz.	5 dBA[2]
Low frequency noise	Measurement of C-weighted and A-weighted level	Measure/assess C and A weighted $L_{eq,T}$ levels over same time period. Correction to be applied if the difference between the two levels is 15 dB or more and: • Where any of the one-third octave noise levels in Table C2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dBA positive adjustment to measured/predicted A-weighted levels for the evening/night period Where any of the one-third octave noise levels in Table C2 are exceeded by more than 5 dBA and cannot be mitigated, a 5 dBA positive adjustment to measured/predicted A-weighted noise levels applies for the evening/night period and a dBA positive adjustment for the daytime period.	5 dBA[2]
Impulsive noise	A-weighted fast response and impulse response	If the difference in A-weighted maximum noise levels between fast response and impulse response is greater than 2 dB.	Apply the difference in measured noise levels as the correction up to a maximum of 5 dBA
Intermittent noise	Subjectively assessed	When the night-time noise level drops to that of the background noise level with a noticeable change in noise level of at least 5 dBA.	5 dBA

Notes: 1) Where two or more modifying factors are present the maximum correction is limited to 10 dBA.
2) Where a source emits a tonal and low-frequency noise, only one 5 dB correction should be applied if the tone is in the low frequency range.

4.3.7 Sleep disturbance

No significant noise associated with the project is anticipated during the night-time hours between 10:00 pm and 7:00 am. As such, an assessment of sleep disturbance is not required.

4.4 Construction traffic

The RNP (DECCW), 2011) provides traffic noise criteria for residential receivers in the vicinity of existing roads, shown in Table 4-6. The criteria is applied to operational and construction traffic on public roads to identify potential road traffic impacts and the requirement for reasonable and feasible mitigation measures.

The RNP application notes state that *"for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the development should be limited to 2 dB above that of the noise level without the development. This limit applies wherever the noise level without the development is within 2 dB of or exceeds, the relevant day or night noise assessment criterion."*

If road traffic noise increases from the development are within 2 dBA of current levels then the objectives of the RNP are met and no specific mitigation measures are required.

Table 4-6 Road traffic noise criteria, $L_{Aeq(period)}$ dBA

Type of Development	Day 7 am to 10 pm	Night 10 pm to 7 am
Existing residence affected by additional traffic on existing arterial/sub-arterial roads generated by land use developments	60 $L_{eq(15hr)}$	55 $L_{eq(9hr)}$
Existing residence affected by additional traffic on existing local roads generated by land use developments	55 $L_{eq(1hr)}$	50 $L_{eq(1hr)}$

The RMS *Noise Criteria Guideline* (2015) defines sub-arterial, collector and local roads as shown in Table 4-7.

Table 4-7 Roads and Maritime road classification criteria

Road	Definition
Sub-arterial	Connects arterials to regions of development and carry traffic from one part of a region to another. Provide connection between arterial roads and local roads. May support arterial roads during peak periods. A road that collects local traffic leaving a locality and connects to another local road, sub-arterial or arterial. Note not all networks are large enough to have both sub-arterial and collector roads
Collector	Connects the sub-arterial roads to the local road system in developed areas. May support sub-arterial roads during peak periods. May have been designed as local streets but can serve major traffic-generating developments or support non-local traffic. Note not all networks are large enough to have both collector and sub-arterial roads. The Road Noise Policy does not provide separate noise criteria for collector roads. Roads and Maritime applies sub-arterial noise criteria to collector roads and still considers collector roads and sub-arterial roads to be different functional classes.

Road	Definition
Local	Provide vehicular access to abutting property and surrounding streets. They are the subdivisional roads within a particular developed area.

Based on the definitions, the roads associated with construction traffic to and from the project site are classified In Table 4-8 below.

Table 4-8 Classification of construction route roads

Local road	Sub-arterial/collector road
• Quarry Road • Dural Street	• Peats Ferry Road • Bridge Street

4.5 Construction vibration

4.5.1 Human comfort

Vibration is assessed based on the criteria in *Assessing Vibration: a technical guideline* (DEC, 2006). *British Standard (BS) 6472 – 2008, Guide to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)* is recognised by the guideline as the preferred standard for assessing the 'human comfort criteria'. Intermittent vibration is assessed using the vibration dose value. Acceptable values of vibration dose are presented in Table 4-9 for sensitive receivers.

Whilst the assessment of response to vibration in *BS 6472-1:1992* is based on vibration dose value and weighted acceleration, for construction related vibration, it is considered more appropriate to provide guidance in terms of a peak particle velocity, since this parameter is likely to be more routinely measured based on the more usual concern over potential building damage.

Humans are capable of detecting vibration at levels which are well below those causing risk of damage to a building. The degrees of perception for humans are suggested by the vibration level categories given in *BS 5228.2 – 2009, Code of Practice Part 2 Vibration for noise and vibration on construction and open sites – Part 2: Vibration,* as shown below in Table 4-10

Table 4-9 Human comfort intermittent vibration dose values (BS 6472-1992)

Receiver type	Period	Intermittent vibration dose value ($m/s^{1.75}$)	
		Preferred value	Maximum value
Residential	Day	0.2	0.4

Table 4-10 Guidance on effects of vibration levels for human comfort (BS 5228.2 – 2009)

Vibration level	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction.
0.3 mm/s	Vibration might be just perceptible in residential environments.
1.0 mm/s	It is likely that vibration at this level in residential environments will cause complaints, but can be tolerated if prior warning and explanation has been given to residents.
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure.

4.5.2 Structural damage

BS 7385 is used to assess the effects of transient vibration on structures. The criteria provided in BS 7385 are presented in Table 4-11. The criteria provided in BS 7385 should be applied to all structures as BS 7385 states *'a building of historical value should not (unless it is structurally unsound) to be assumed to be more sensitive'*. Structures of significance should be assessed on a case-by-case basis if a dilapidation report indicates that they are structurally unsound. Heritage items have been identified within the study area, with the TAFE buildings K and M being the nearest heritage structures. However, these buildings are of brick construction and should not be deemed as structurally unsound. As such, the adopted BS 7385 criteria has been chosen to be appropriate.

Table 4-11 Transient vibration guide values – minimal risk of cosmetic damage (BS 7385-2)

Type of building	Peak component particle velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures. Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
Unreinforced or light framed structures. Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above.

4.5.3 Summary of vibration criteria

A summary of vibration screening criteria is provided in Table 4-12. The criteria are provided as a guide for determining potential human comfort or structural damage impacted buffer distances to determine if further detailed investigation is required. The levels provided in Table 4-12 are recommended screening criteria for the impact assessment. During construction of the Project compliance monitoring should be assessed against all criteria in Section 4.5.

Table 4-12 Recommended screening vibration criteria

Receiver type	Criteria type	Peak particle velocity screening criteria
Residential (standard structures)	Human comfort	1 mm/s
	Structural damage	15 mm/s[1]
Heritage structure	Structural damage	7.5 mm/s

Note:

1) The vibration screening criteria for heritage structures has been assumed to be half of the residential structural damage criteria and is considered conservative.

5. Modelling methodology

5.1 Construction noise assessment

5.1.1 Construction works program and noise generating equipment

The anticipated plant and equipment used for the project is shown in Table 5-1 with the corresponding octave-band sound power levels used in the noise model. Noise level data has been obtained from *BS5228-1:2009 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*. Other equipment may be used however it is anticipated that they would produce similar noise emissions.

Table 5-1 Modelled mobile quarry plant and sound power levels - dBA

Equipment	Octave band sound power level [Hz], dB(A)								Sound power LW (A)	Source
	63	125	250	500	1000	2000	4000	8000		
30T Excavator	88	98	99	105	106	104	99	91	111	BS5228-1:2009
Articulated dump truck	93	99	104	101	106	103	98	90	111	BS5228-1:2009
Bulldozer	86	95	97	105	105	101	95	88	109	BS5228-1:2009
30T Excavator and ripper	97	107	108	114	115	113	108	100	120	BS5228-1:2009
45T Excavator and breaker	93	103	108	117	114	115	112	106	121	BS5228-1:2009
Mobile crusher	96	106	112	115	115	113	107	95	120	BS5228-1:2009
Mini hydraulic excavator	81	88	84	94	93	91	86	79	99	BS5228-1:2009
Loader	87	97	93	101	100	99	98	88	107	BS5228-1:2009
Mobile screen	89	97	101	107	105	106	103	94	112	BS5228-1:2009
Roller / Compactor	92	100	97	101	106	105	101	93	111	BS5228-1:2009
Water cart	83	101	106	106	109	109	102	99	114	BS5228-1:2009
Tub grinder and mulcher	92	100	104	110	108	109	106	97	115	BS5228-1:2009

The magnitude of off-site noise impact associated with construction will be dependent upon a number of factors:

- The intensity and location of construction activities.
- The type of equipment used.
- Existing background noise levels.
- Intervening terrain and structures.
- The prevailing weather conditions.

5.1.2 Noise modelling assumptions

The noise modelling assumptions used in this assessment are as follows:

- Four construction work regions within the project site have been identified as shown in Figure 6.
- Three potential construction scenarios have been provided and can be summarised as (see Appendix C):

  Scenario 1

  – West: Excavation and rock breaking/ripping/crushing works

  – Quarry: Rock ripping, filling works, screening and excavation

  Scenario 2

  – North: Excavation works

  – Quarry: Excavation, Rock breaking/sawing/crushing, filling and screening

  – East: Excavation and filling

  Scenario 3

  – West: Excavation and rock sawing

  – Quarry: Filling

  – East: Rock ripping/sawing/crushing, filling, excavation and screening

Two quarry topographies for each scenario has been modelled. One representing the existing topography of the quarry at the beginning of the construction works (sub-scenarios A and B) and the other representing the proposed topography of the quarry based on the final design (sub scenarios C and D)(see Table 5-2).

- The loudest construction activities, being ripping, rock breaking and crushing were assessed as separate scenarios (30T Excavator and ripper, 45T Excavator and breaker and the mobile crusher). Sub-scenarios A and C do not include the rock breaking activities, whereas sub-scenarios B and D include the rock-breaking activities (see Table 5-3).

As a result, 12 potential construction sub-scenarios have been modelled. The parameters of each scenario is outlined below in Table 5-2 and Table 5-3.

- As a worst-case scenario, the two noisiest items of equipment within each scenario have been modelled at the closest distance between the receiver and the relevant construction area. For the majority of the time, construction equipment will be at a further distance from the sensitive receiver.
- The modelled items of construction equipment are assumed to be operating for a full 15 minute period.
- The equipment distribution for each construction scenario/area along with the adopted sound power level for the construction activity is presented in Table 5-3.

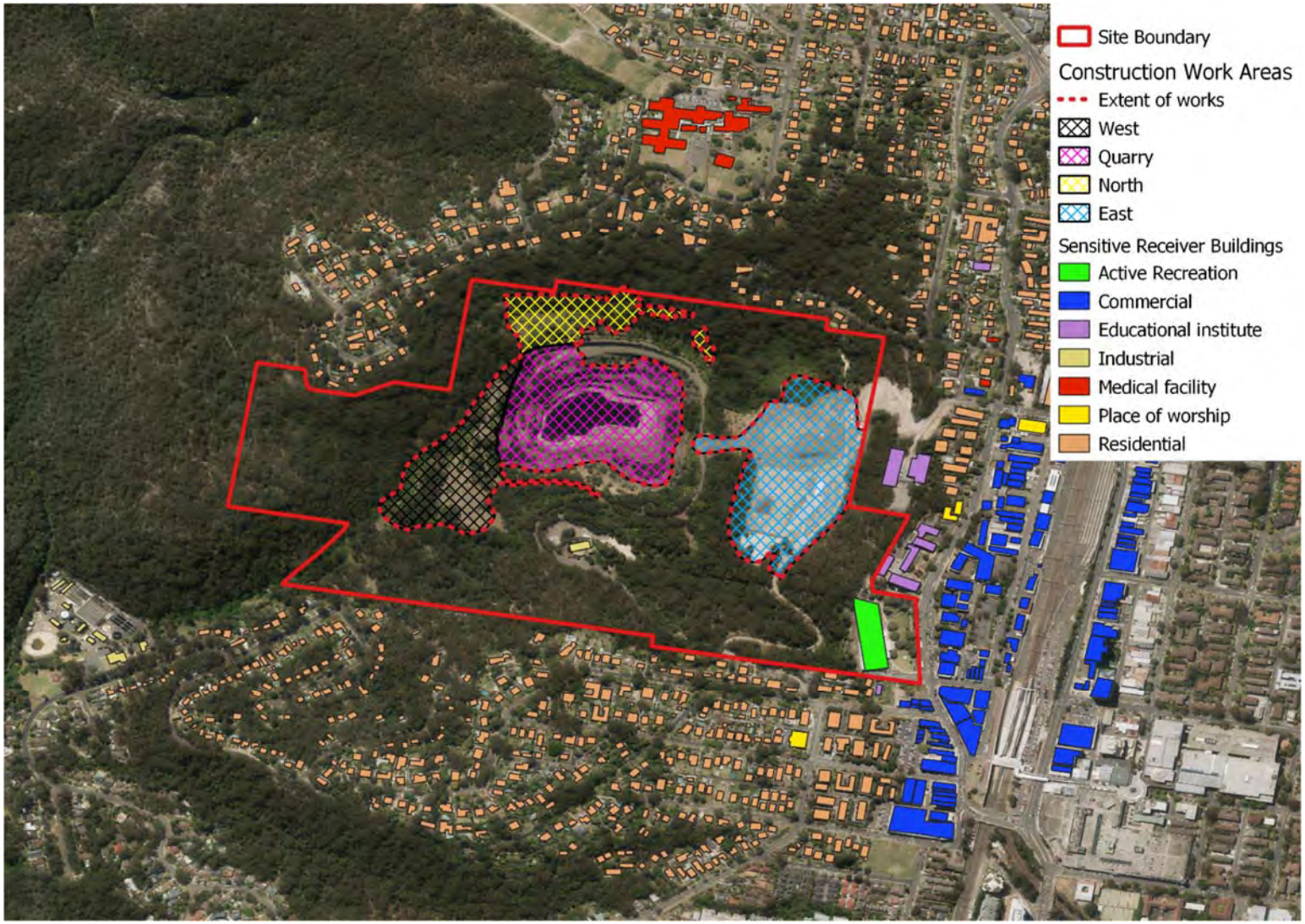


Figure 6 Construction work areas

Table 5-2 Construction scenario summary

Parameter	CS1A	CS1B	CS1C	CS1D	CS2A	CS2B	CS2C	CS2D	CS3A	CS3B	CS3C	CS3D
Construction Scenario	1	1	1	1	2	2	2	2	3	3	3	3
Topography used in model	Existing	Existing	Final Design	Final Design	Existing	Existing	Final Design	Final Design	Existing	Existing	Final Design	Final Design
Rock breaking / ripping/ sawing / crushing	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓

Table 5-3 Construction scenarios, equipment and activity sound power level

Equipment	CS1A				CS1B				CS1C				CS1D				CS2A				CS2B				CS2C				CS2D				CS3A				CS3B				CS3C				CS3D			
	W	Q	N	E	W	Q	N	E	W	Q	N	E	W	Q	N	E	W	Q	N	E	W	Q	N	E	W	Q	N	E	W	Q	N	E	W	Q	N	E	W	Q	N	E	W	Q	N	E	W	Q	N	E
30T Excavator	✓	✓			✓	✓			✓	✓			✓	✓				✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓		✓
Articulated dump truck	✓				✓				✓				✓					✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓		✓
Bulldozer		✓				✓				✓				✓					✓				✓				✓				✓				✓				✓				✓				✓
30T Excavator and ripper					✓	✓							✓	✓																																		
45T Excavator and breaker					✓								✓									✓								✓										✓								✓
Mobile crusher					✓								✓									✓								✓										✓								✓
Mini hydraulic excavator	✓	✓			✓	✓			✓	✓			✓	✓				✓				✓				✓				✓						✓				✓				✓				✓
Loader	✓	✓			✓	✓			✓	✓			✓	✓				✓				✓				✓				✓						✓				✓				✓				✓
Mobile screen	✓	✓			✓	✓			✓	✓			✓	✓				✓				✓				✓				✓						✓				✓				✓				✓
Roller/Compactor		✓				✓				✓				✓				✓		✓		✓		✓		✓		✓		✓		✓		✓		✓		✓		✓		✓		✓		✓		✓
Water cart	✓	✓			✓	✓			✓	✓			✓	✓				✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓		✓
Tub grinder and mulcher	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																																
Activity sound power level, dBA	**118**	**118**	**115**	**115**	**124**	**121**	**115**	**115**	**118**	**118**	**115**	**115**	**124**	**121**	**115**	**115**	**-**	**116**	**116**	**116**	**-**	**124**	**116**	**116**	**-**	**116**	**116**	**116**	**-**	**124**	**116**	**116**	**116**	**116**	**-**	**116**	**116**	**116**	**-**	**124**	**116**	**116**	**-**	**116**	**116**	**116**	**-**	**124**

Notes:

1) W refers to the western construction area
2) Q refers to the Quarry construction area
3) N refers to the northern construction area
4) E refers to the eastern construction area

5.1.1 Noise modelling inputs

Acoustic modelling was undertaken using SoundPLAN 7.4 noise modelling software to predict the effects of construction noise generated by the proposed works at Hornsby Quarry.

SoundPLAN 7.4 is a computer program for the calculation, assessment and prognosis of noise propagation. SoundPLAN calculates environmental noise propagation according to *ISO 9613-2:1996*. Terrain topography, ground absorption, atmospheric absorption and relevant shielding objects are taken into account in the calculations.

The *ISO 9613-2:1996* algorithm also takes into account the presence of a well-developed moderate ground based temperature inversion, such as commonly occurs on clear, calm nights or 'downwind' conditions which are favourable to sound propagation. The proposed construction hours are 7.00 am to 6 pm weekdays and until 1 pm on Saturdays meaning that temperature inversions are not likely. As such, modelling moderate temperature inversions and downwind during the daytime is considered conservative.

General parameters used in the model are listed in Table 5-4.

Table 5-4 Noise modelling parameters

Variable	Parameter Used
Calculation method	ISO 9613-2:1996
Meteorology	Well-developed moderate ground based temperature inversion, such as commonly occurs on clear, calm nights or 'downwind' conditions which are favourable to sound propagation.
Topography - existing	1 metre resolution
Topography – final design	1 metre resolution
Receiver heights	1.5 metres above building ground level
Building heights	Calculated based on LiDAR data of the study area
Floor height	3 metres per storey
Ground absorption	0.75 for the areas of vegetation 0.5 for all other areas (0 is non-porous ground and 1 is porous ground such as that found in a rural setting comprising of mainly grass and vegetation)
Volume attenuation area (foliage)	10 metre high foliage in areas of dense vegetation – ISO 9613-2:1996

5.2 Existing noise conditions due to the NorthConnex works

Noise modelling of the existing NorthConnex construction works was undertaken using the same noise modelling parameters detailed in Section 5.1.1. The current construction works boundary for the Hornsby Quarry site was modelled using an activity sound power level of SWL 115 dBA (typical for bulk earthworks and truck movements). Noise levels were predicted to the 2018 noise monitoring locations (see Section 3.4) and compared with the noise results shown in Appendix B to verify the noise model.

5.2.1 Validation of noise model

A review of the noise monitoring charts in Appendix B was undertaken to determine the range of the existing construction noise levels received at M1 – M5. These levels were compared to the predicted noise levels due to the NorthConnex construction works at Hornsby Quarry.

Table 5-5 presents a summary of the predicted noise levels and validation of the existing noise levels at M1 – M5. Overall the noise model can be considered validated and representative of the existing noise conditions at Hornsby Quarry and the surrounding receivers. Validation of the

existing noise conditions with the noise model ensures relative accuracy with the future noise modelling predictions.

Table 5-5 Verification of existing noise levels at M1 – M5

Noise Monitoring I.D	Address	Existing $L_{Aeq(15min)}$ construction noise levels (range)		Predicted L_{Aeq} noise level, dBAl	Predicted levels within existing range?
		Minimum	Maximum		
M1	Corner of Bridge Road and Roper Lane	65	70	59	No[1]
M2	9 Fern Tree Close	53	58	58	Yes
M3	98 Manor Road	50	55	54	Yes
M4	30 Lowanna Place	45	50	50	Yes
M5	Quarry Road	48	53	53	Yes

Note:

1) The measured construction noise levels at M1 were dominated by heavy vehicle movements along Bridge Road which was not modelled as part of the validation process.

6. Noise and vibration impacts

Construction noise levels have been predicted to the sensitive receivers within the study area with consideration to the acoustic requirements of the NPI and the ICNG.

The noise management levels (NML) (ICNG) and the project noise trigger levels (PTNL) (NPI) are presented in Table 6-1 and

Table 6-2 along with the predicted maximum and average L_{Aeq} noise level for each noise catchment area (NCA) or non-residential receiver. Also presented in the table are the maximum exceedances above the NML and PNTL and the worst-affected residential receiver within the NCA or non-residential receiver type.

The predicted noise levels for all sensitive receivers in the study area against the requirements of the ICNG and the NPI are shown in Appendix D and Appendix E, respectively. The predicted noise results show that CS1B, CS2D and CS3D will result in the highest number of exceedances for each of the three potential construction scenarios (see Appendix C). This is due to the fact that these scenarios include rock-breaking activities and is modelled at the closest distance between the source and the receivers. $L_{Aeq(15min)}$ noise contours CS1B, CS2D and CS3D are shown in Appendix F. The sub-scenario to result in the greatest amount of exceedances is CS3D.

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Table 6-1 Summary of predicted noise levels – residential receivers

NCA	NML	PTNL	Max. level in NCA	Avg. level in NCA	Max. exc. above NML	Max. exc. above PNTL	No. of exc. above NML	No. of exc. above PNTL	Worst affected receiver in NCA
CS1A – Existing terrain, no rock breaking works (West, Quarry)									
NCA01	45	40	67	44	22	27	117	151	R0391
NCA02	49	44	65	42	16	21	67	133	R0409
NCA03	47	42	61	41	14	19	62	84	R0318, R0819
NCA04	45	40	62	54	18	23	112	115	R1035
Total	-	-	-	-	-	-	358	483	
CS1B – Existing terrain, rock breaking works (West, Quarry)									
NCA01	45	40	68	48	23	28	143	204	R0380, R1144
NCA02	49	44	65	46	16	21	144	243	R0400, R0409
NCA03	47	42	67	43	20	25	75	108	R0819
NCA04	45	40	68	60	24	29	115	115	R1035
Total	-	-	-	-	-	-	477	670	
CS1C – Design terrain, no rock breaking works (West, Quarry)									
NCA01	45	40	67	44	22	27	117	151	R0391
NCA02	49	44	65	42	16	21	67	134	R0409
NCA03	47	42	61	41	14	19	62	85	R0383, R0819
NCA04	45	40	62	54	18	23	113	115	R0397, R1035
Total	-	-	-	-	-	-	359	485	
CS1D – Design terrain, rock breaking works (West, Quarry)									
NCA01	45	40	68	47	23	28	137	176	R0380
NCA02	49	44	65	45	16	21	135	186	R0400, R0409
NCA03	47	42	67	43	20	25	76	104	R0383, R0819
NCA04	45	40	68	60	24	29	115	115	R1035
Total	-	-	-	-	-	-	463	581	
CS2A – Existing terrain, no rock breaking works (North, East & Quarry)									
NCA01	45	40	68	43	23	28	109	146	R0391

NCA	NML	PTNL	Max. level in NCA	Avg. level in NCA	Max. exc. above NML	Max. exc. above PNTL	No. of exc. above NML	No. of exc. above PNTL	Worst affected receiver in NCA
NCA02	49	44	66	40	17	22	78	126	R0409
NCA03	47	42	60	40	13	18	58	86	R0400, R0680, R0834
NCA04	45	40	50	46	5	10	101	113	R0303, R0515, R0819, R1069
Total	-	-	-	-	-	-	346	471	
CS2B – Existing terrain, no rock breaking works (North, East & Quarry)									
NCA01	45	40	68	45	23	28	120	155	R0391
NCA02	49	44	66	43	17	22	119	165	R0380, R0409
NCA03	47	42	60	42	13	18	75	103	R0680, R0834
NCA04	45	40	58	51	13	18	110	113	R1069
Total	-	-	-	-	-	-	424	536	
CS2C – Design terrain, no rock breaking works (North, East & Quarry)									
NCA01	45	40	68	43	23	28	110	146	R0391
NCA02	49	44	66	41	17	22	78	126	R0409
NCA03	47	42	60	40	13	18	58	86	R0680, R0834
NCA04	45	40	51	46	6	11	101	113	R1059
Total	-	-	-	-	-	-	347	471	
CS2D – Design terrain, rock breaking works (North, East & Quarry)									
NCA01	45	40	68	45	23	28	120	155	R0391
NCA02	49	44	66	43	17	22	119	166	R0409
NCA03	47	42	60	42	13	18	75	103	R0680, R0834
NCA04	45	40	59	53	14	19	111	113	R0316, R0410, R1059
Total	-	-	-	-	-	-	425	537	
CS3A – Existing terrain, no rock breaking works (West, East & Quarry)									
NCA01	45	40	64	42	19	24	111	153	R0109, R0110, R0407, R0408
NCA02	49	44	66	40	17	22	77	126	R0409
NCA03	47	42	60	40	13	18	62	88	R0380, R0680, R0834, R1144
NCA04	45	40	60	52	16	21	112	113	R0673, R1035

NCA	NML	PTNL	Max. level in NCA	Avg. level in NCA	Max. exc. above NML	Max. exc. above PNTL	No. of exc. above NML	No. of exc. above PNTL	Worst affected receiver in NCA
Total	-	-	-	-	-	-	362	480	
CS3B – Existing terrain, rock breaking works (West, East & Quarry)									
NCA01	45	40	72	49	27	32	170	210	R0109, R0110, R0407, R0408
NCA02	49	44	74	48	25	30	163	208	R0109, R0110, R0407, R0408
NCA03	47	42	68	47	21	26	96	137	R0409
NCA04	45	40	60	52	16	21	112	114	R0680, R0834
Total	-	-	-	-	-	-	541	669	R0299, R1035
CS3C – Design terrain, no rock breaking works (West, East & Quarry)									
NCA01	45	40	64	42	19	24	111	153	R0109, R0110, R0407, R0408
NCA02	49	44	66	40	17	22	77	127	R0409
NCA03	47	42	60	40	13	18	63	88	R0680, R0834, R1144
NCA04	45	40	60	52	16	21	113	115	R0673, R0710, R1035
Total	-	-	-	-	-	-	364	483	
CS3D – Design terrain, rock breaking works (West, East & Quarry)									
NCA01	45	40	72	49	27	32	170	210	R0109, R0110, R0407, R0408
NCA02	49	44	74	48	25	30	164	208	R0409
NCA03	47	42	68	47	21	26	95	138	R0680, R0834
NCA04	45	40	60	52	16	21	113	116	R0299, R1035
Total	-	-	-	-	-	-	542	672	

Table 6-2 Summary of predicted noise levels – non-residential receivers

Receiver type	NML	PTNL	Max. level	Avg. level	Max. exc. above NML	Max. exc. above PNTL	No. of exc. above NML	No. of exc. above PNTL	Worst affected receiver
CS1A – Existing terrain, no rock breaking works (West, Quarry)									
Commercial	70	65	60	40	-	-	-	-	
Industrial	75	70	67	49	-	-	-	-	
Medical facility	55	50	50	45	-	-	-	1	
Place of worship	55	50	61	53	6	11	2	3	R0715
Educational institute	55	55	71	62	16	16	7	7	R0106
Active Recreation	65	55	76	57	11	21	1	2	R1151
CS1B – Existing terrain, rock breaking works (West, Quarry)									
Commercial	70	65	60	45	-	-	-	-	
Industrial	75	70	73	55	-	3	-	1	
Medical facility	55	50	56	51	2	6	3	5	R0116
Place of worship	55	50	61	55	7	11	2	3	R0715
Educational institute	55	55	71	62	17	16	7	7	
Active Recreation	65	55	76	60	12	21	1	3	R1151
CS1C – Design terrain, no rock breaking works (West, Quarry)									
Commercial	70	65	60	40	-	-	-	-	
Industrial	75	70	67	49	-	-	-	-	
Medical facility	55	50	50	46	-	-	-	2	
Place of worship	55	50	61	53	7	11	2	3	R0715
Educational institute	55	55	71	62	17	16	7	7	R0106
Active Recreation	65	55	76	57	12	21	1	2	R1151
CS1D – Design terrain, rock breaking works (West, Quarry)									
Commercial	70	65	60	45	-	-	-	-	
Industrial	75	70	74	55	-	4	-	1	
Medical facility	55	50	56	51	2	6	2	5	R0116
Place of worship	55	50	61	55	7	11	2	3	R0715

Receiver type	NML	PTNL	Max. level	Avg. level	Max. exc. above NML	Max. exc. above PNTL	No. of exc. above NML	No. of exc. above PNTL	Worst affected receiver
Educational institute	55	55	71	62	17	16	7	7	R0106
Active Recreation	65	55	76	60	12	21	1	3	R1151
CS2A – Existing terrain, no rock breaking works (North, East & Quarry)									
Commercial	70	65	61	38	-	-	-	-	
Industrial	75	70	59	36	-	-	-	-	
Medical facility	55	50	50	44	-	-	-	1	
Place of worship	55	50	62	54	8	12	2	3	R0715
Educational institute	55	55	72	63	18	17	7	7	R0106
Active Recreation	65	55	77	56	13	22	1	2	R1151
CS2B – Existing terrain, no rock breaking works (North, East & Quarry)									
Commercial	70	65	61	42	-	-	-	-	
Industrial	75	70	66	39	-	-	-	-	
Medical facility	55	50	55	47	-	5	1	3	
Place of worship	55	50	62	55	8	12	2	3	R0715
Educational institute	55	55	72	63	18	17	7	7	R0106
Active Recreation	65	55	77	59	13	22	1	2	R1151
CS2C – Design terrain, no rock breaking works (North, East & Quarry)									
Commercial	70	65	61	42	-	-	-	-	
Industrial	75	70	59	39	-	-	-	-	
Medical facility	55	50	51	47	-	1	-	1	
Place of worship	55	50	62	55	8	12	2	3	R0715
Educational institute	55	55	72	63	18	17	7	7	R0106
Active Recreation	65	55	77	59	13	22	1	2	R1151
CS2D – Design terrain, rock breaking works (North, East & Quarry)									
Commercial	70	65	61	42	-	-	-	-	
Industrial	75	70	66	39	-	-	-	-	
Medical facility	55	50	55	47	-	5	1	3	

Receiver type	NML	PTNL	Max. level	Avg. level	Max. exc. above NML	Max. exc. above PTNL	No. of exc. above NML	No. of exc. above PTNL	Worst affected receiver
Place of worship	55	50	62	55	8	12	2	3	R0715
Educational institute	55	55	72	63	18	17	7	7	R0106
Active Recreation	65	55	77	59	13	22	1	2	R1151
CS3A – Existing terrain, no rock breaking works (West, East & Quarry)									
Commercial	70	65	61	42	-	-	-	-	
Industrial	75	70	66	39	-	-	-	-	
Medical facility	55	50	49	47	-	-	-	-	
Place of worship	55	50	62	55	8	12	2	3	R0715
Educational institute	55	55	72	63	18	17	7	7	R0106
Active Recreation	65	55	77	59	13	22	1	2	R1151
CS3B – Existing terrain, rock breaking works (West, East & Quarry)									
Commercial	70	65	69	42	-	4	-	1	
Industrial	75	70	67	39	-	-	-	-	
Medical facility	55	50	57	47	2	7	3	6	R0116
Place of worship	55	50	70	55	16	20	3	3	R0715
Educational institute	55	55	80	63	26	25	8	8	R0106
Active Recreation	65	55	85	59	21	30	2	3	R1151
CS3C – Design terrain, no rock breaking works (West, East & Quarry)									
Commercial	70	65	61	42	-	-	-	-	
Industrial	75	70	66	39	-	-	-	-	
Medical facility	55	50	49	47	-	-	-	-	
Place of worship	55	50	62	55	8	12	2	3	R0715
Educational institute	55	55	72	63	18	17	7	7	R0106
Active Recreation	65	55	77	59	13	22	1	2	R1151
CS3D – Design terrain, rock breaking works (West, East & Quarry)									
Commercial	70	65	69	42	-	4	-	1	
Industrial	75	70	67	39	-	-	-	-	

Receiver type	NML	PTNL	Max. level	Avg. level	Max. exc. above NML	Max. exc. above PNTL	No. of exc. above NML	No. of exc. above PNTL	Worst affected receiver
Medical facility	55	50	57	47	2	7	3	6	
Place of worship	55	50	70	55	16	20	3	3	R0715
Educational institute	55	55	80	63	26	25	8	8	R0106
Active Recreation	65	55	85	59	21	30	2	3	R1151

6.1 Noise impacts – Interim Construction Noise Guideline (ICNG)

Where the predicted $L_{Aeq(15\ minute)}$ noise level is greater than the noise management levels, all feasible and reasonable work practices should be applied, however, it is unlikely that mitigation measures would reduce the predicted noise levels below the management levels. The magnitudes of construction noise levels are dependent on the duration of construction, the type of equipment, location of activities, the surrounding environment's background noise levels and the weather conditions during construction. The predicted noise levels are generally conservative as the construction noise model predicts the worse-case 15 minute scenario and these levels may not represent the actual noise emission experienced by the community throughout the entire construction period.

The predicted noise levels to receivers within the study area against the NMLs are presented in Appendix D. The residential NMLs are predicted to be exceeded at the majority of residences located within 800 metres of the construction works at some stage during construction. CS3D is predicted to result in the highest number of exceedances of the NMLs.

The predicted results at the worst-affected receivers during CS3D indicate that:

- R0109, R0110, R0407 and R0408 (NCA01) are predicted to receive noise levels 27 dBA above the NML
- R0409 (NCA02) is predicted to receive noise levels 25 dBA above the NML
- R0680 and R0834 (NCA03) are predicted to receive noise levels 21 dBA above the NML
- R0299 and R1035 (NCA04) are predicted to receive noise levels 16 dBA above the NML
- R0117 (Medical facility – Mount Wilga Private Hospital) is predicted to receive noise levels 2 dBA above the NML
- R0106 (Educational institute – Hornsby TAFE) is predicted to receive noise levels 25 dBA above the NML
- R0715 (Place of worship – St Peter's Anglican Church) is predicted to receive noise levels 16 dBA above the NML
- R1151 (Active recreation – Hornsby Mountain Bike Trail) is predicted to receive noise levels 21 dBA above the NML
- No other non-residential receivers are predicted to receive noise levels that exceed the NML

All other construction scenarios are predicted to result in a lower amount of exceedances of the NMLs. No exceedances of the highly noise affected criteria of 75 dBA have been predicted at any residential receivers.

It should be noted that the predicted noise levels is a maximum noise level from the closest potential distance from the receiver to the relevant construction activity. For the majority of the time, noise levels will be much lower than the predicted results as there will be a greater distance between the source and the receiver.

Mitigation measures to manage noise impacts have been recommended and are provided in Section 7.

6.2 Noise impacts - Noise Policy for Industry (NPI)

6.2.1 Suitability of NPI requirements

Section 1.5 of the NPI provides a list of activities that are excluded from the policy and includes construction activities. As the construction works proposed at Hornsby Quarry are not permanent and are temporary in nature, the ICNG should be considered a more suitable framework to assess potential noise impacts. Never-the-less, the acoustic requirements detailed in the SEARS 1167 require the noise impacts be assessed against the NPI project noise trigger levels for sensitive receivers. A summary of the predicted noise levels against the sub-scenario with the greatest amount of exceedances is provided below. The predicted noise levels to sensitive receivers within the study area against the PNTLs are presented in Appendix E.Appendix D

6.2.2 Predicted noise levels

The predicted results at the worst-affected receivers during CS3D indicate that:

- R0109, R0110, R0407 and R0408 (NCA01) are predicted to receive noise levels 32 dBA above the PNTL
- R0409 (NCA02) is predicted to receive noise levels 30 dBA above the PNTL
- R0680 and R0834 (NCA03) are predicted to receive noise levels 26 dBA above the PNTL
- R0299 and R1035 (NCA04) are predicted to receive noise levels 20 dBA above the PNTL
- R004 (Commercial – Service NSW Hornsby) is predicted to receive noise levels 4 dBA above the PNTL
- R0117 (Medical facility – Mount Wilga Private Hospital) is predicted to receive noise levels 7 dBA above the PNTL
- R0106 (Educational institute – Hornsby TAFE) is predicted to receive noise levels 25 dBA above the PNTL
- R0715 (Place of worship – St Peter's Anglican Church) is predicted to receive noise levels 16 dBA above the PNTL
- R1151 (Active recreation – Hornsby Mountain Bike Trail) is predicted to receive noise levels 30 dBA above the PNTL
- No industrial receivers are predicted to receive noise levels that exceed the PNTL

All other construction sub-scenarios are predicted to result in a lower amount of exceedances of the PNTLs.

Mitigation measures to manage noise impacts (including an assessment of potential noise barriers) have been recommended and are provided in Section 7 along with an assessment of the residual noise impacts subsequent to the incorporation of the mitigation measures

6.2.3 Tonal noise assessment

Tonal noise characteristics are identified by assessing the predicted one-third octave noise levels. No modifications to the predicted operational noise levels are required as no tonal noise characteristics were identified at the nearest sensitive receivers.

6.2.4 Low frequency noise assessment

Low frequency noise impacts were assessed using the modelled A-weighted and C-weighted L_{eq} noise levels. The difference between the C-weighted and A-weighted levels at the nearest

sensitive receivers during each assessment period did not result in any modification of the predicted noise results.

6.3 Exceedances above the PNTLs/NMLs

The predicted exceedances above the NMLs and the PNTLs at sensitive receivers are predicted to be significant during high noise activities (rock breaking works) and when the distance between the source and receiver is the shortest. CS1B, CS2D and CS3D are predicted to result in the highest number of exceedances, respectively, as they involve rock breaking activities and are modelled at the highest terrain.

A summary of the degrees of exceedances above the NMLs and the PNTLs for CS2B (worst-case scenario) are presented in Table 6-3 and Table 6-4.

Table 6-3 Exceedances above NMLs (ICNG)

Sensitive Receiver Type	Noise Management Level (NML)	Sensitive receivers exceeding NML	Sensitive receivers exceeding NML +10 dBA	Sensitive receivers exceeding NML +20 dBA	Sensitive receivers exceeding NML +30 dBA
NCA01	45	170	91	10	0
NCA02	49	163	58	20	0
NCA03	47	96	45	7	0
NCA04	45	112	32	0	0
Commercial	70	0	0	0	0
Industrial	75	0	0	0	0
Medical facility	55	3	0	0	0
Educational institute	55	8	7	1	0
Place of worship	55	3	2	0	0
Active recreation	65	2	1	1	0

Table 6-4 Exceedances above PNTLs (NPI)

Sensitive Receiver Type	Project Noise Trigger Level (PNTL)	Sensitive receivers exceeding PTNL	Sensitive receivers exceeding PTNL + 10 dBA	Sensitive receivers exceeding PTNL + 20 dBA	Sensitive receivers exceeding PTNL + 30 dBA
NCA01	40	210	126	36	5
NCA02	44	208	104	35	0
NCA03	42	137	63	34	0
NCA04	40	114	101	1	0
Commercial	65	1	0	0	0
Industrial	70	0	0	0	0
Medical facility	50	6	0	0	0
Educational institute	55	8	7	1	0
Place of worship	50	3	2	1	0
Active recreation	55	3	2	1	1

Exceedances above the PNTLs are shown graphically in Appendix G for CS1B, CS2D and CS3D. The mitigation measures in Section 7 have been recommended to reduce the severity of the exceedances above the PNTLs and the NMLs.

6.4 Construction traffic impacts – Road Noise Policy (RNP)

The RNP recommends that "*any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'without construction' scenario".* Construction activities would generate heavy vehicle movements associated with the transportation of construction machinery, equipment and materials to and from the site via Dural Street and Quarry Road at the start and end of the project. No other significant heavy vehicle movement are anticipated as no spoil is to be moved to or from the site. For safety reasons, some heavy machinery/equipment may need to be delivered via Dural Street and Quarry Road during the night period. Light vehicle movements would be associated with the entry and exit for construction staff to and from the site via Bridge Road and Peats Ferry Road during the entire construction period.

Dural Street and Quarry Road – Heavy vehicle movements

Approximately 26 heavy vehicles (delivering construction plant and equipment) will travel to and from the site via Dural Street and Quarry Road over the space of a week with a predicted maximum of twelve heavy vehicle movements in a day. This equates to approximately one heavy vehicle movement within an hour period. The existing traffic volumes for Dural Street and Quarry Road were not available as part of this assessment. As such, the predicted increase in noise level has not been assessed.

However, the predicted $L_{Aeq(1hr)}$ noise level due to one heavy vehicle movement an hour along Dural Street and Quarry Road is 50 dBA when assessed at the nearest residential façade 7 metres from Quarry Road (RMS Construction Road Traffic Noise Estimator). As such, the construction traffic movements along Dural Street and Quarry Road is predicted to comply with the acoustic requirements of the RNP during the day and night period given there is only one heavy vehicle movement per hour.

Peats Ferry Road – Light vehicle movements

GHD's traffic impact assessment indicates that over 5,000 vehicles utilise Peats Ferry Road between the hours of 7:00 am and 10:00 pm. A significant increase in traffic volume would be needed in order to increase road traffic noise by 2 dBA (a doubling in traffic corresponds to about a 3 dBA increase). 60 light vehicle movements along Peats Ferry Road during the day period is not significant enough to increase the noise levels by 2 dBA. As such, the construction traffic movements along Peats Ferry Road is predicted to comply with the acoustic requirements of the RNP.

Bridge Road – Light vehicle movements

Table 6-29 from the *Hornsby Quarry – Road construction Spoil Management Project EIS* (RMS & AECOM, 2015) presents 1 hour road traffic volumes for Bridge Road. The lowest traffic hour for Bridge Road is 86 light vehicles and no heavy vehicles. An increase of 30 light vehicles in an hour travelling to or from the site is predicted to result in an increase of 1.3 dBA at the nearest residential facade 12 metres from the road (RMS Construction Road Traffic Noise Estimator). As such, the construction traffic due to movements along Bridge Road is predicted to comply with the acoustic requirements of the RNP.

Road Noise Policy (RNP)

During the construction period, the use of construction vehicles along Dural Street, Quarry Road, Peats Ferry Road and Bridge Street is predicted to comply with the acoustic requirements of the RNP. Mitigation measures to reduce potential construction traffic noise impacts along Dural Street and Quarry Road are provided in Section 7.2.

6.5 Construction vibration impacts

6.5.1 Assessment methodology

The methodology for the construction vibration assessment included:

- vibration from surface construction plant and equipment was assessed with consideration to the vibration safe working distances presented within the *Construction Noise and Vibration Guideline (RMS 2010)* and German Standard *DIN 4150-3: 1999 Structural Vibration – Part 3: Effects of vibration on structures* (Deutsches Institut für Normung, 1999)
- where vibration levels were predicted to exceed the construction noise management levels, appropriate construction noise and vibration mitigation measures were provided to minimise impacts from each construction phase.

Energy from construction equipment is transmitted into the ground and transformed into vibrations, which attenuates with distance. The magnitude and attenuation of ground vibration is dependent on the following:

- the efficiency of the energy transfer mechanism of the equipment (i.e. impulsive; reciprocating, rolling or rotating equipment)
- the frequency content
- the impact medium stiffness
- the type of wave (surface or body)
- the ground type and topography.

Construction and demolition works have the potential to impact human comfort and / or cause structural damage to buildings. Potential vibration inducing activities identified during construction and demolition works include:

- rock breaking will generate impulsive vibration emissions
- bulk earthworks, vibratory rolling and compacting works will be a source of intermittent or continuous vibration.

Safe working buffer distances to comply with the human comfort, cosmetic damage and heritage structural damage criteria were taken from the Construction Noise and Vibration Guideline (CNVG) and are provided in Table 6-5. Safe working buffer distances for heritage buildings were estimated by doubling the buffer distance for standard structures.

Table 6-5 Vibration safe working buffer distances, m

Activity	Human comfort	Structural damage	
		Heritage building/structure	Standard dwellings
Vibratory roller (>18 tonnes)	100 m	50 m	25 m
Vibratory roller (13-18 tonnes)	100 m	40 m	20 m
Vibratory roller (7-13 tonnes)	100 m	30 m	15 m

Activity	Human comfort	Structural damage	
		Heritage building/structure	Standard dwellings
Vibratory roller (4-6 tonnes)	40 m	24 m	12 m
Vibratory roller (2-4 tonnes)	20 m	12 m	6 m
Vibratory roller (1-2 tonnes)	15 m	10 m	5 m
Large hydraulic hammer (1600 kg, 18 to 34 tonne excavator)	73 m	44 m	22 m
Medium hydraulic hammer (900 kg, 12 to 18 tonne excavator)	23 m	14 m	7 m
Small hydraulic hammer 300 kg, 5 to 12 tonne excavator)	7 m	4 m	2 m

Note:

1) The safe working distance for heritage structures has been assumed to be double the safe working distance for standard dwellings

6.5.2 Construction vibration impacts

Vibratory rolling and compacting works (plant over 18 tonnes) haven been identified as the most vibration intensive activity associated with the construction works. Safe working buffer distances for human comfort (100 metres) and structural damage to standard (25 metres) and heritage buildings (50 metres) due to rolling/compacting works are shown in Figure 7. A review of the sensitive receivers within the safe working distances has been undertaken and the following has been found:

- The nearest residential receivers to the north of the site are within the safe working distances for human comfort. Rolling works within 100 metres of residential dwellings have the potential to cause adverse vibration impacts to human comfort to the residences to the north. These impacts are temporary in nature and would likely only be experienced for limited periods during construction.
- Hornsby TAFE has been identified within 100 metres of the eastern construction works and may result in adverse human comfort vibration impacts during rolling/compacting works. These impacts are temporary in nature and would likely only be experienced for limited periods during construction.
- No other sensitive receivers have been identified within the 100 metre safe working distance for human comfort.
- No standard dwellings have been identified within 25 metres of the construction work areas. As such, no adverse structural damage impacts to standard dwellings are anticipated.
- One heritage structure has been identified within the 50 metre structural damage buffer. This structure has been identified as the most western building of Hornsby TAFE. The building is only marginally within the calculated structural damage buffer zone. This building is not considered structurally unsound and as such, no adverse structural damage impacts are anticipated to this building as a result of rolling/compacting works along the eastern construction area.

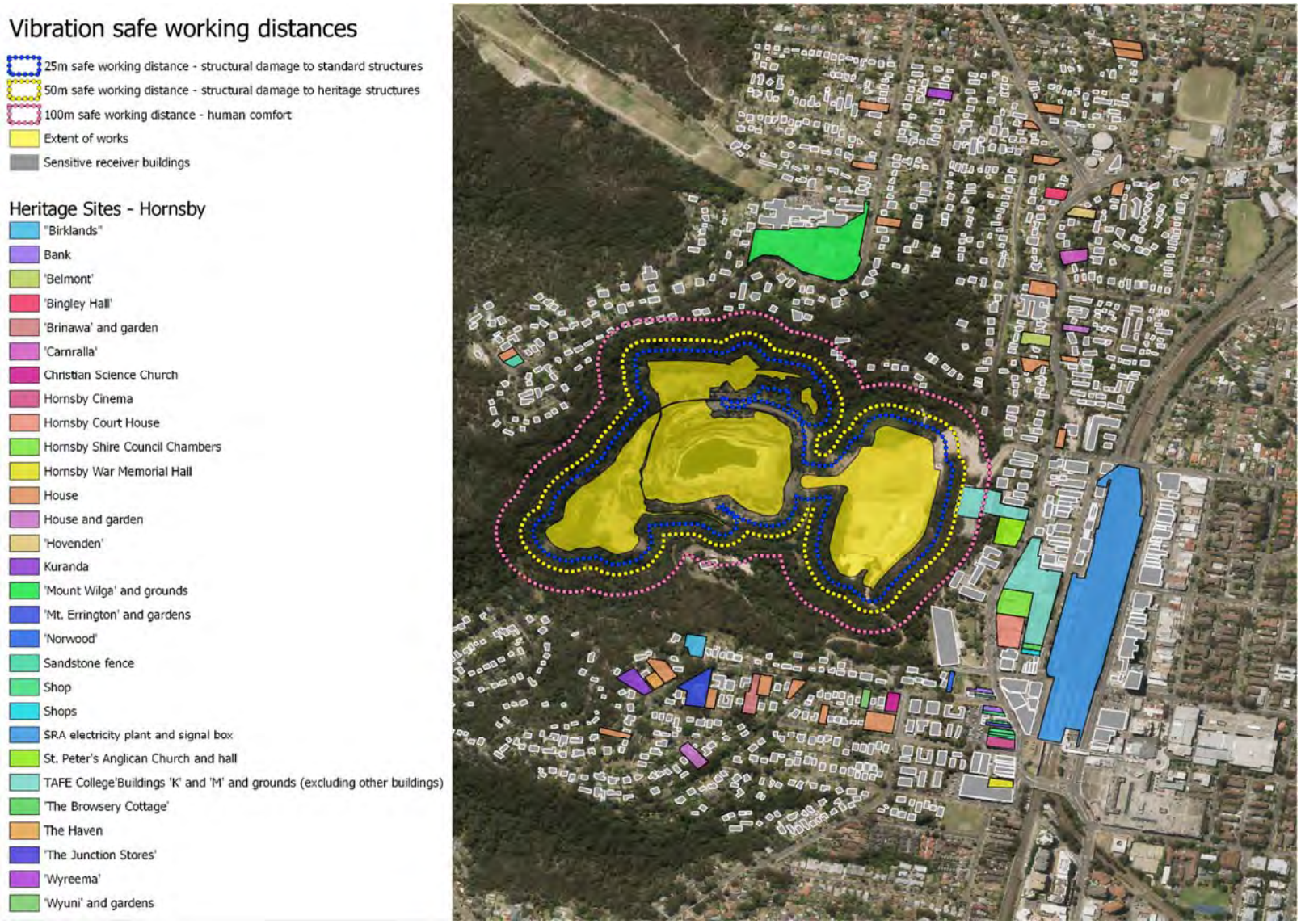

Figure 7 Vibration safe working distances

7. Mitigation measures

7.1 Construction noise

It is typical for construction projects to exceed the construction noise management levels. Any impacts due to construction works are temporary in nature and would not represent a permanent impact on the community and surrounding environment. The predicted noise levels are generally conservative and would only be experienced for limited periods during construction. Impacts may be reduced through the introduction of feasible and reasonable mitigation measures which have been recommended. However, these mitigation measures are unlikely to reduce noise levels below the construction noise management levels (ICNG) and the project noise trigger levels (NPI) at the nearest sensitive receivers.

7.2 Recommended management mitigation measures

These measures should be incorporated in the Environmental Management Plan as general work practice:

- All activities on site should be confined between the hours: daytime hours of 7:00 am to 6:00 pm from Monday to Friday and 7:00 am to 1:00 pm on Saturday
- All personnel on site should be made aware of the potential for noise impacts and should aim to minimise impact or elevated noise levels, where possible.
- Regular identification of noisy activities and adoption of improvement techniques
- Minimise the need for vehicle reversing (for example, by arranging for one-way site traffic routes)
- Construction heavy vehicles utilising Dural Street and Quarry Road should be limited to one vehicle per hour during the night period
- Scheduling of respite periods for high noise activities including rock breaking, ripping and sawing
- A noise monitoring program should be carried out for the duration of the works in accordance with any approval and license conditions
- No swearing or unnecessary shouting or loud stereos/radios on site
- All employees, contractors and sub-contractors are to receive an environmental induction. The induction should include:
  - all relevant project specific and 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
  - construction traffic routes
  - site opening/closing times (including deliveries)
  - environmental incident procedures

- Notification detailing work activities, dates and hours, impacts and mitigation measures indication of work schedule, and contact phone number (for noise complaints and project information) should be made available for the community.

7.3 Noise mitigation strategies

Generally, there are three mitigation strategies that can be used to reduce noise emission to sensitive receivers, being (from most preferred to least preferred):

1. Control at the source (for e.g. selecting quieter equipment, enclosing the source, closing doors at sensitive times, active noise control, times of operation etc.)
2. Control in transmission (noise barriers, mound and bunds and site design to maximise distance or utilise intervening buildings as barriers etc.)
3. Receiver controls (insulation, upgraded glazing of windows and use of mechanical ventilation etc.)

7.3.1 Recommended noise mitigation measures (at source)

The following mitigation measures are recommended to reduce noise at the source. The typical and maximum noise reductions due to these measures have been summarised in Table 7-1.

Table 7-1 Noise control measures

Control measure	Type of control	Typical reduction, dBA	Maximum reduction, dBA	Source
Silencers / mufflers / diffusers	Source	7 - 10	15	AS2436
Acoustic enclosures	Source	15 - 30	50	AS2436
Equipment substitution	Source	5-10	10	AS2436
Distance	Source / transmission path	6 per doubling of distance	6 per doubling of distance	AS2436

Substitution

- Where reasonably practicable, noisy plant should be replaced by less noisy alternatives

Modification of existing equipment

- All engine covers should be kept closed while equipment is operating.
- Plant and vehicles should be kept properly serviced and fitted with appropriate mufflers and silencers, where applicable.
- The use of exhaust brakes should be eliminated, where practical.
- Where practical, plant operating on site are to be fitted with broadband reversing alarms.
- Acoustic enclosures should be provided for suitable equipment

Use and siting of plant

- The offset distance between noisy plant and adjacent sensitive receivers is to be maximised where practical
- Plant used intermittently is to be throttled down or shut off
- Noise-emitting plant is to be directed away from sensitive receivers, where possible

Regular and effective maintenance

- Regularly inspect and maintain equipment to ensure it is in good working order. Also check the condition of mufflers
- Machines found to produce excessive noise compared to industry best practice should be removed from the site or stood down until repairs or modifications can be made.
- Ensure air lines on pneumatic equipment do not leak
- Return any hired equipment that is causing noise that is not typical for the equipment – the increased noise may indicate the need for repair.

Alternative methods

- Examine and implement, where feasible and reasonable, alternatives to rock-breaking work methods, such as hydraulic splitters for rock and concrete, hydraulic jaw crushers, chemical rock and concrete splitting. The suitability of alternative methods should be considered on a case-by-case basis.

7.3.2 Recommended noise mitigation measures (in transmission)

Due to the environment surrounding the project site (the size and topography), it is unlikely that transmission path controls would be feasible during the construction works. Never-the-less, computer noise modelling has been undertaken to quantify the acoustic benefit of a hypothetical 5 metre noise barrier surrounding all construction work areas at Hornsby Quarry. The predicted noise reduction at the worst-affected receivers are shown in Table 7-2.

Table 7-2 5 metre barrier noise reduction at nearest receivers

Receiver	Receiver Type	NCA	Noise reduction, dBA
R0106	Educational institute	-	2.2
R0365	Residential	NCA01	3.2
R0404	Residential	NCA01	3.3
R0405	Residential	NCA01	2.4
R0406	Residential	NCA01	2.6
R0407	Residential	NCA01	3.8
R0408	Residential	NCA01	2.9
R1037	Residential	NCA04	2.7
R1086	Residential	NCA04	2.2
R1129	Residential	NCA04	3.5
R1131	Residential	NCA04	2.7
R1147	Residential	NCA04	4.2
Maximum noise reduction			**4 dBA**
Average noise reduction			**3 dBA**

The predicted noise reductions indicate a maximum noise reduction of 4 dBA and an average noise reduction of 3 dBA when assessed at the worst-affect sensitive receivers. As some of these receivers are predicted to result in exceedances of greater than 20 dBA above the project noise trigger levels (NPI), the incorporation of noise barriers around the project area is not considered reasonable or feasible as it would only provide limited acoustic benefit. This is due to the terrain of the quarry and the prevalence to two-storey dwellings surrounding the quarry area where line-of-sight between the receiver and construction equipment is only marginally reduced by the incorporation of a noise barrier. Any noise barrier higher than 5 metres is not likely to be practically feasible to construct due to the terrain of the project site.

7.3.3 Recommended noise mitigation measures (at receiver)

Noise control measures at the receiver are not suitable for construction noise as construction noise is temporary in nature and will not result in long-term noise impacts the community. Additionally, noise control measures at receivers is not cost-effective due to the high number of receivers surrounding the project site.

7.4 Residual noise impacts

The noise levels at the most-affected receivers during the construction works are predicted to exceed the project noise trigger levels by more than 20 dBA without noise mitigation. The incorporation of the noise controls at the source will likely provide a noise reduction between 5 – 10 dBA. As such, the residual noise impact will likely be in excess of 10 dBA above the project noise trigger levels (NPI).

As the construction works are temporary in nature, the noise impacts will only be during the duration of the project and will result in a benefit to community as the quarry is proposed to be rehabilitated as a public park.

7.5 Vibration mitigation measures

Where vibratory rolling or compacting works undertaken within 100 metres of the most western building of the Hornsby TAFE, the occupants of this building should be notified of the expected impacts. Should complaints be received, vibration monitoring should be undertaken to determine the extent of the vibration impact and to guide mitigation measures, which may include the use of smaller equipment when the TAFE is in use.

Where practical, rolling works near the TAFE should be undertaken during the holiday break period to minimise potential vibration impacts.

8. Conclusion

Noise and vibration impacts - Interim Construction Noise Guideline (ICNG)

Noise levels are predicted to exceed the construction noise management levels (NMLs) at the nearest sensitive receivers during recommended standard hours. Noise levels are not predicted to exceed the highly noise affected criteria at any residential receivers.

It is typical for construction projects to exceed the construction noise management levels. Any impacts due to construction works will be temporary during the construction period and would not represent a continuous impact on the community and surrounding environment due to changes in activities and plant used. The predicted noise levels are generally considered conservative and would likely only be experienced for limited periods during construction. Potential impacts would be reduced through the introduction of feasible and reasonable mitigation measures which have been recommended within this report,

Safe working distances for vibration activities have been identified for standard/heritage structures and for human comfort. No adverse structural damage impacts are anticipated as a result of the project. One building within Hornsby TAFE has been identified within the safe working distance for human comfort. Mitigation measures have been recommended to reduce potential construction vibration impacts.

Noise impacts – Noise Policy for Industry (NPI)

Noise levels are predicted to exceed the project trigger noise levels (PTNLs) during the daytime period at the majority of sensitive receivers within the study area.

Note should be made that the Noise Policy for Industry (NPI) is generally used to assess permanent noise impacts to sensitive receivers due to the operation of industrial premises or developments. Construction activities are excluded from the NPI as they are temporary in nature. Section 1.5 of the NPI make specific reference to activities and facilities that are excluded from the policy, one of these being construction activities. Never-the-less, potential noise impacts have been assessed against the NPI and ICNG criteria to adequately satisfy the acoustic requirements detailed within the Secretary's Environmental Assessment Requirements (SEARs 1167).

Mitigation measures have been recommended to reduce potential noise impacts. Subsequent to the incorporation of these mitigation measures, the residual noise impact is predicted to still exceed the PTNLs at the nearest sensitive receivers.

Construction road traffic noise

Traffic noise levels resulting from construction vehicle movements are predicted to meet the RNP noise criteria when assessed at residences adjacent to Bridge Road, Peats Ferry Road, Dural Street and Quarry Road.

Mitigation measures

Mitigation measures have been recommended to reduce potential noise impacts at sensitive receivers during the construction works. The following is a summary of the mitigation measures:

- Management measures (times of operation, respite periods, community consultation, provision of a noise monitoring program etc.)
- Control at the source (substitutions for quieter equipment, modification of existing equipment, use and siting of plant, regular maintenance of equipment and alternative construction methods)

- Control in transmission (noise barriers have been assessed and modelled and are not considered as a reasonable and feasible mitigation option)
- Control at the receiver (not a reasonable and feasible mitigation option as the works are temporary and will result in a benefit to the community when the works are completed)

9. References

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British Standards, 2008, *BS 6472 – 2008, Gudie to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)*

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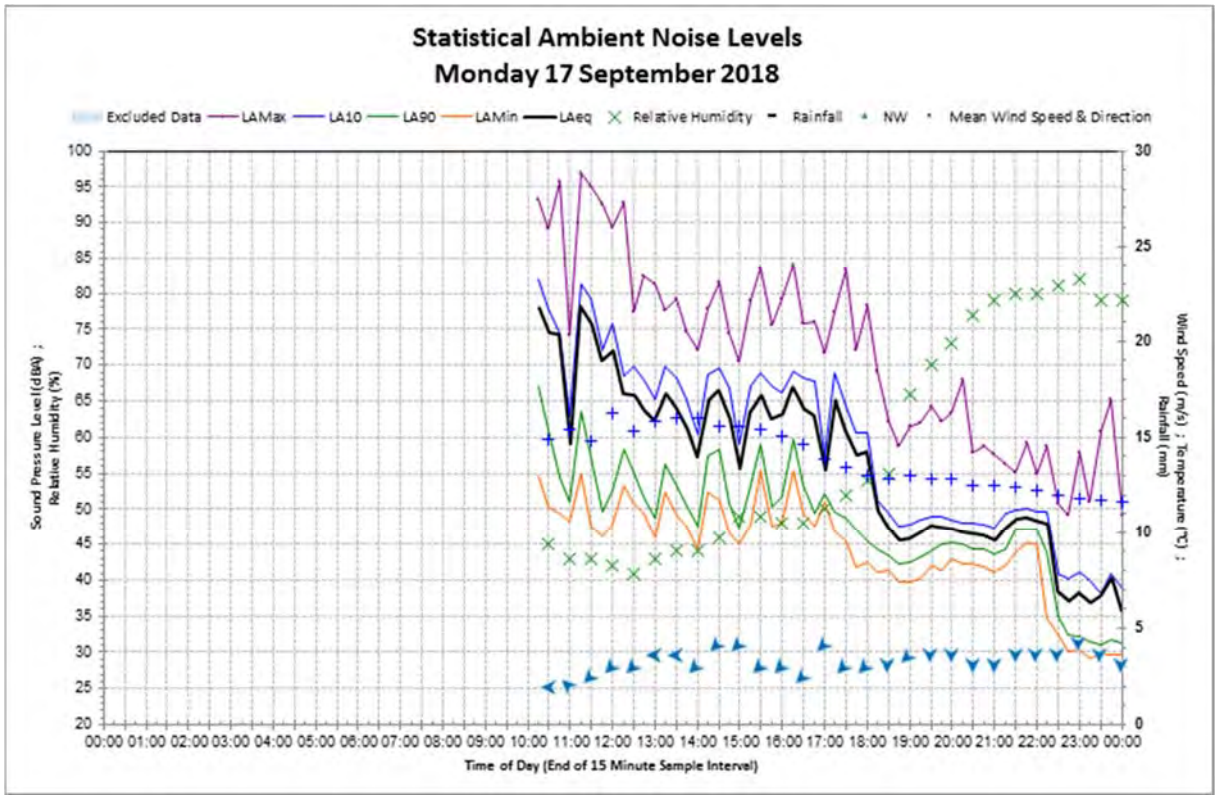
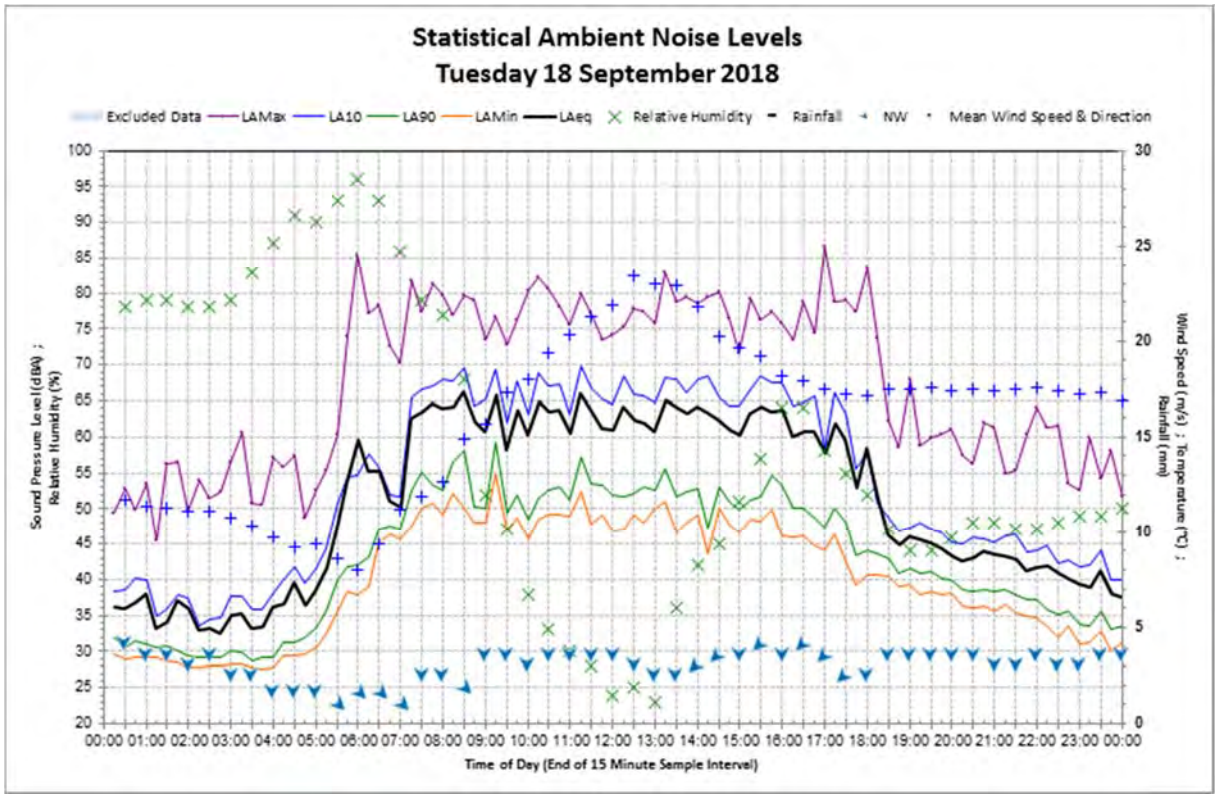
International Organization for Standardization, 2017, *ISO 9613-2:1996, Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*

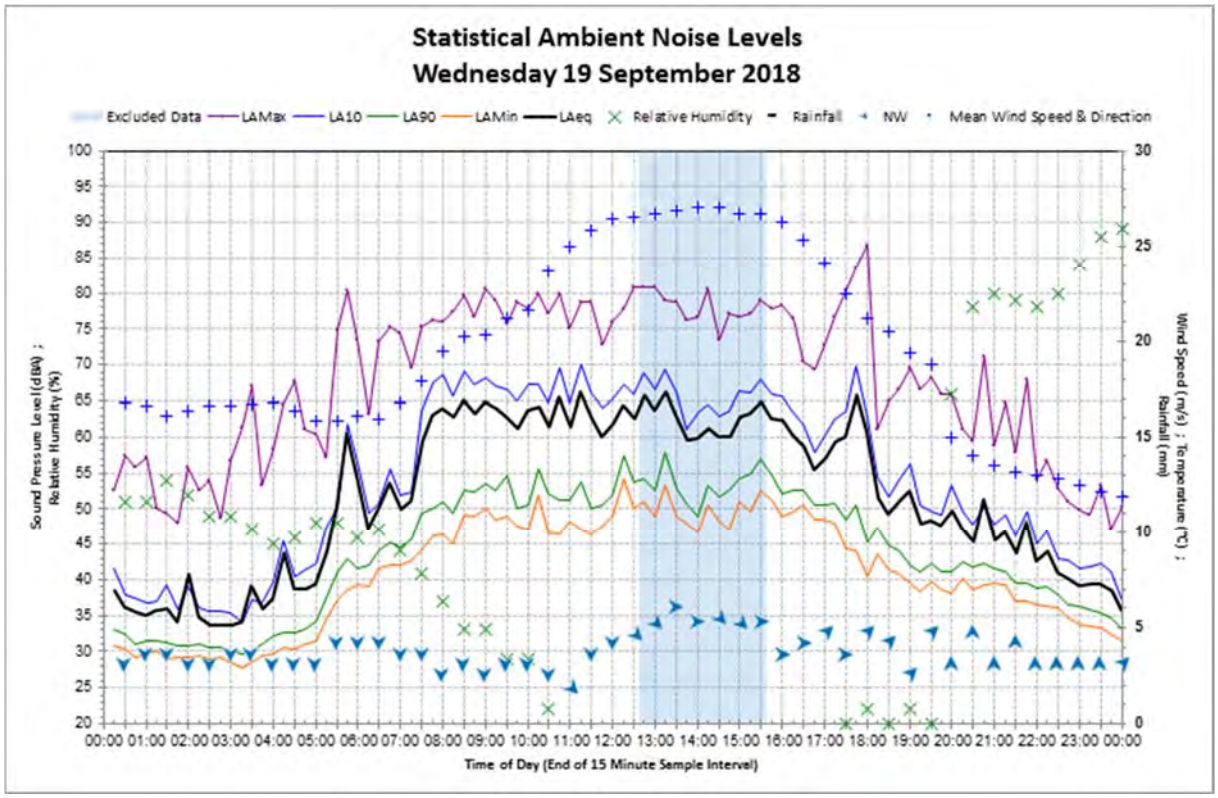
Appendices

Appendix A – List of sensitive receivers

Appendix B – Noise monitoring charts



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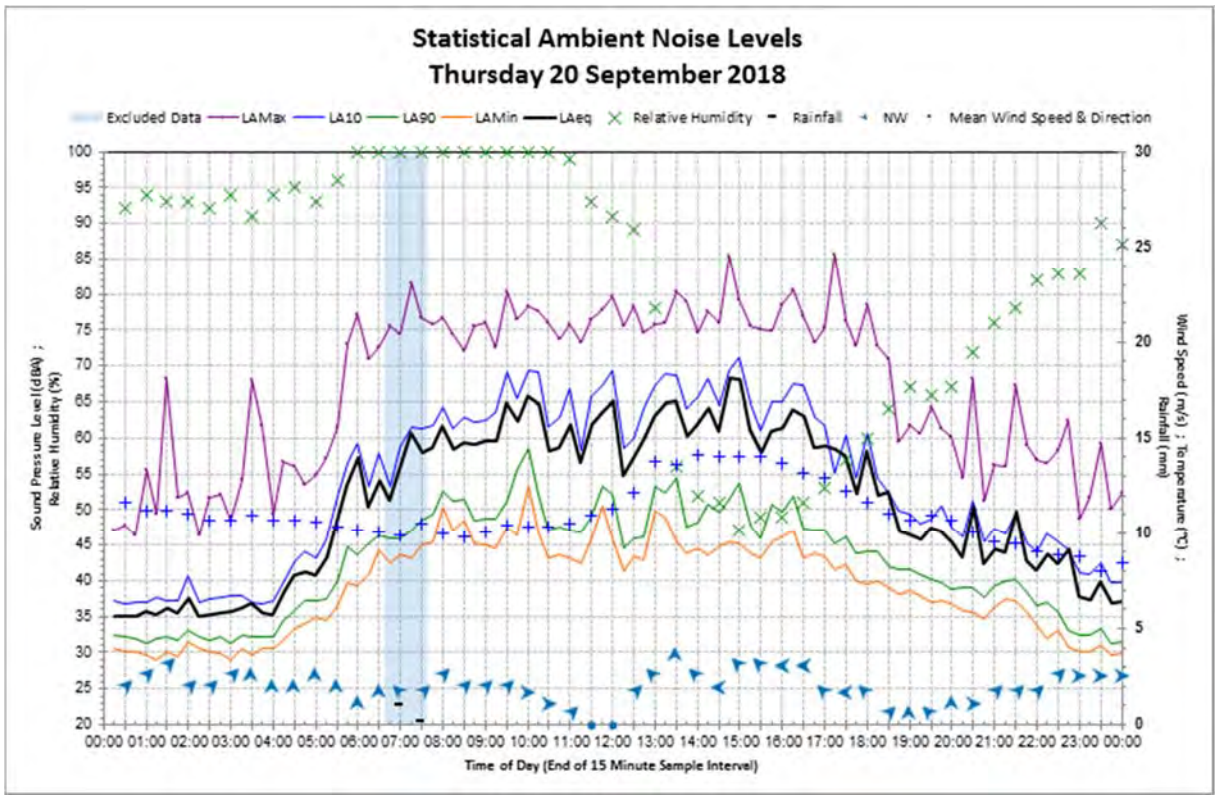
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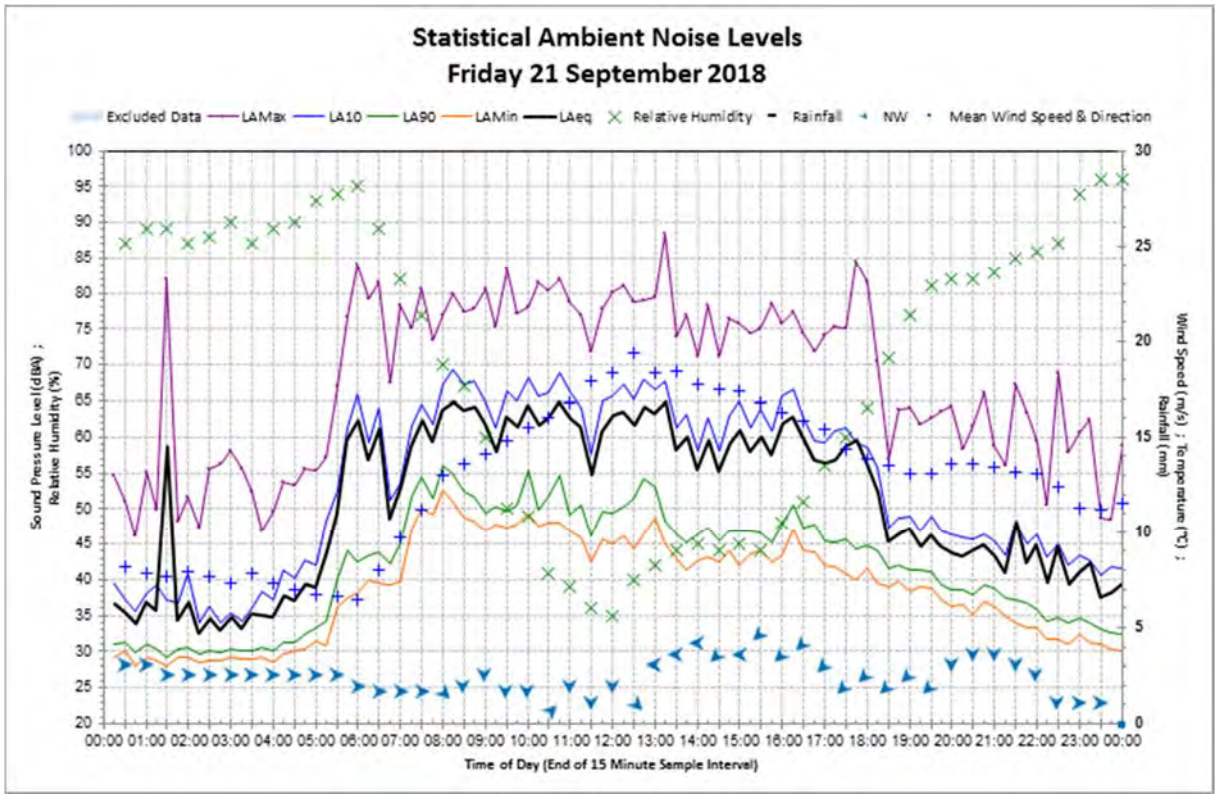
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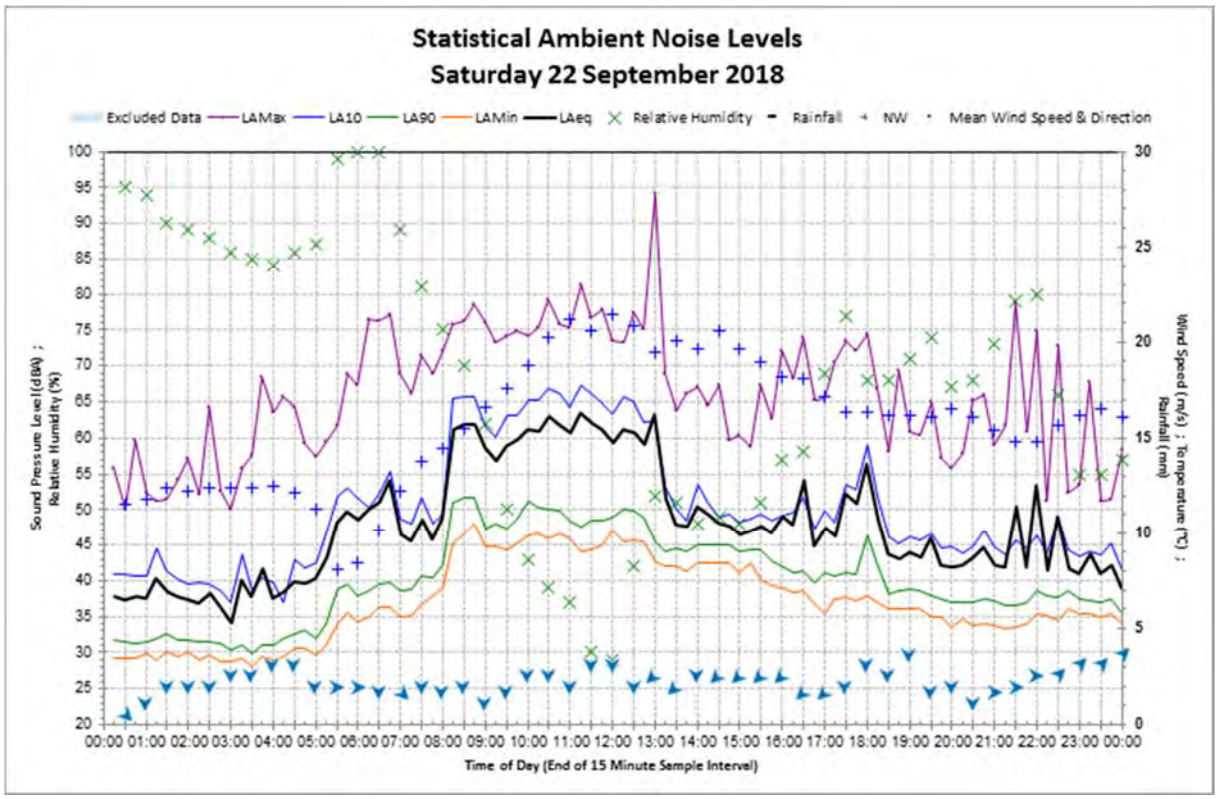
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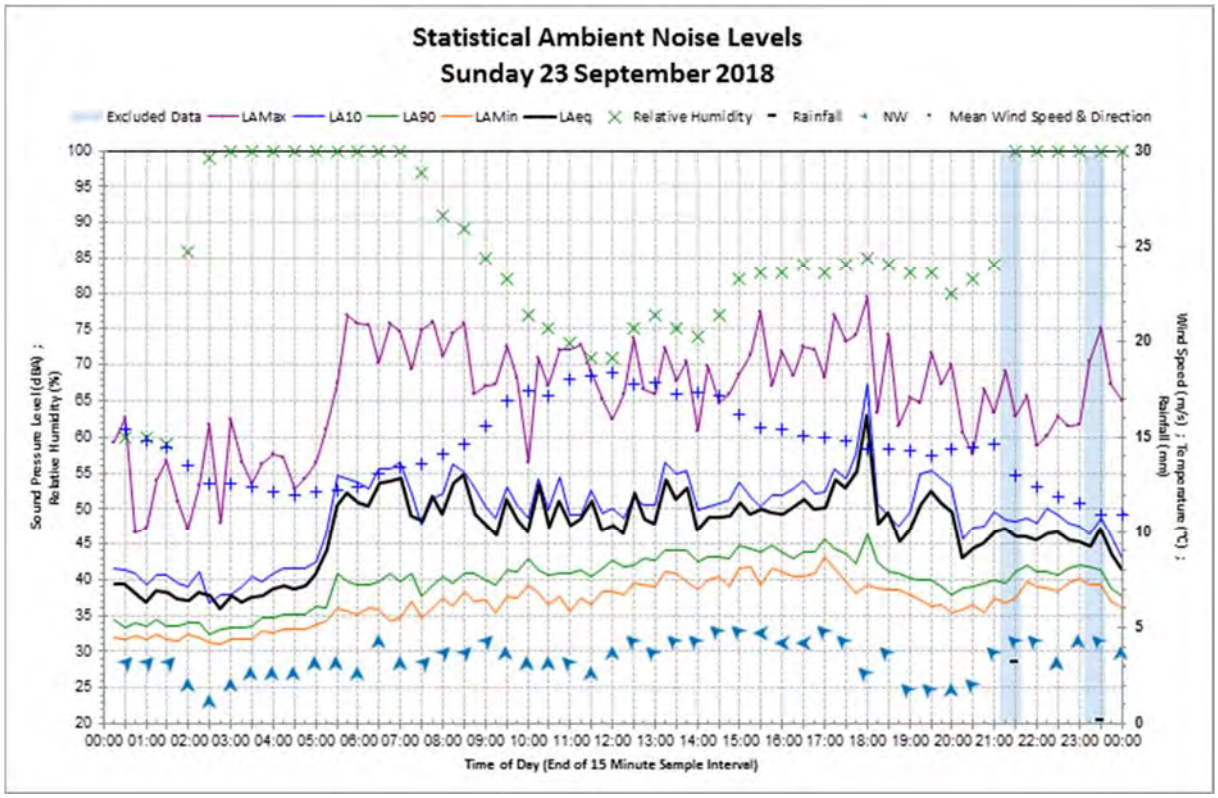
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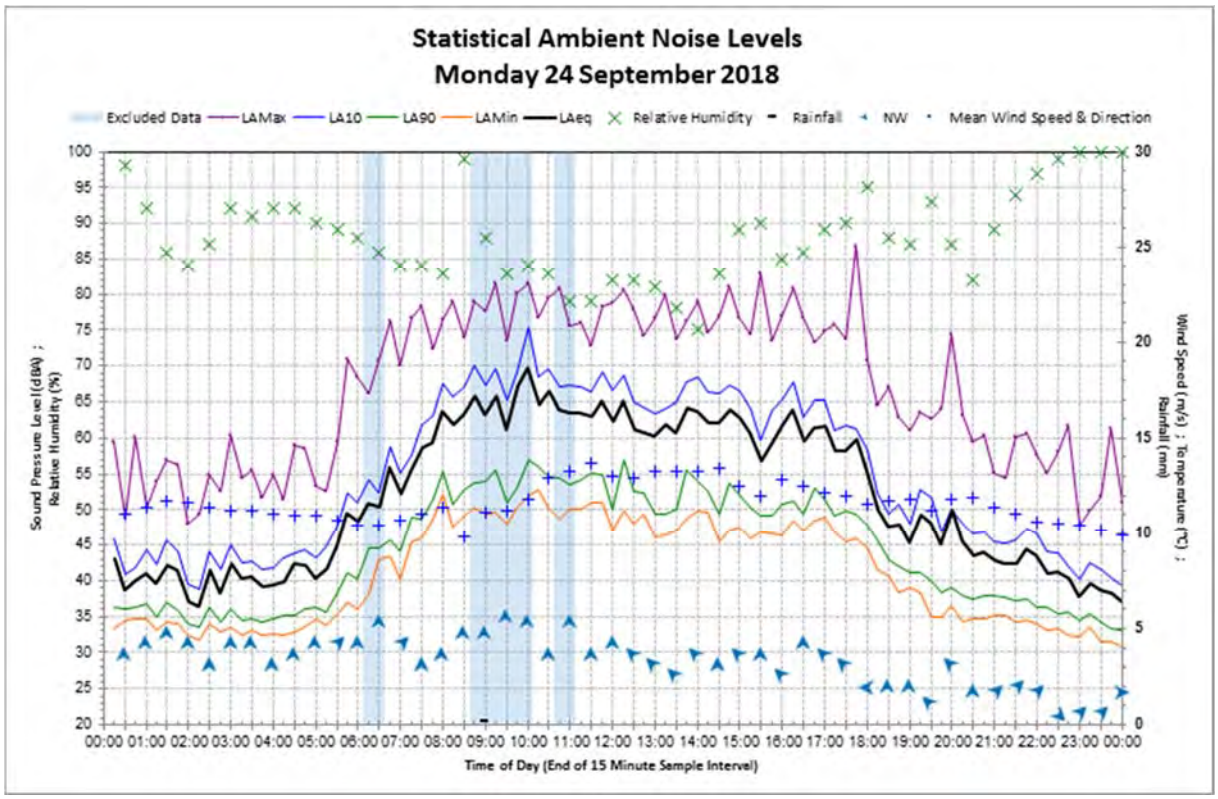
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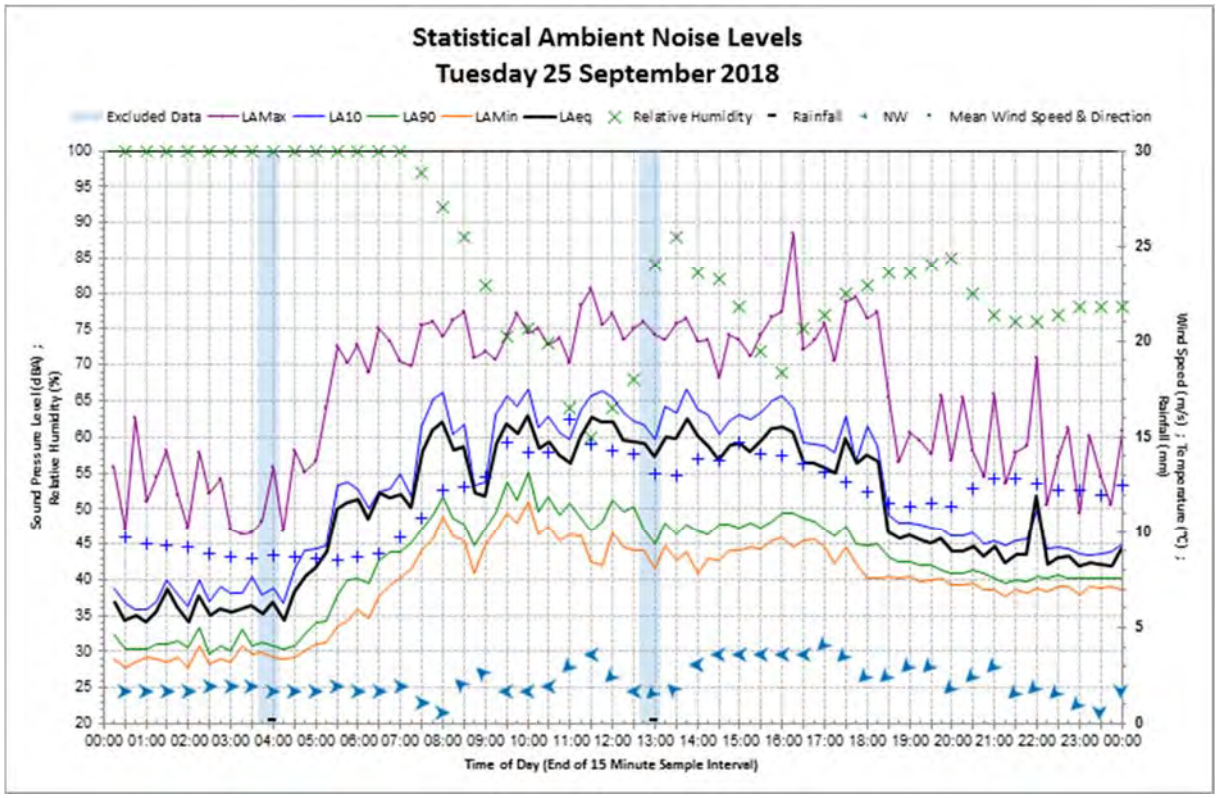
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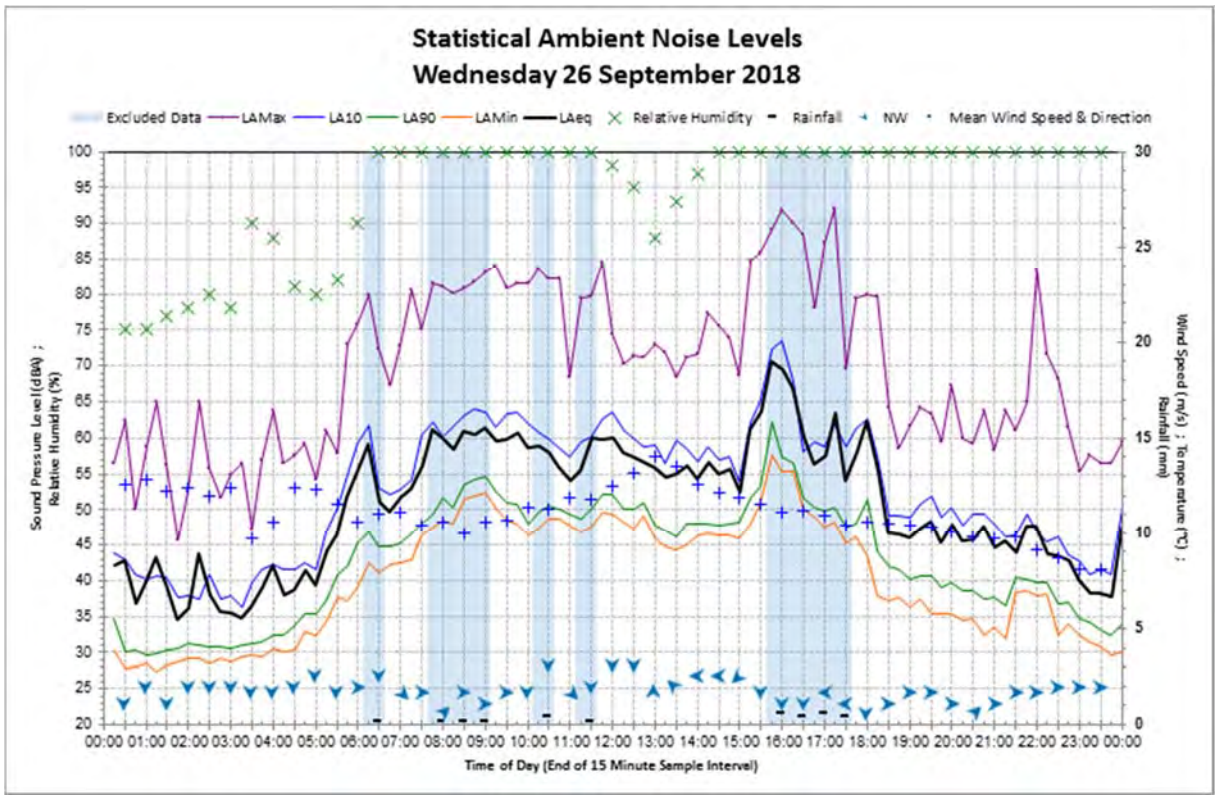
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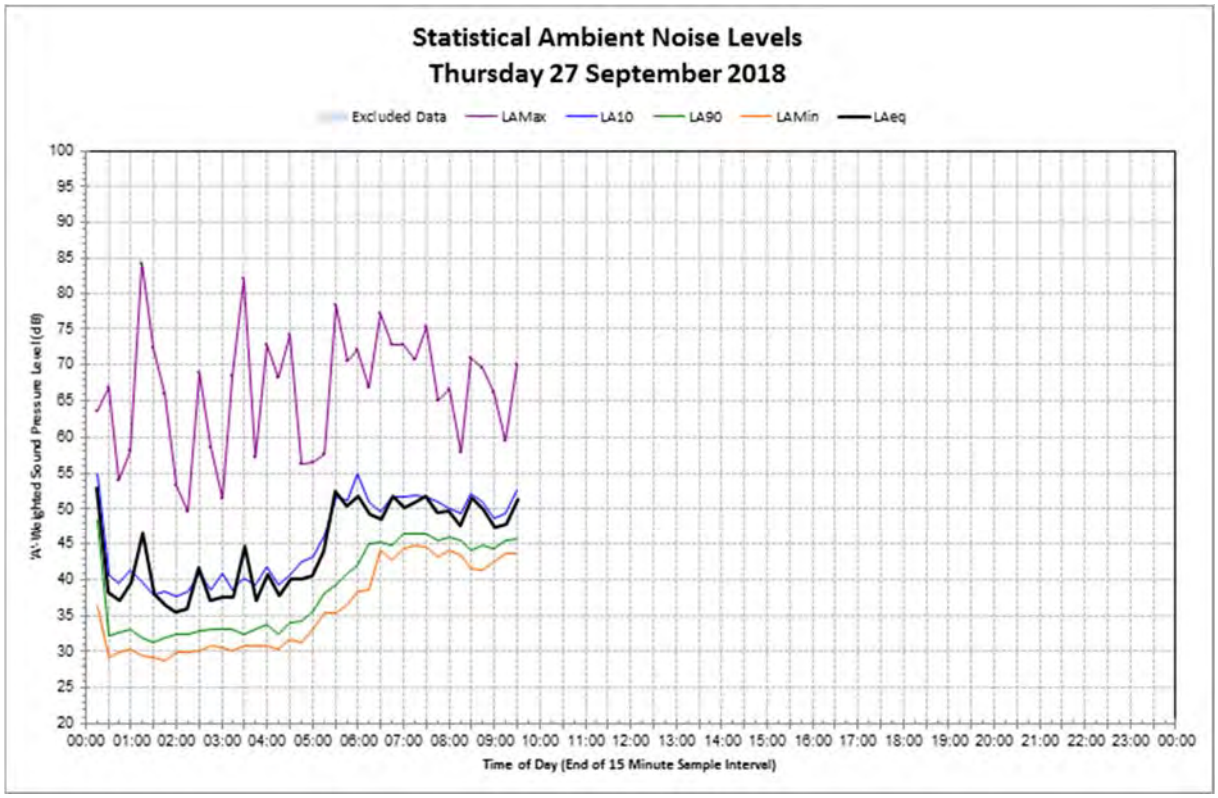
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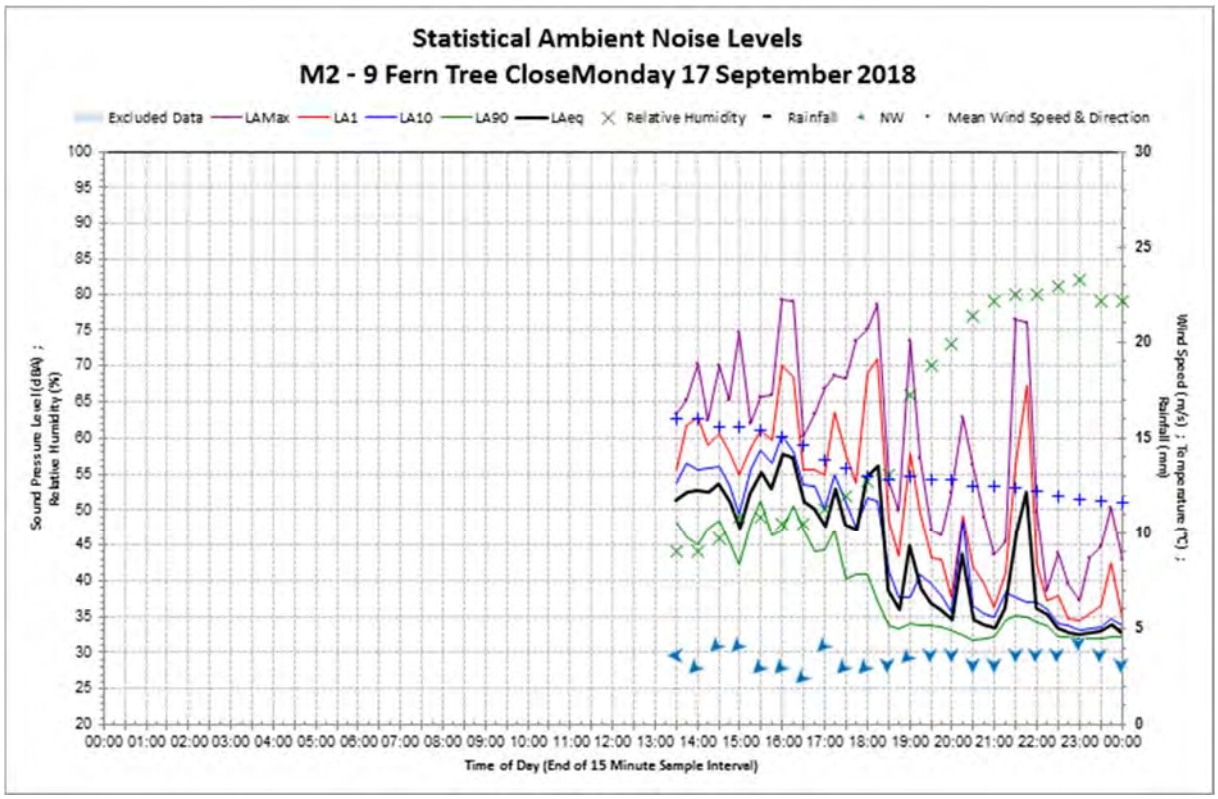
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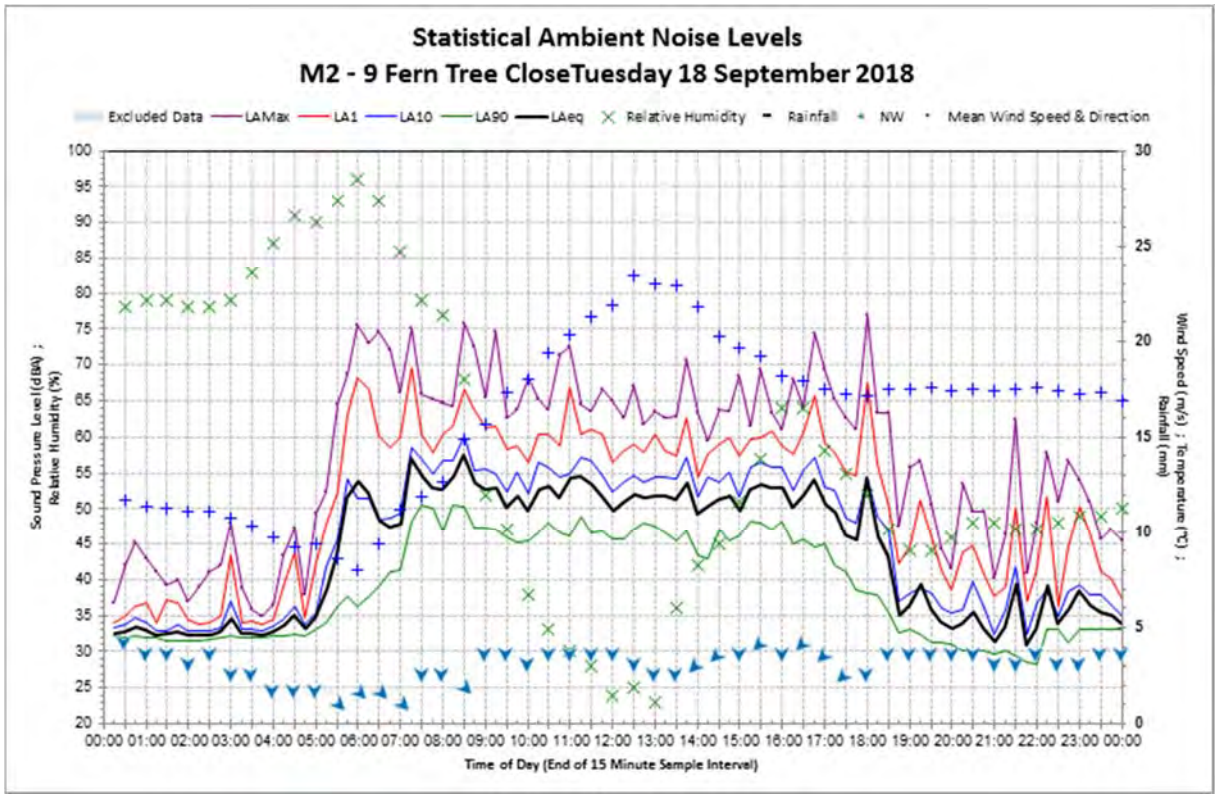
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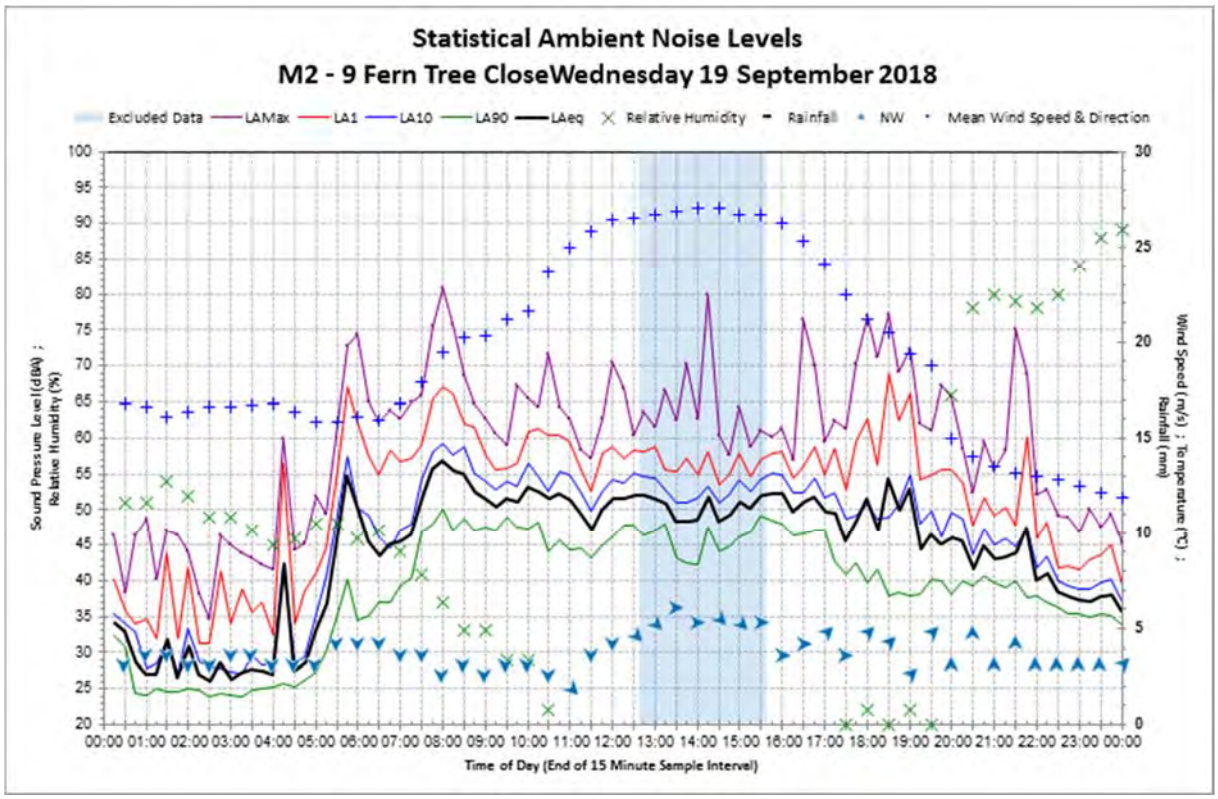
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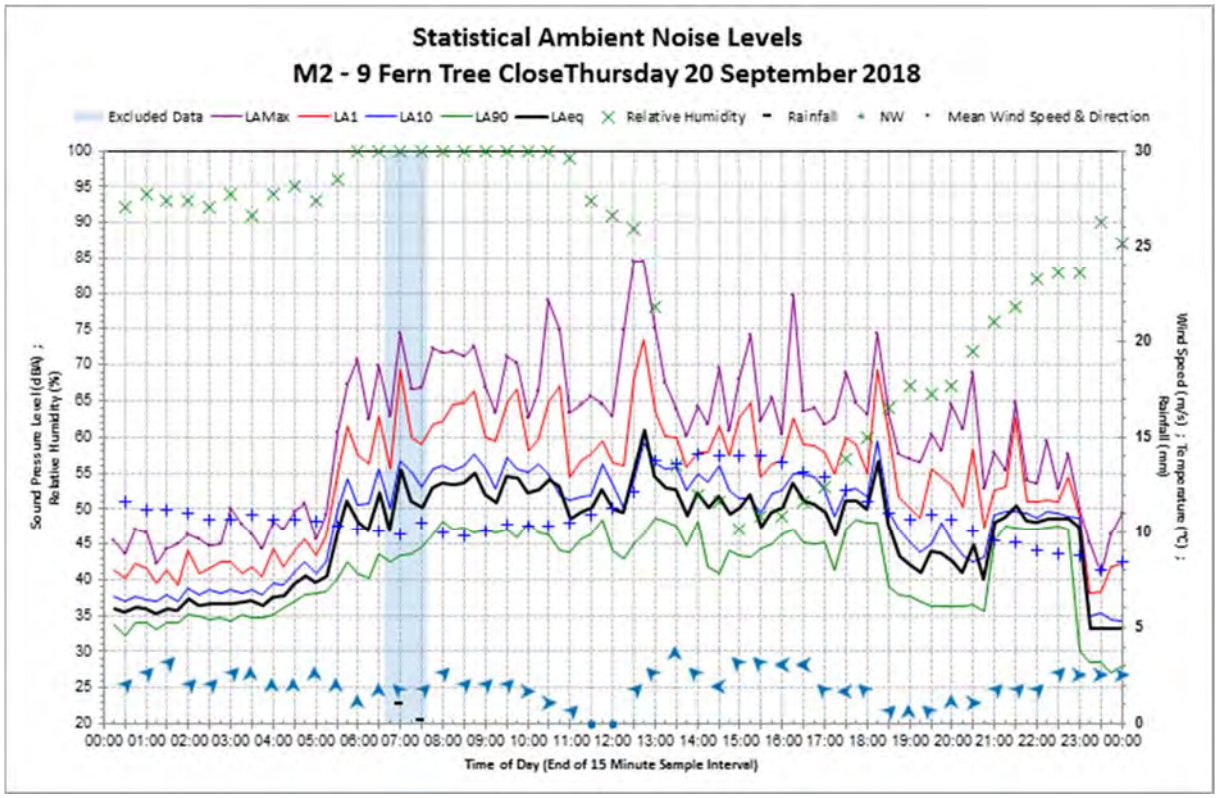
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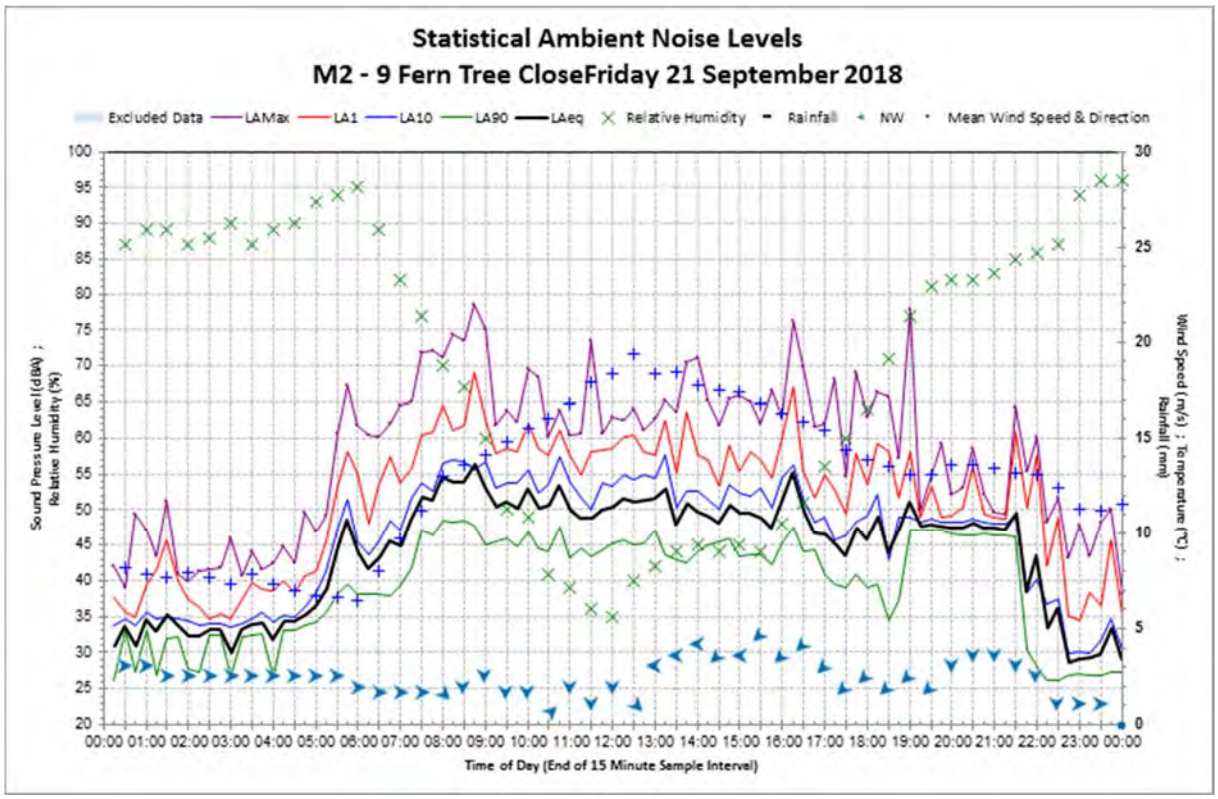
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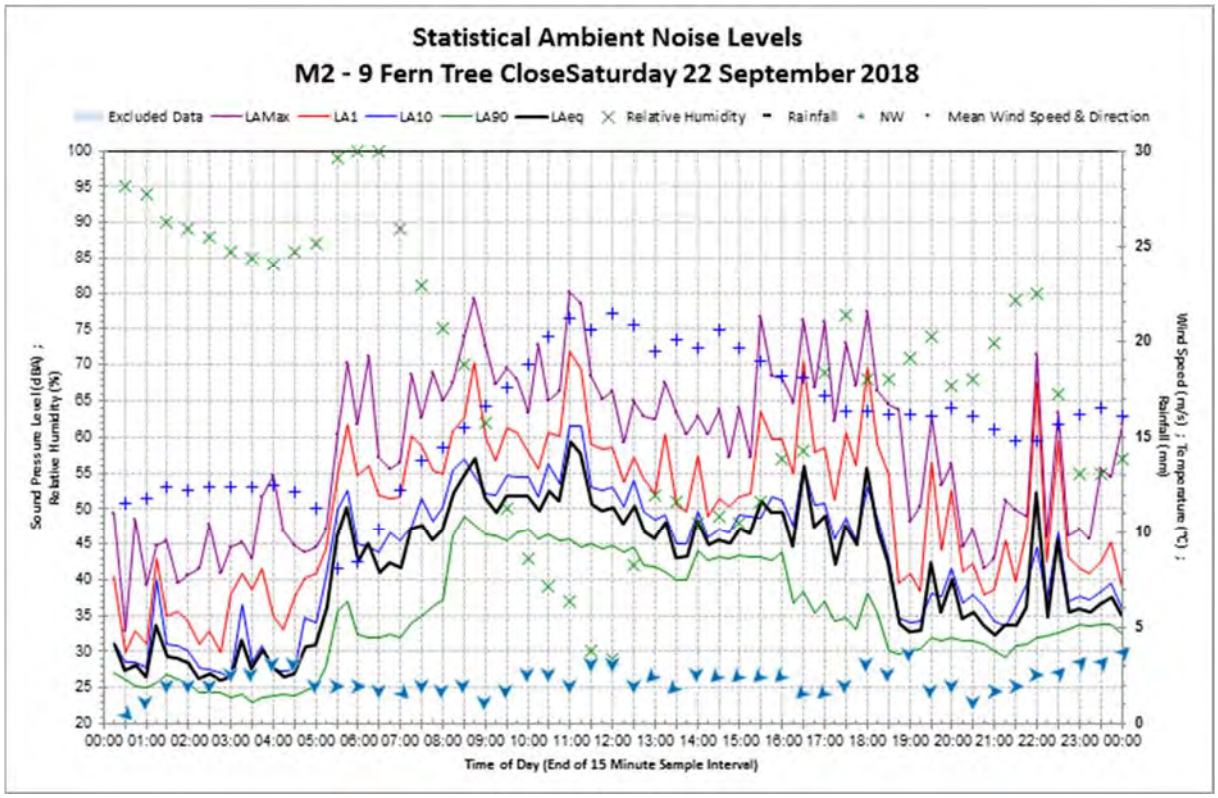
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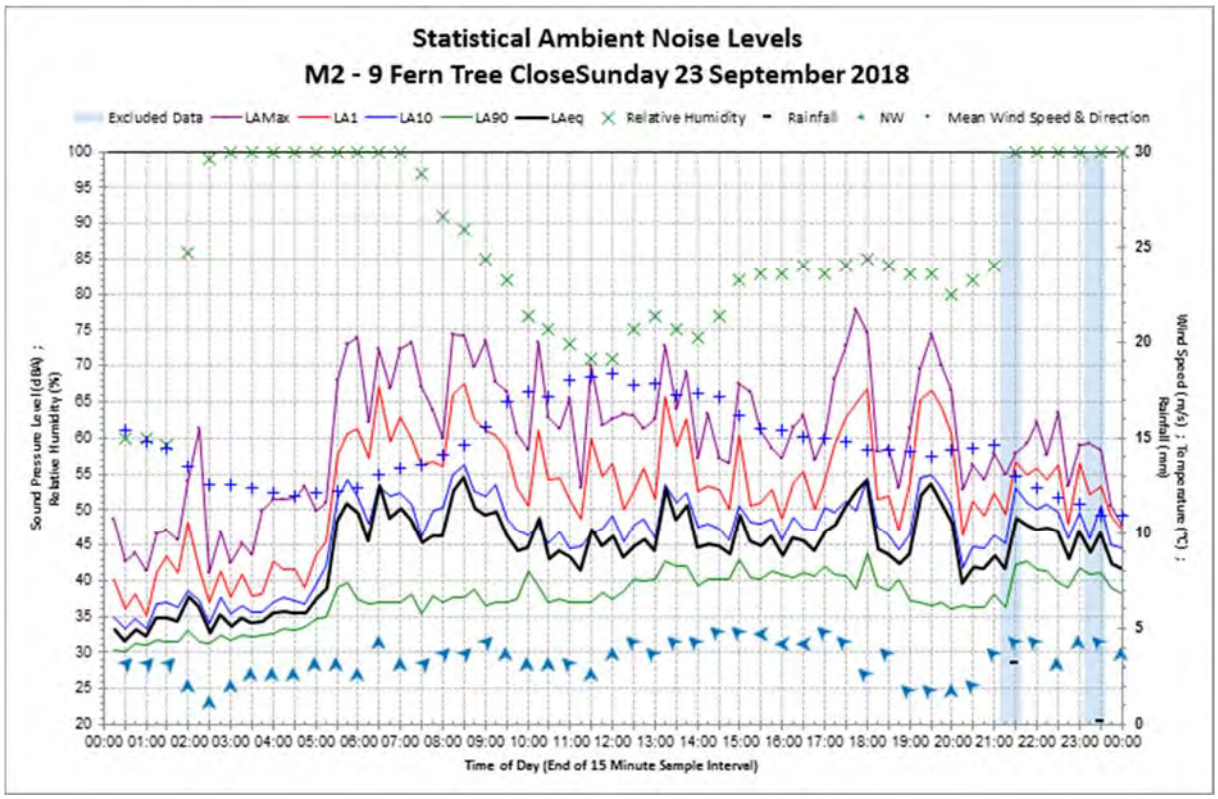
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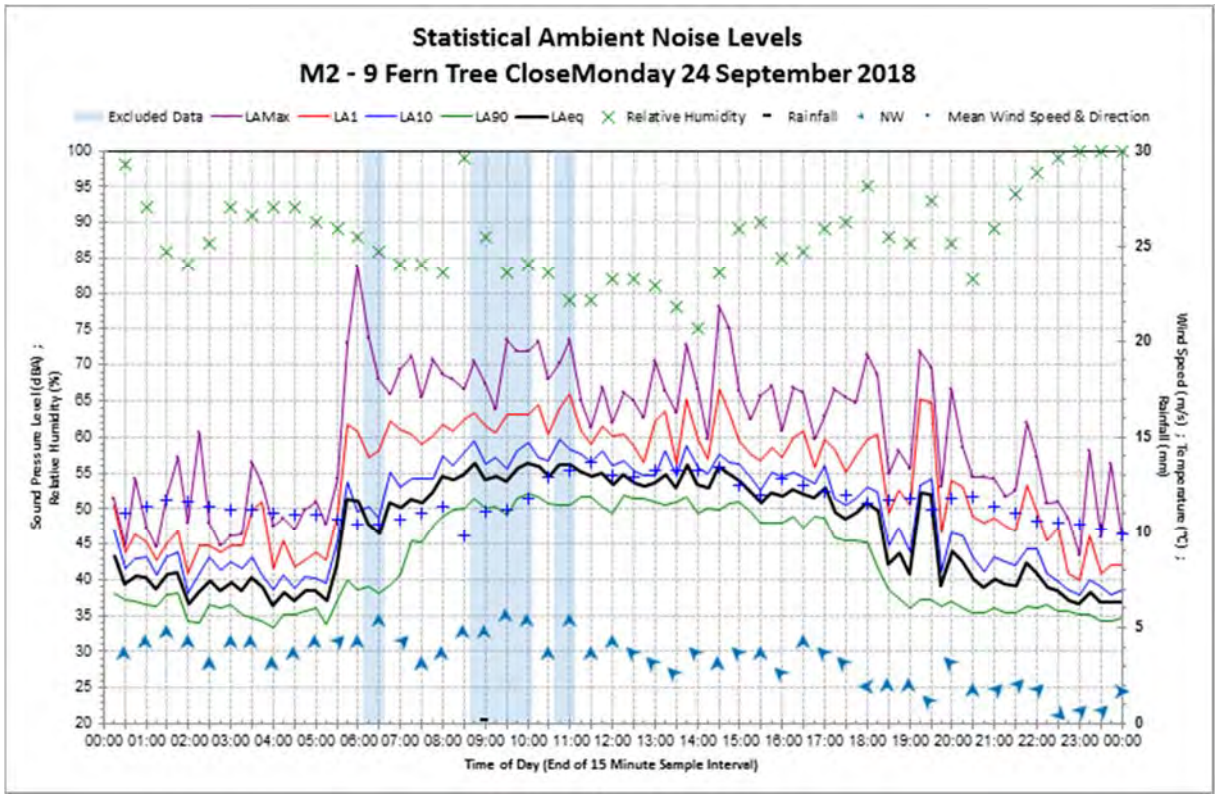
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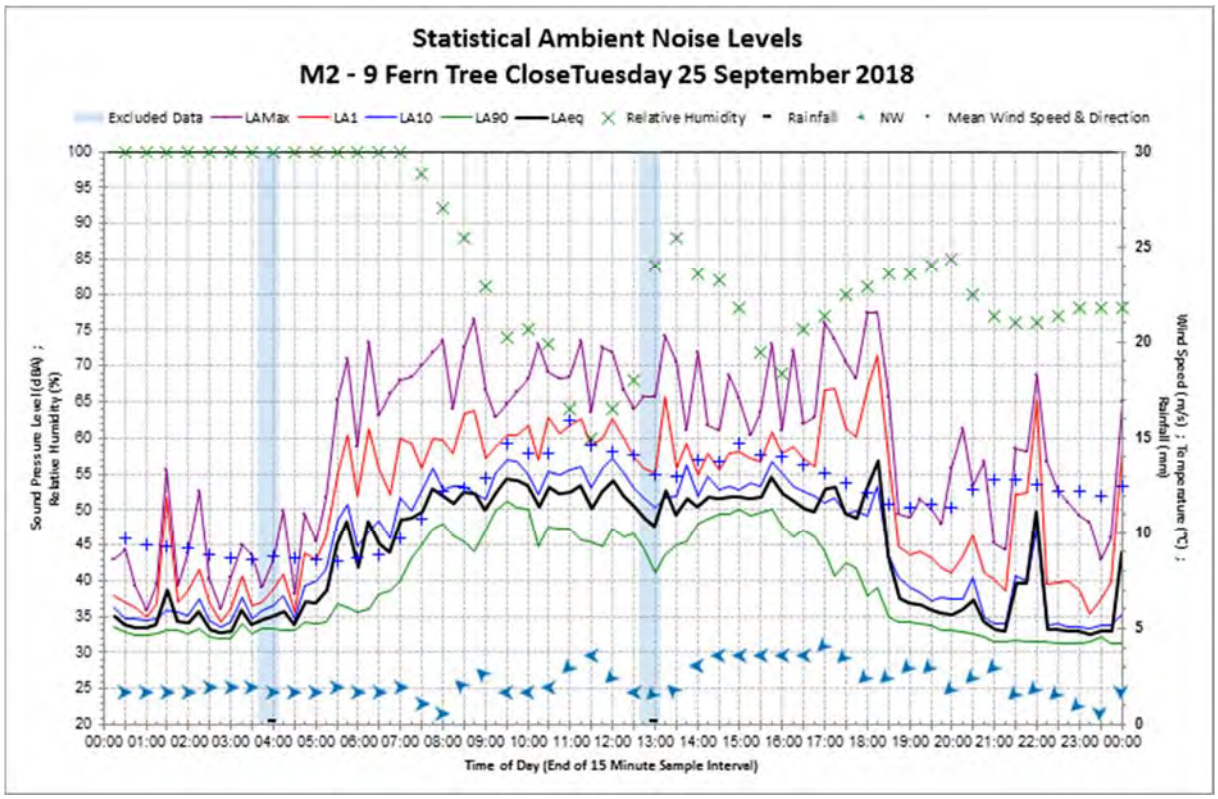
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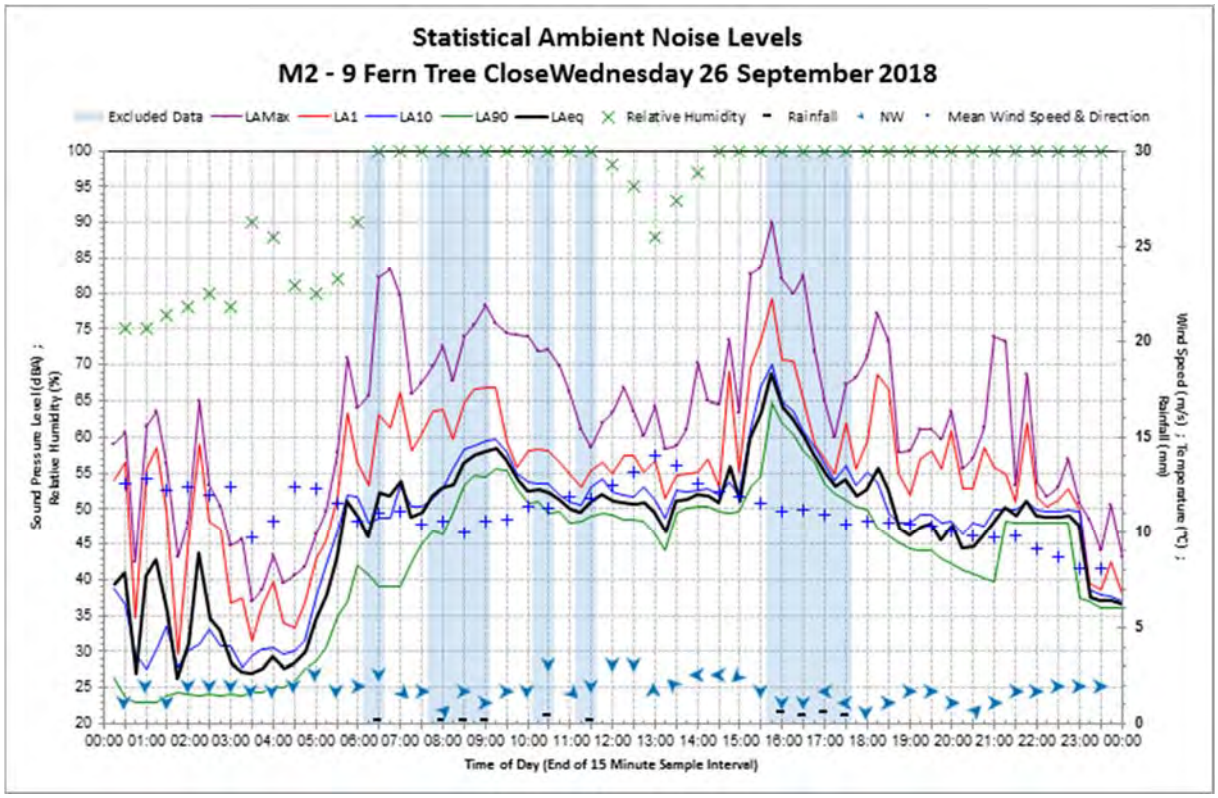
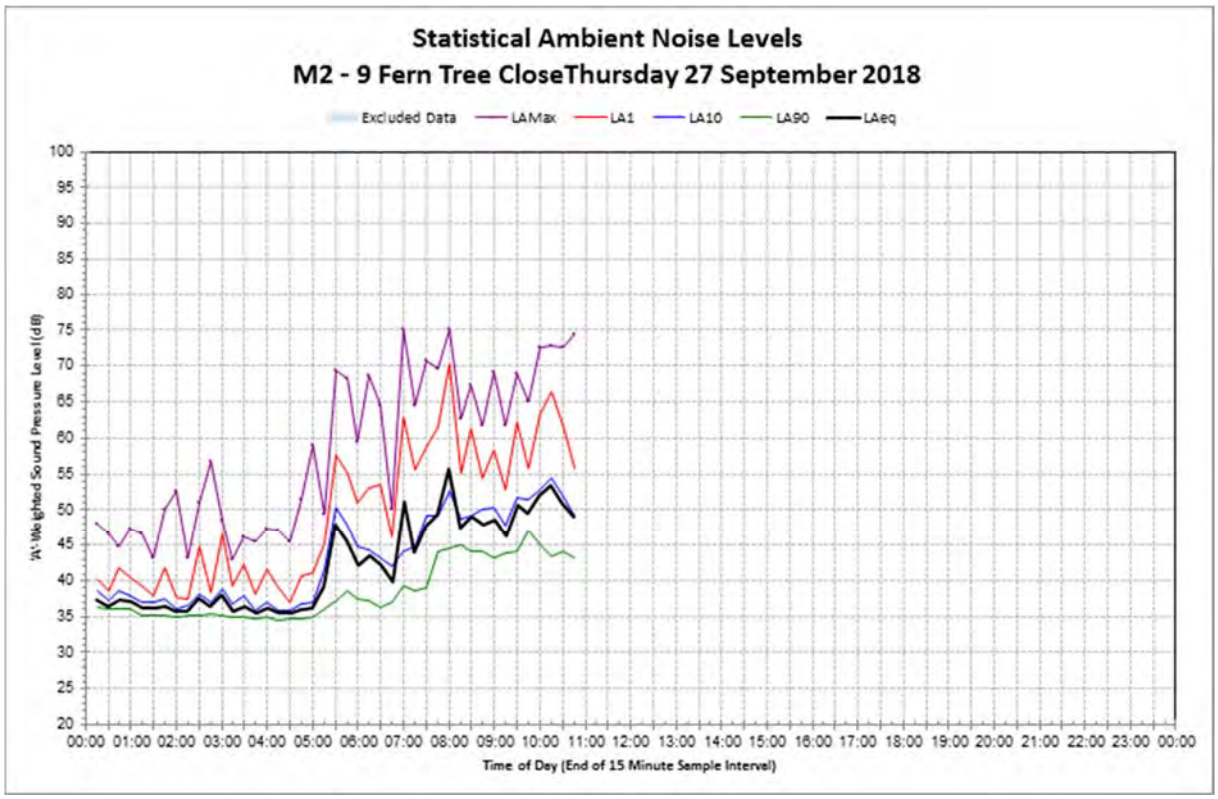
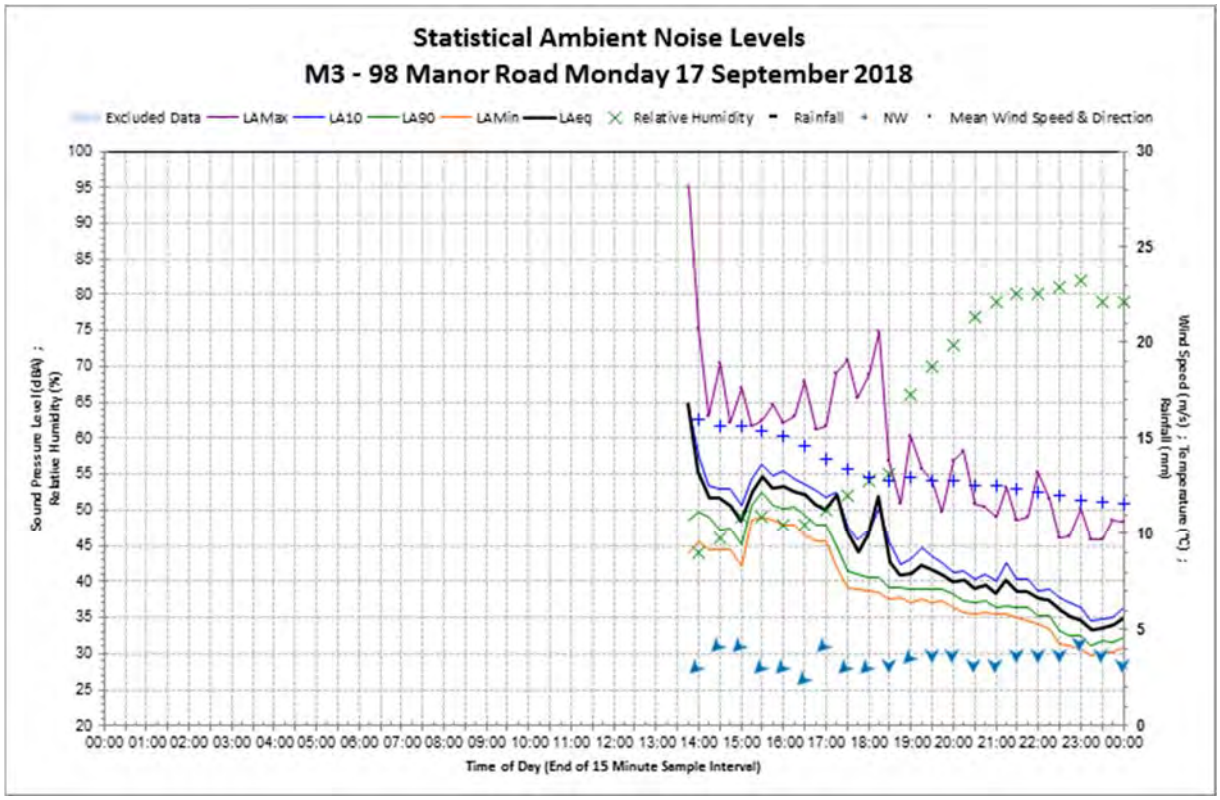
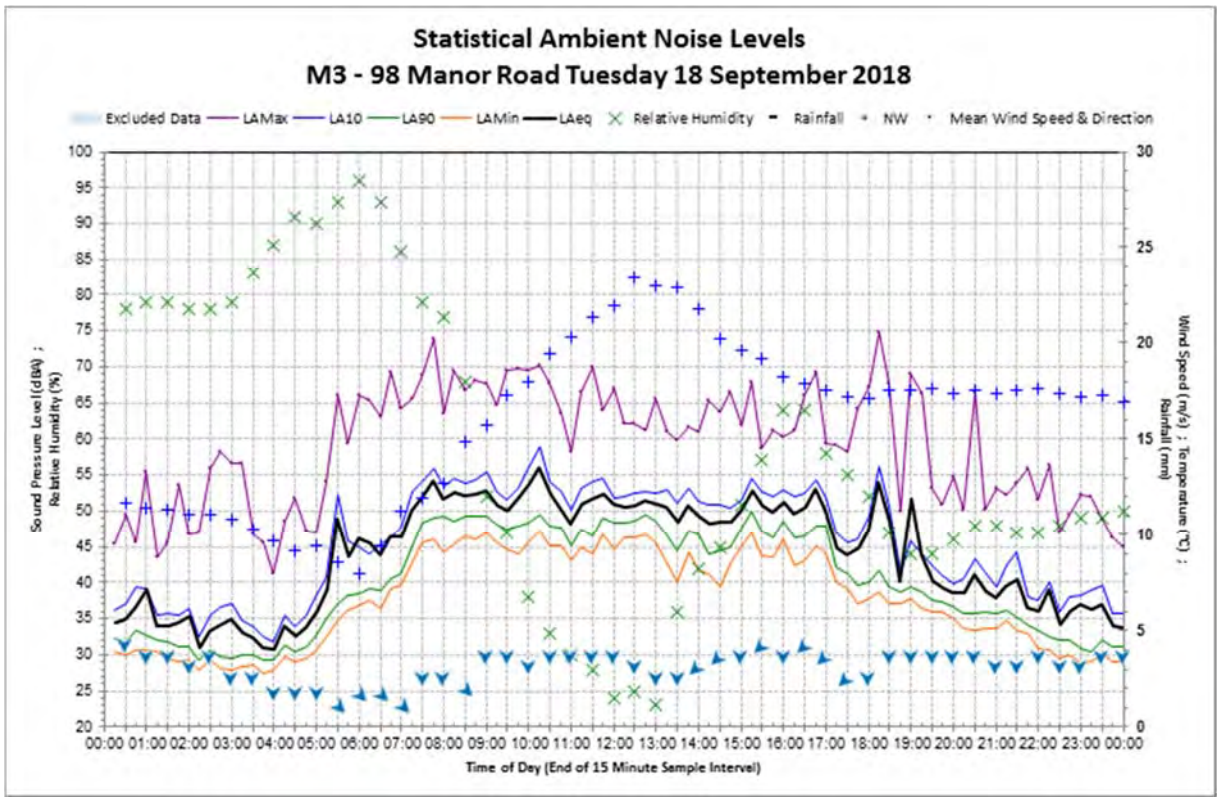
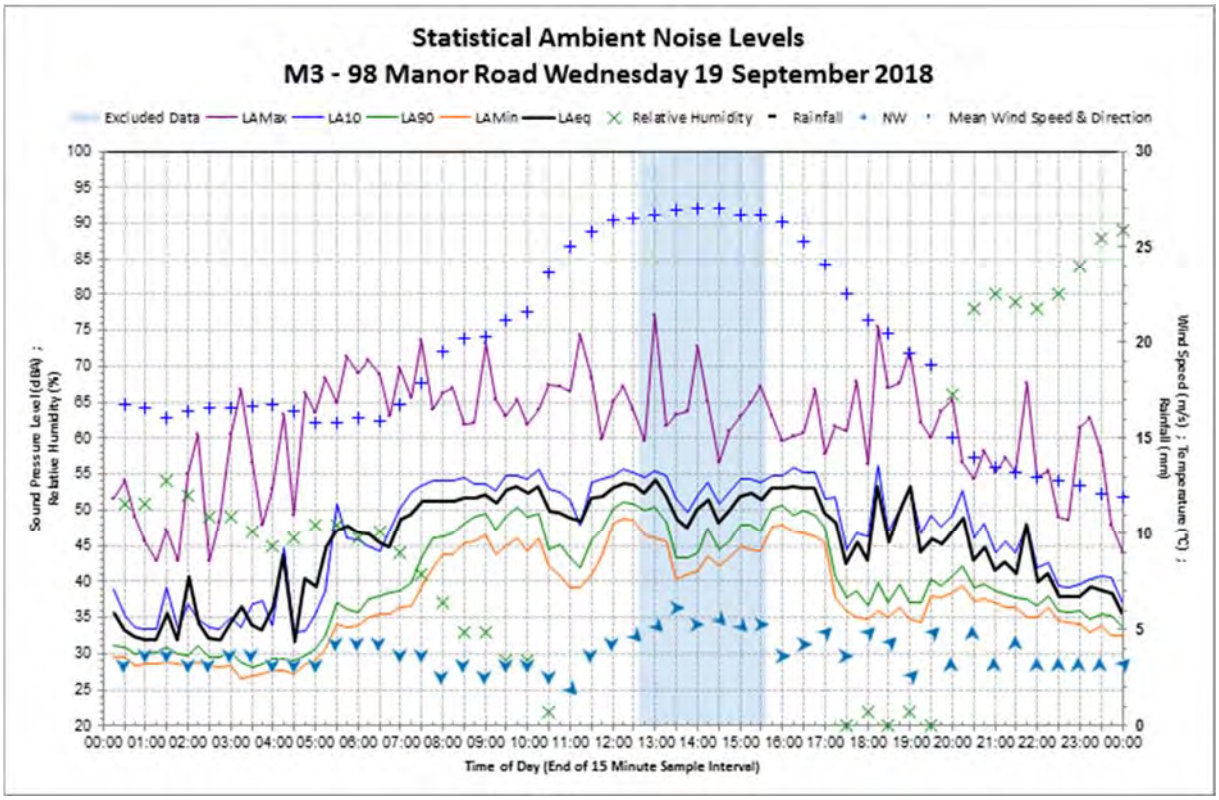
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

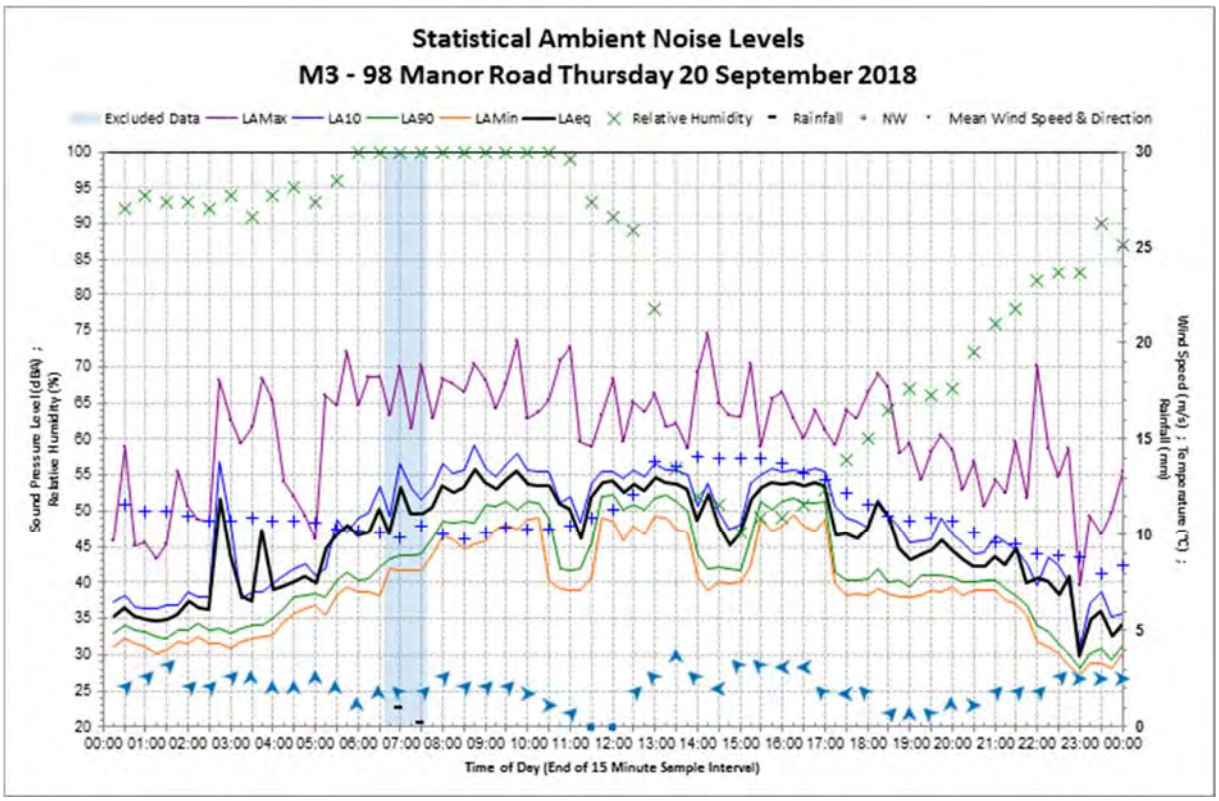

Statistical Ambient Noise Levels
M2 - 9 Fern Tree CloseWednesday 26 September 2018
Excluded Data
LAMax
LA1
LA10
LA90
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

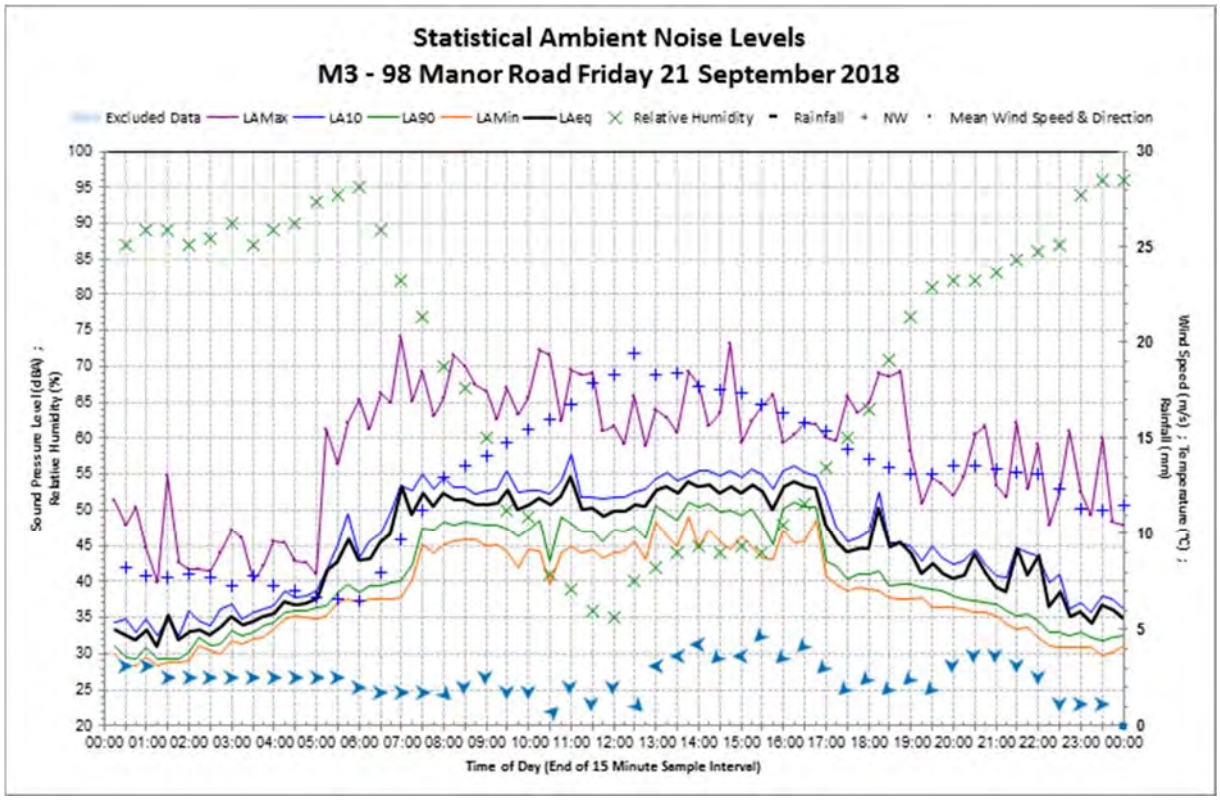

Statistical Ambient Noise Levels
M2 - 9 Fern Tree CloseThursday 27 September 2018
Excluded Data
LAMax
LA1
LA10
LA90
LAeq
'A' Weighted Sound Pressure Level (dB)
Time of Day (End of 15 Minute Sample Interval)

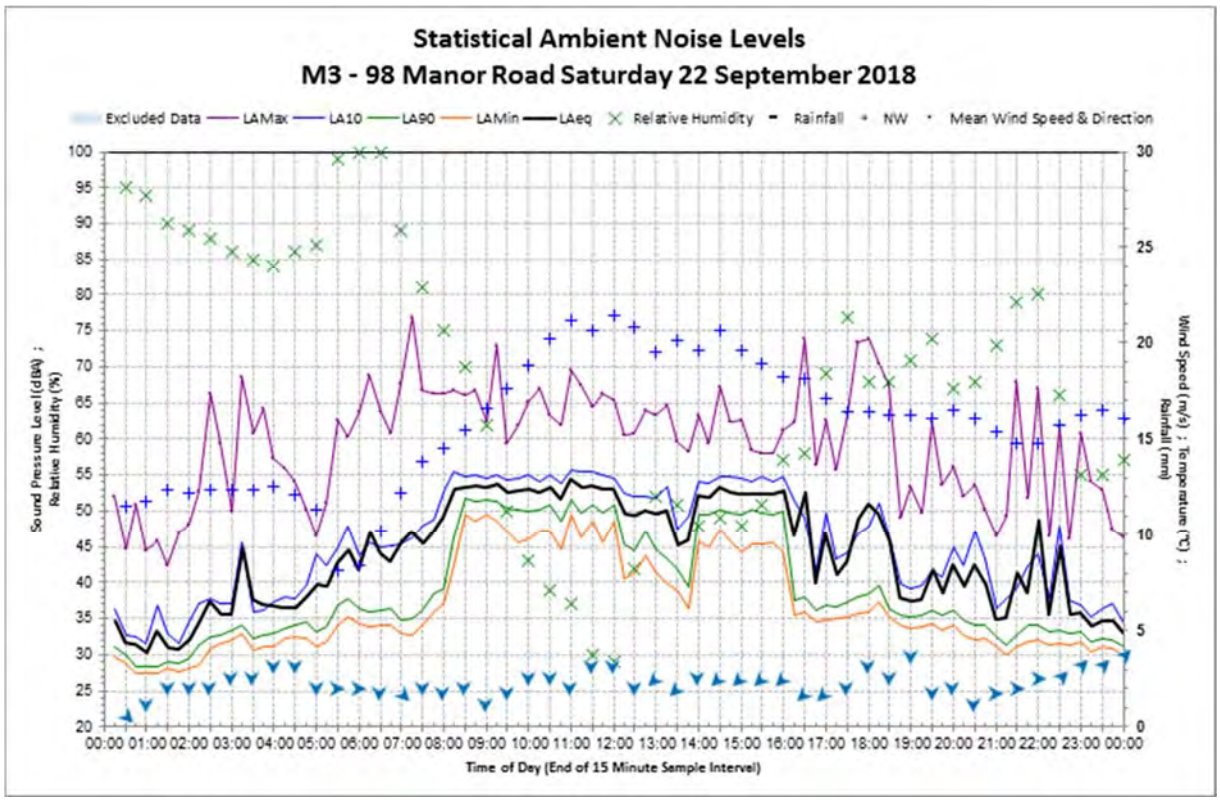

Statistical Ambient Noise Levels
M3 - 98 Manor Road Monday 17 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

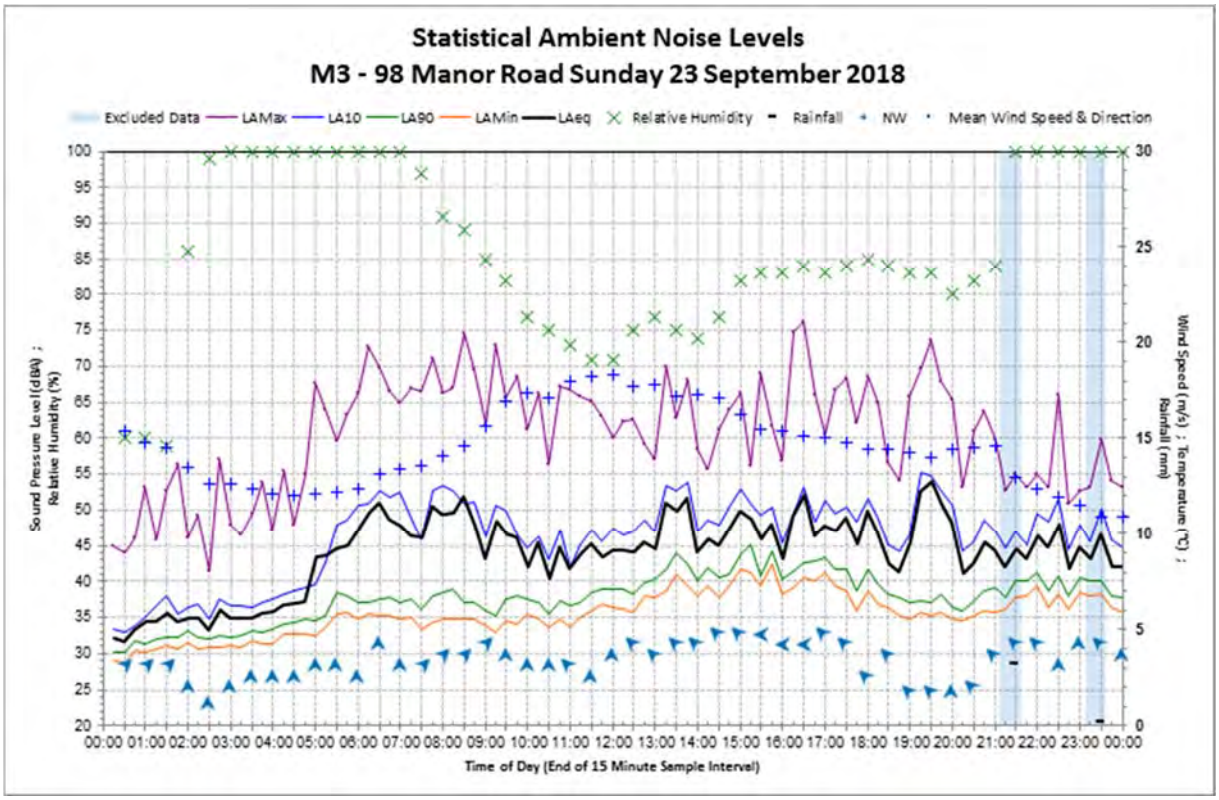

Statistical Ambient Noise Levels
M3 - 98 Manor Road Tuesday 18 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

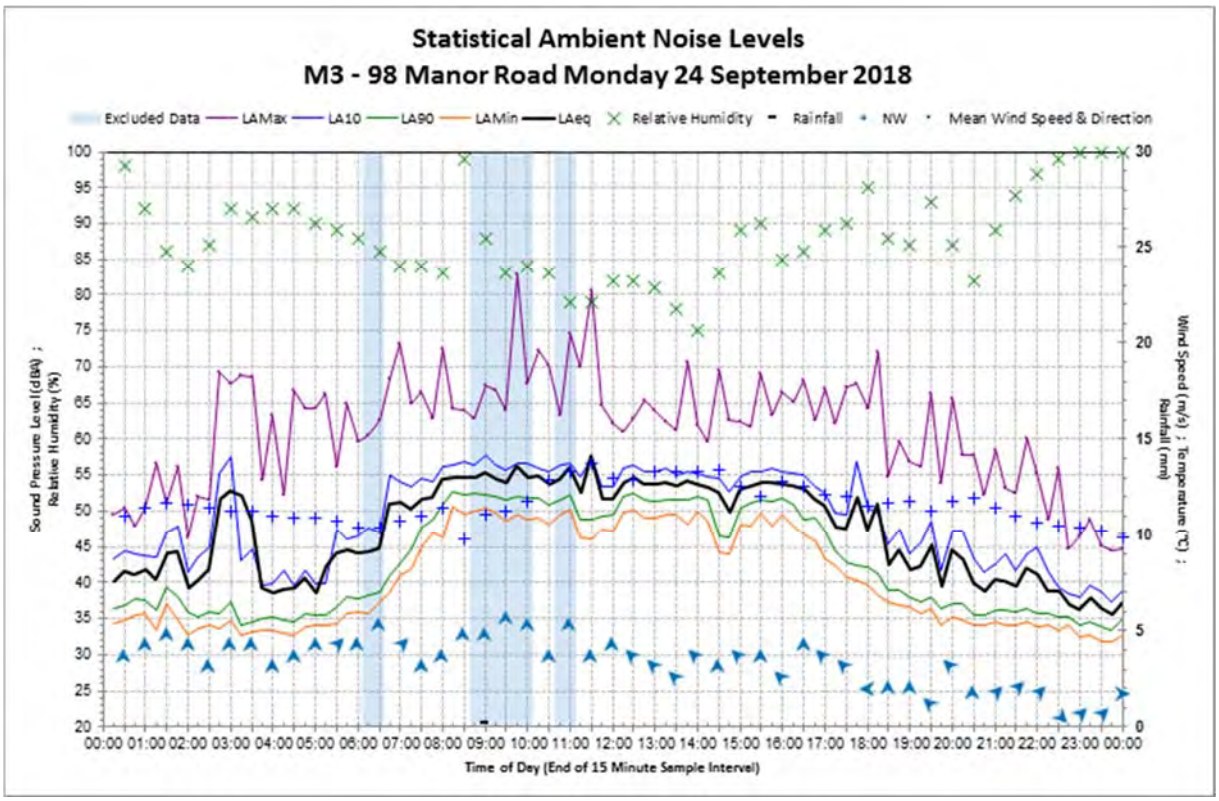

Statistical Ambient Noise Levels
M3 - 98 Manor Road Wednesday 19 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

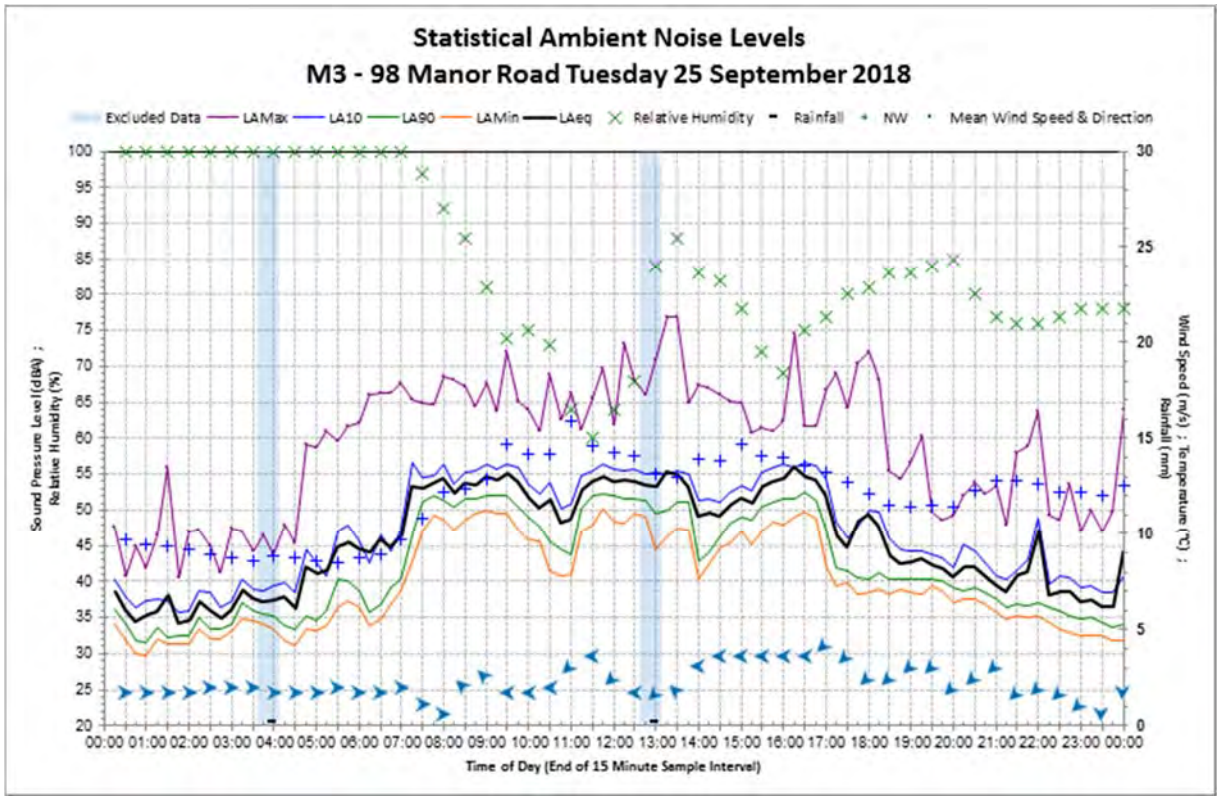

Statistical Ambient Noise Levels
M3 - 98 Manor Road Thursday 20 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

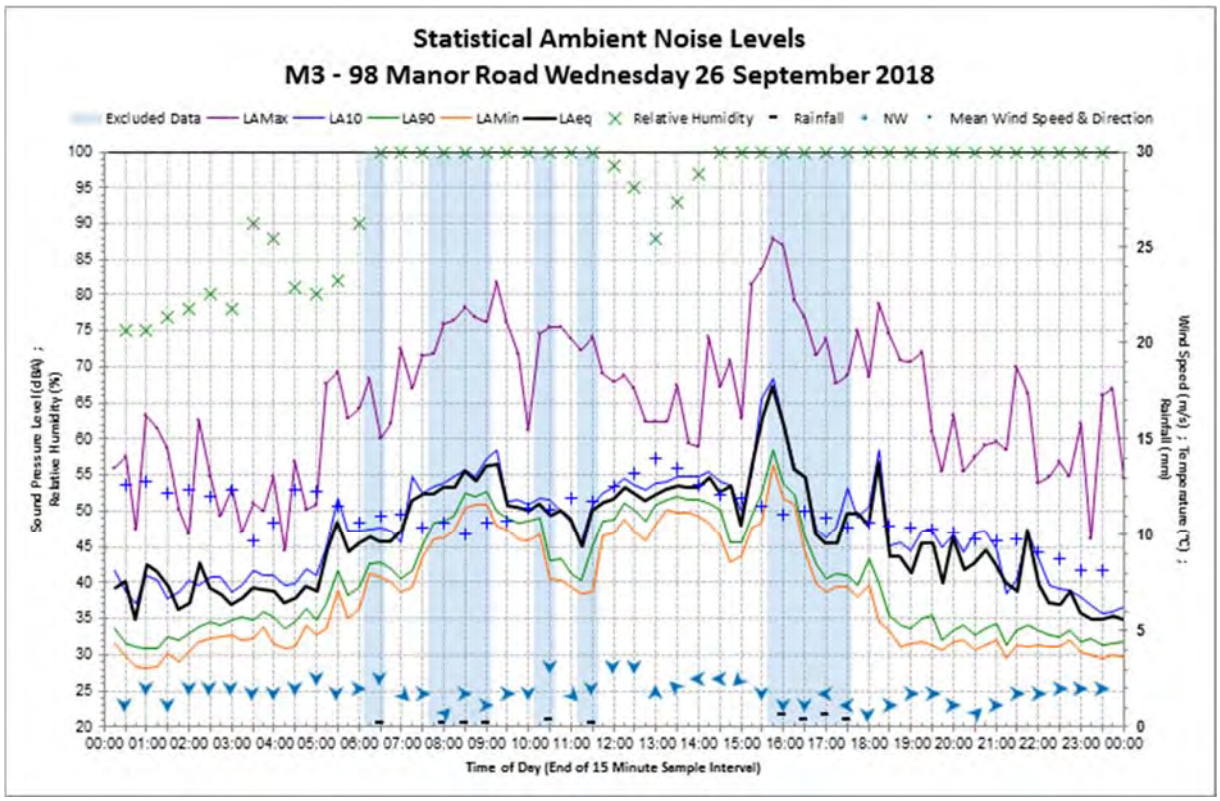

Statistical Ambient Noise Levels
M3 - 98 Manor Road Friday 21 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

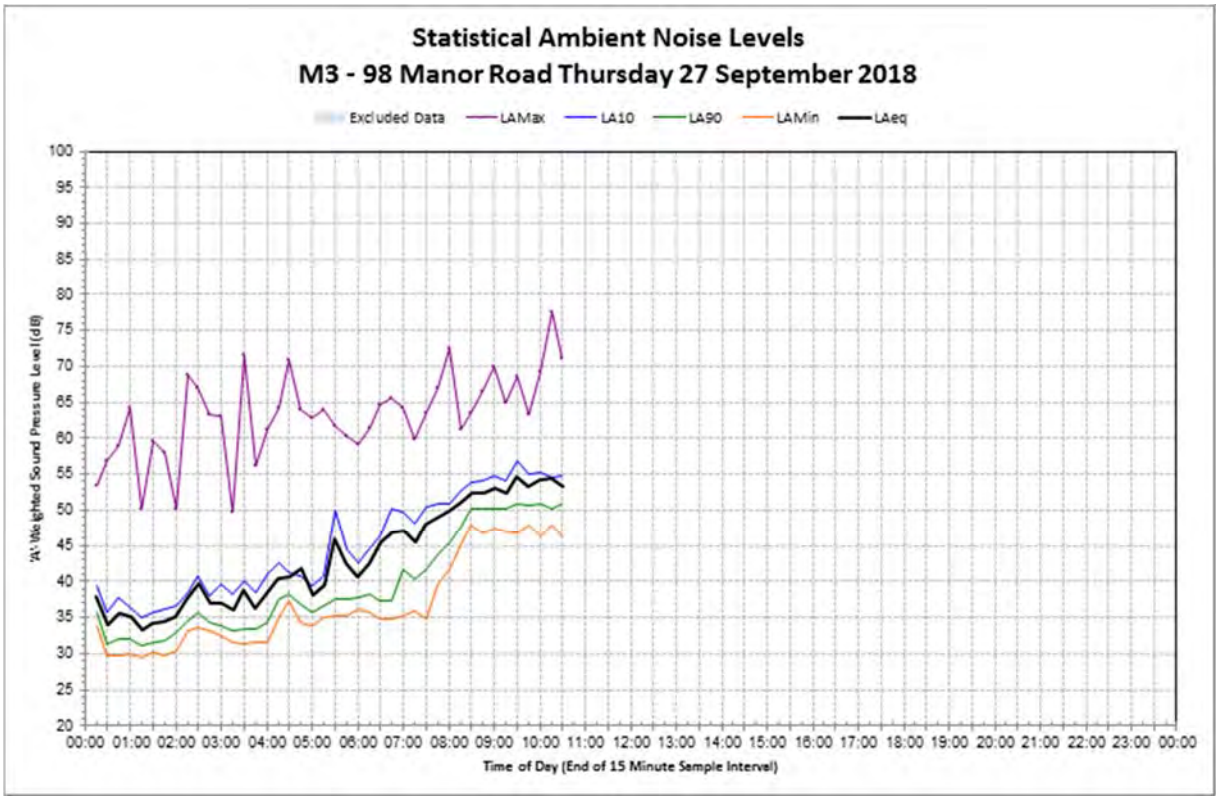

Statistical Ambient Noise Levels
M3 - 98 Manor Road Saturday 22 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

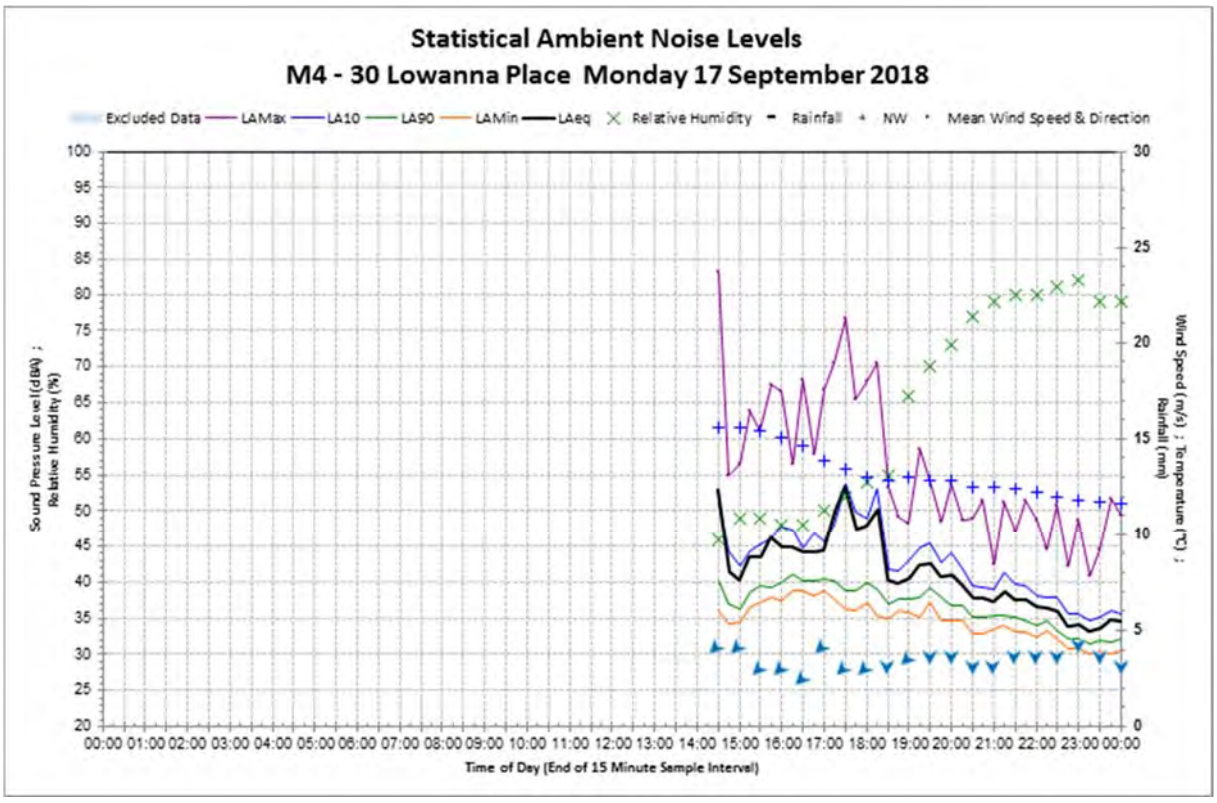

Statistical Ambient Noise Levels
M3 - 98 Manor Road Sunday 23 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

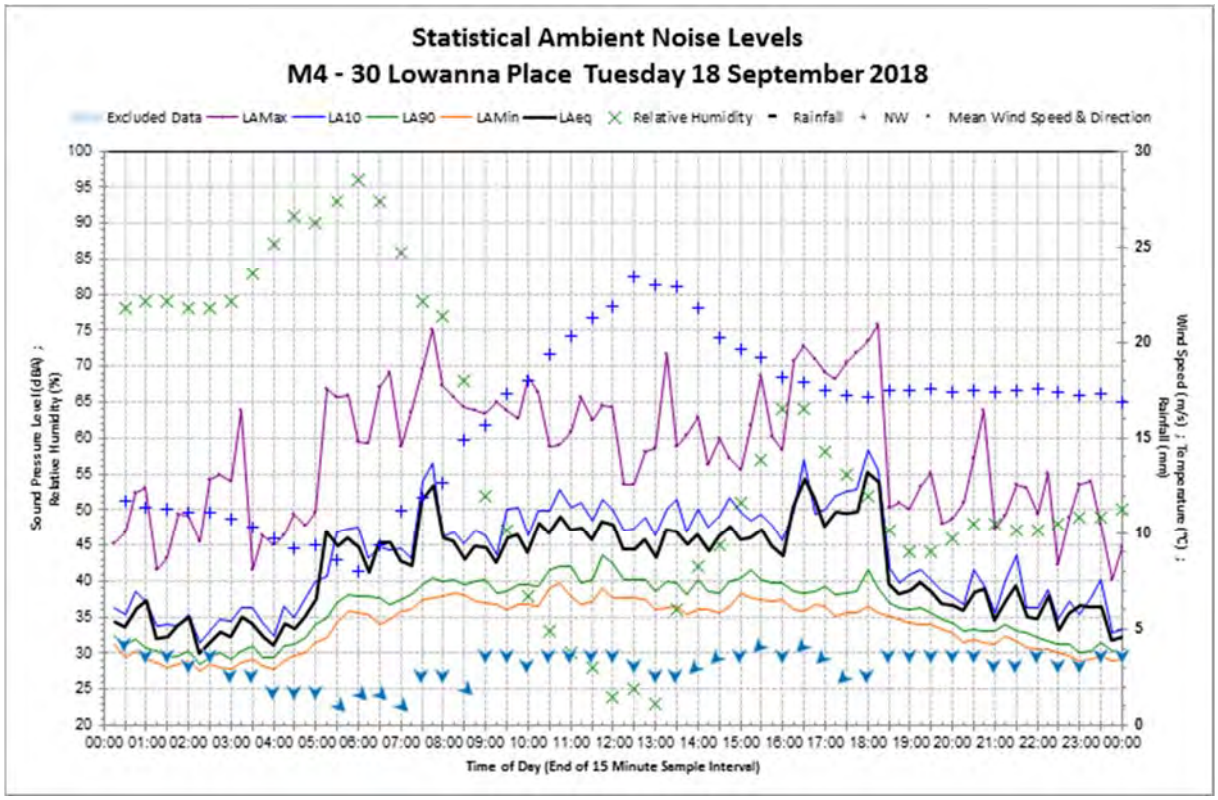

Statistical Ambient Noise Levels
M3 - 98 Manor Road Monday 24 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

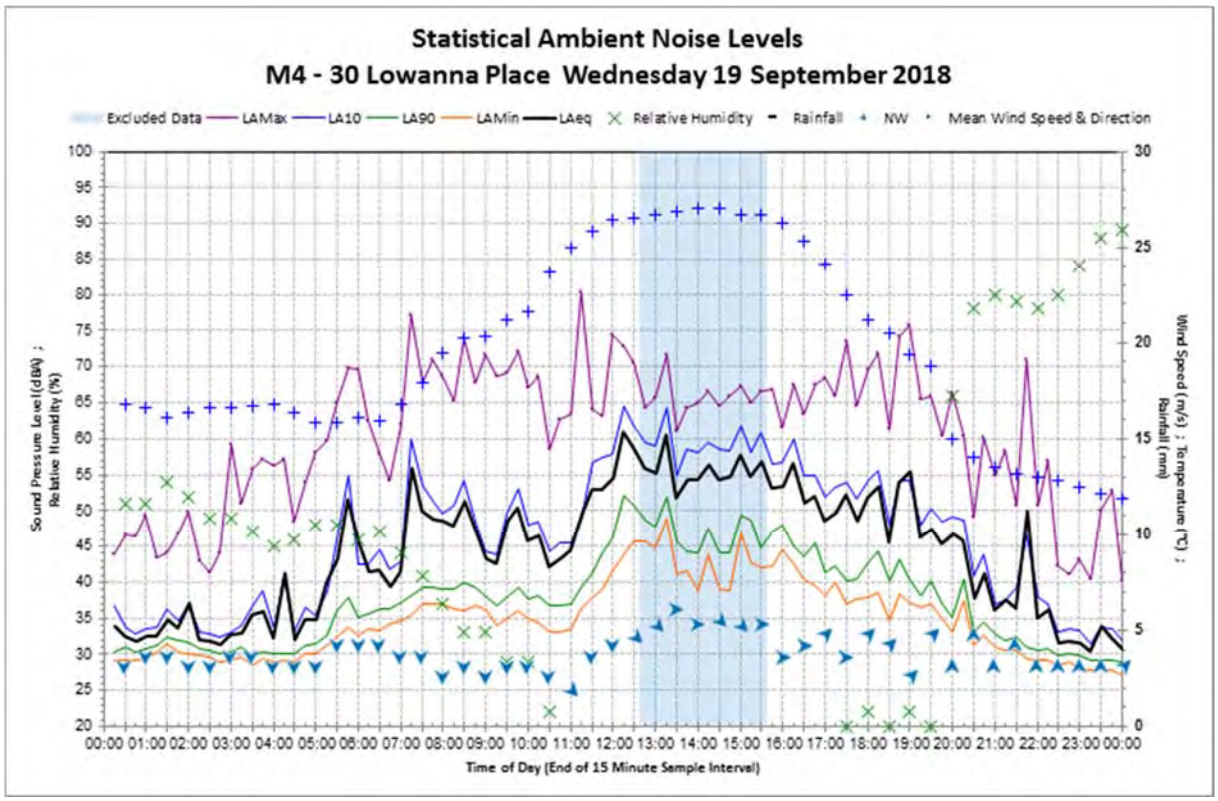

Statistical Ambient Noise Levels
M3 - 98 Manor Road Tuesday 25 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

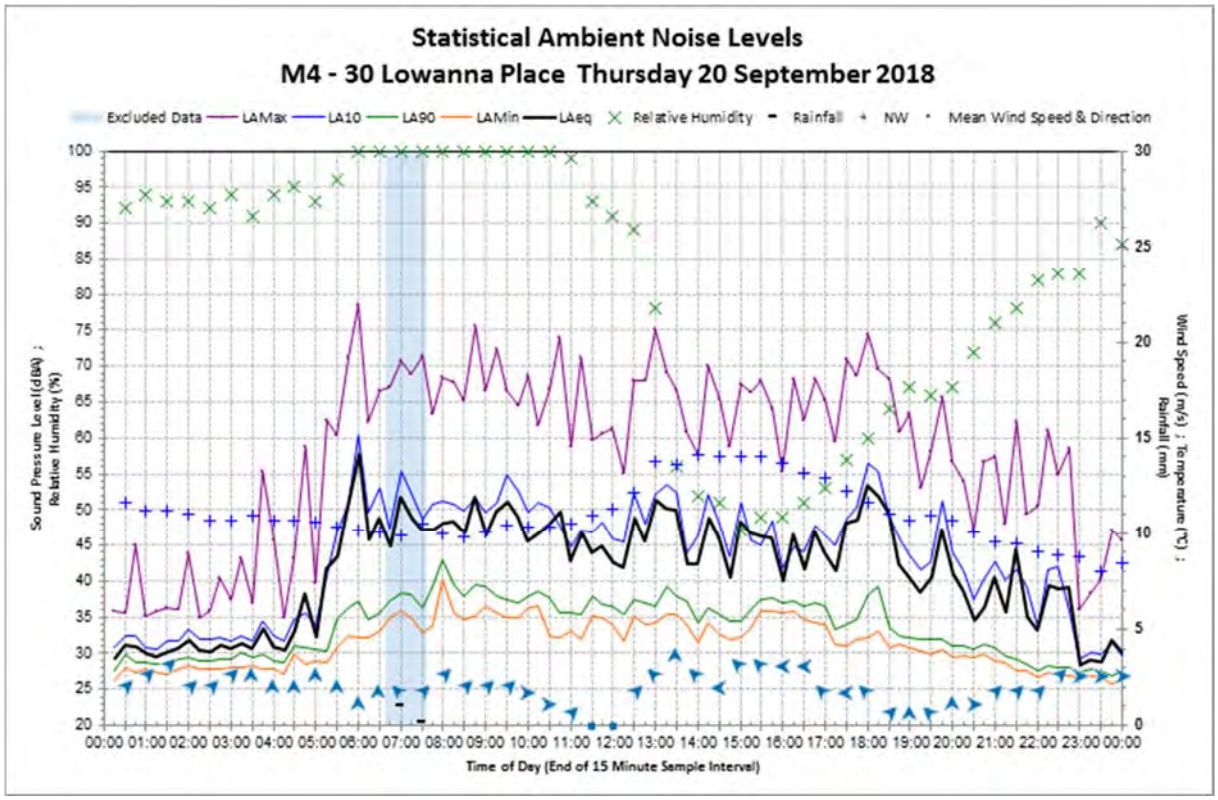

Statistical Ambient Noise Levels
M3 - 98 Manor Road Wednesday 26 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

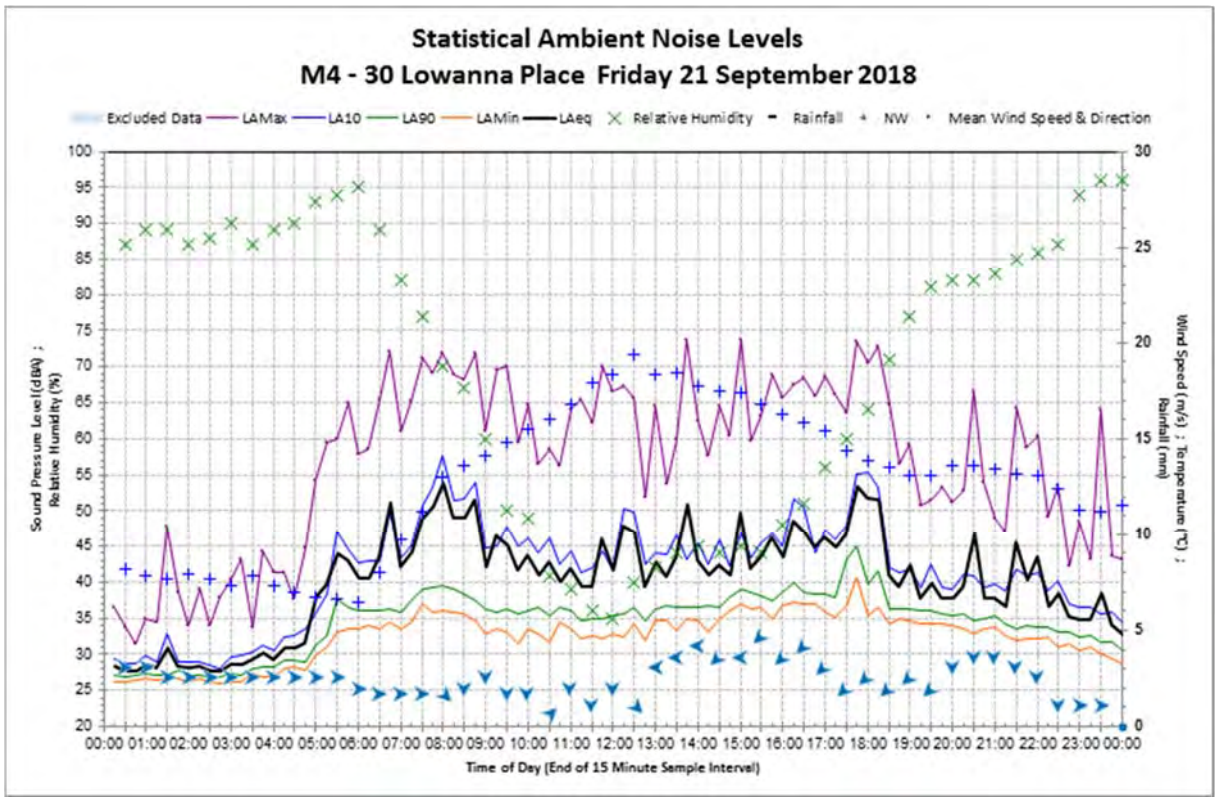

Statistical Ambient Noise Levels
M3 - 98 Manor Road Thursday 27 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
'A' Weighted Sound Pressure Level (dB)
Time of Day (End of 15 Minute Sample Interval)

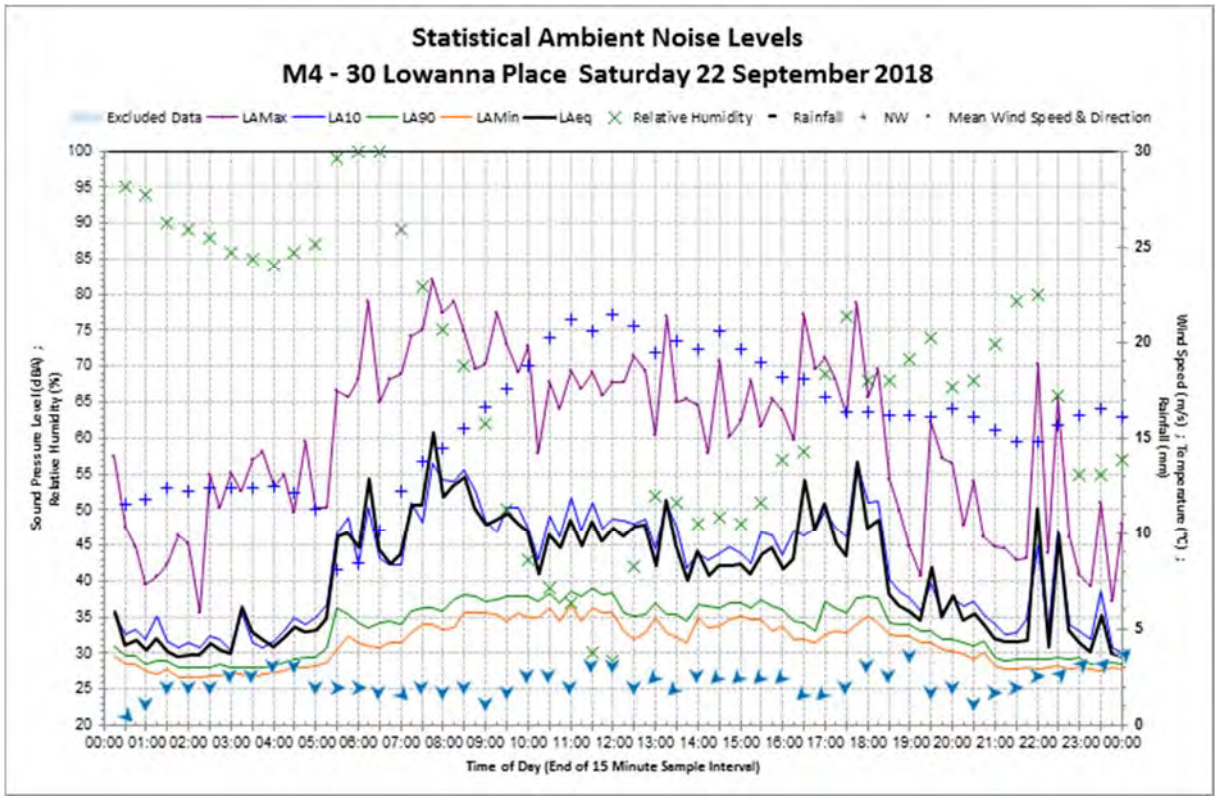

Statistical Ambient Noise Levels
M4 - 30 Lowanna Place Monday 17 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Rainfall (mm) ; Wind Speed (m/s) ; Temperature (°C) ;
Time of Day (End of 15 Minute Sample Interval)

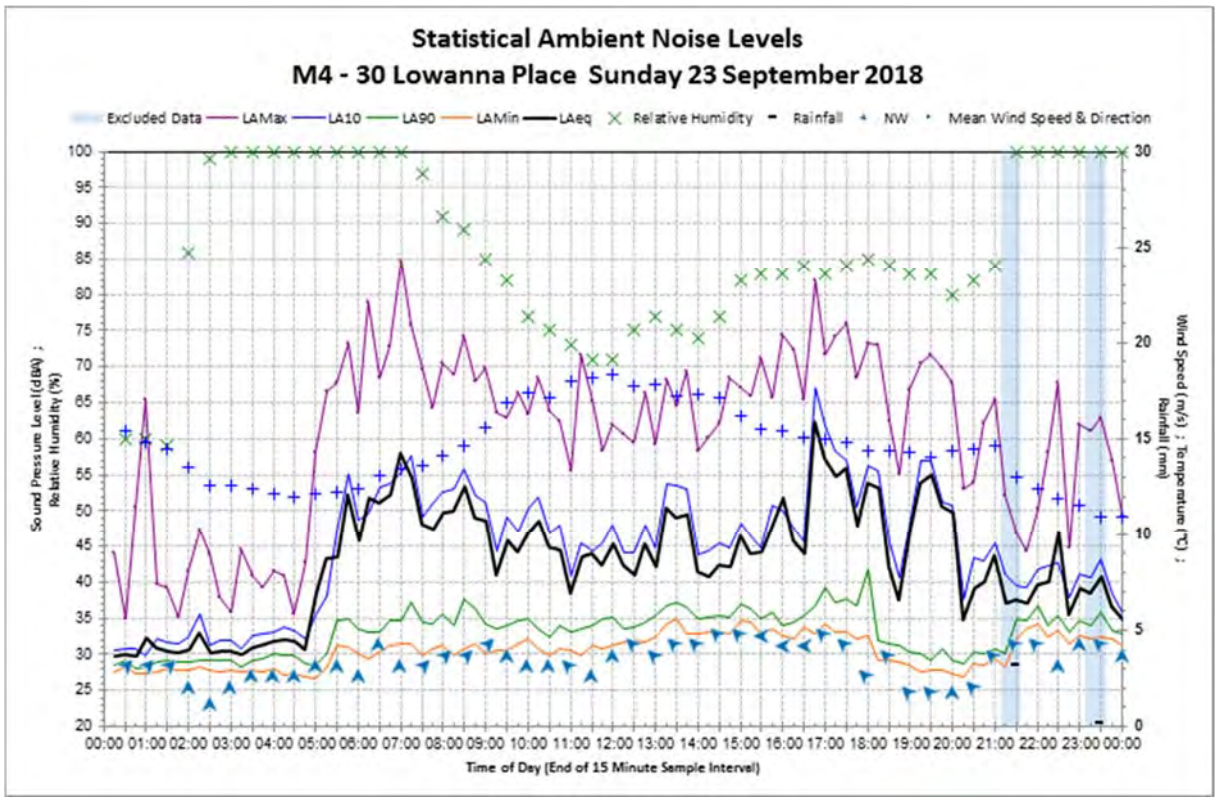

Statistical Ambient Noise Levels
M4 - 30 Lowanna Place Tuesday 18 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

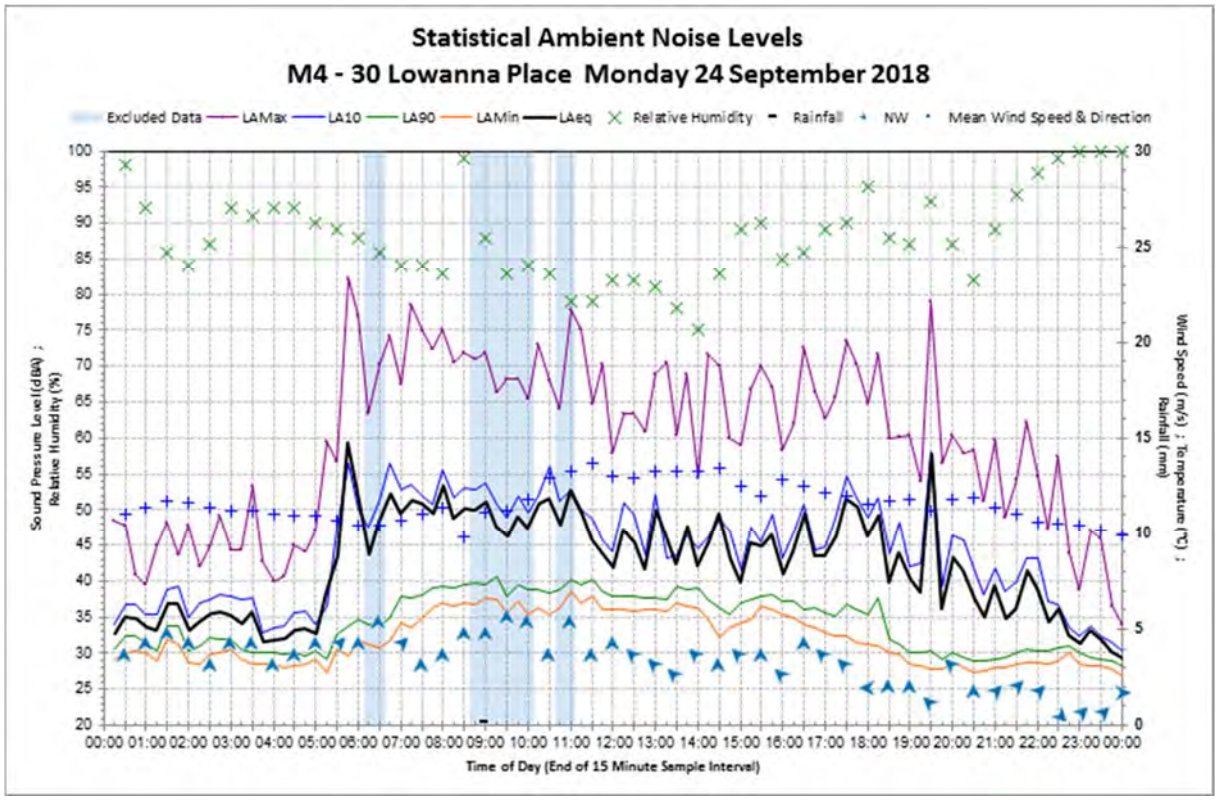

Statistical Ambient Noise Levels
M4 - 30 Lowanna Place Wednesday 19 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

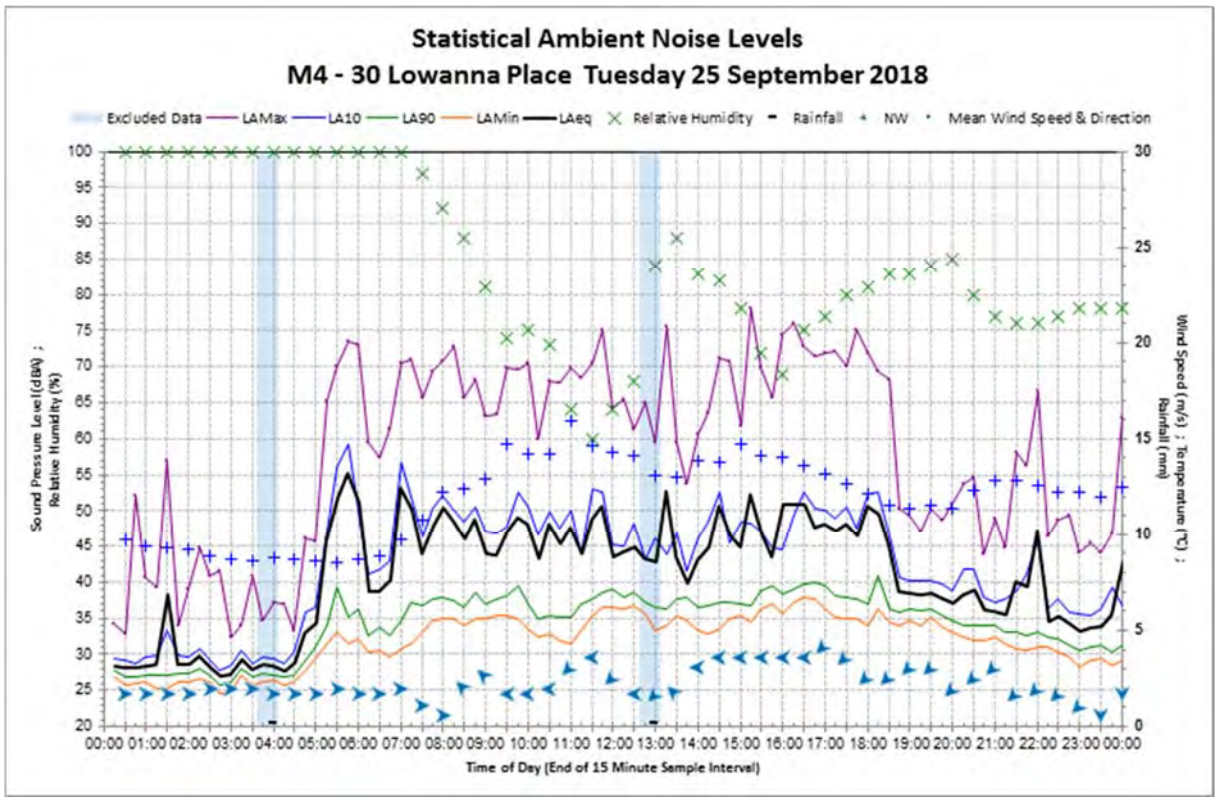

Statistical Ambient Noise Levels
M4 - 30 Lowanna Place Thursday 20 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

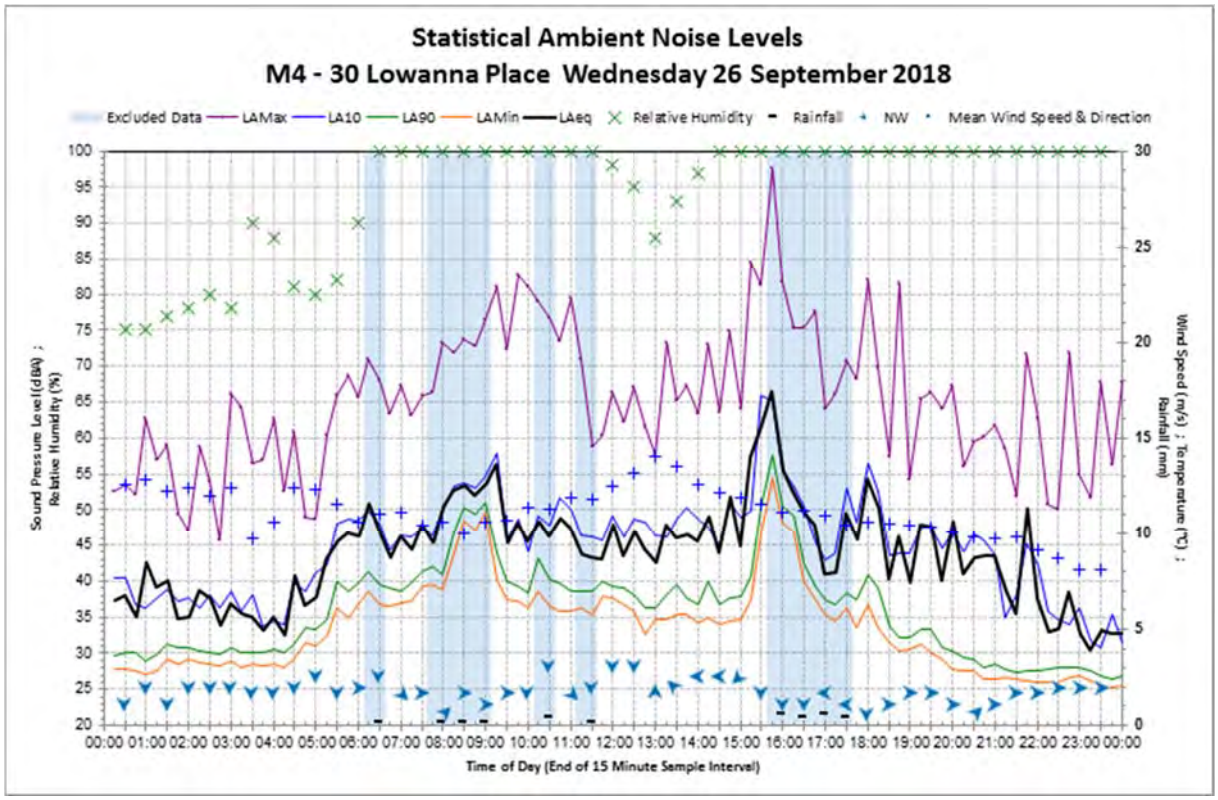

Statistical Ambient Noise Levels
M4 - 30 Lowanna Place Friday 21 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

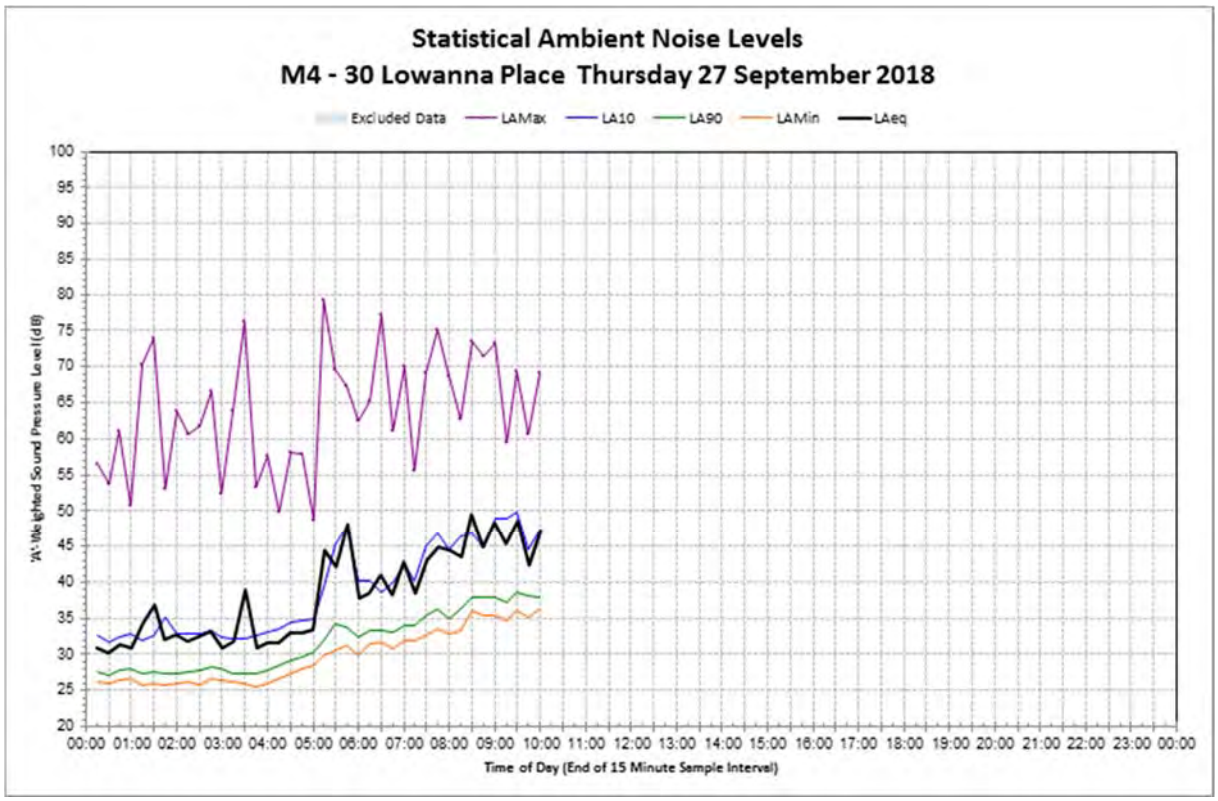

Statistical Ambient Noise Levels
M4 - 30 Lowanna Place Saturday 22 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

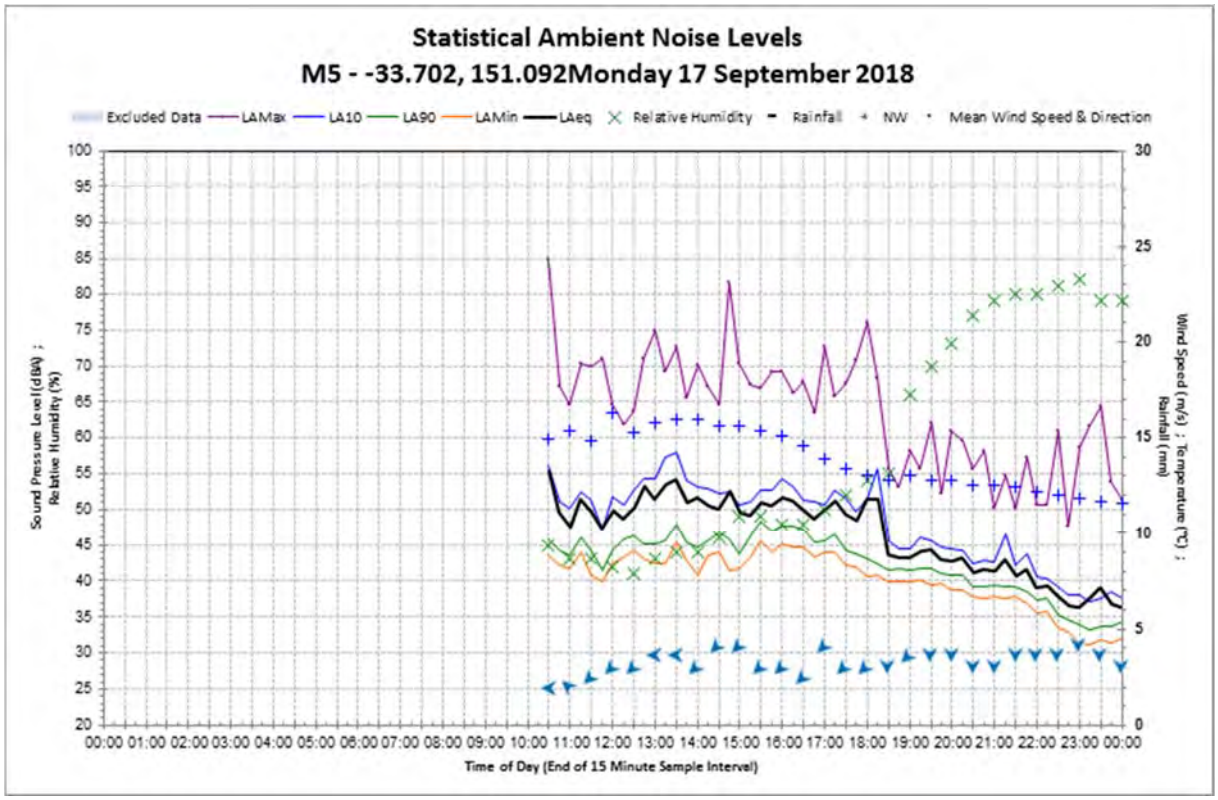

Statistical Ambient Noise Levels
M4 - 30 Lowanna Place Sunday 23 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

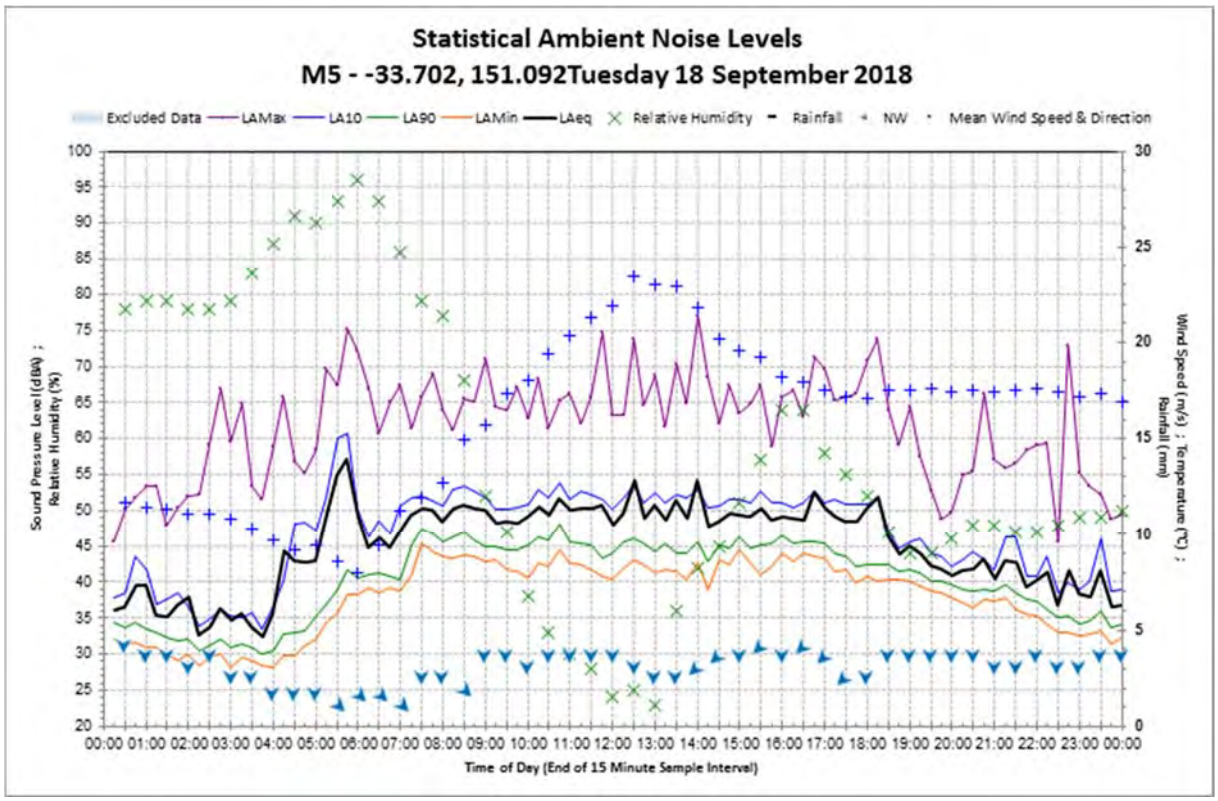

Statistical Ambient Noise Levels
M4 - 30 Lowanna Place Monday 24 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

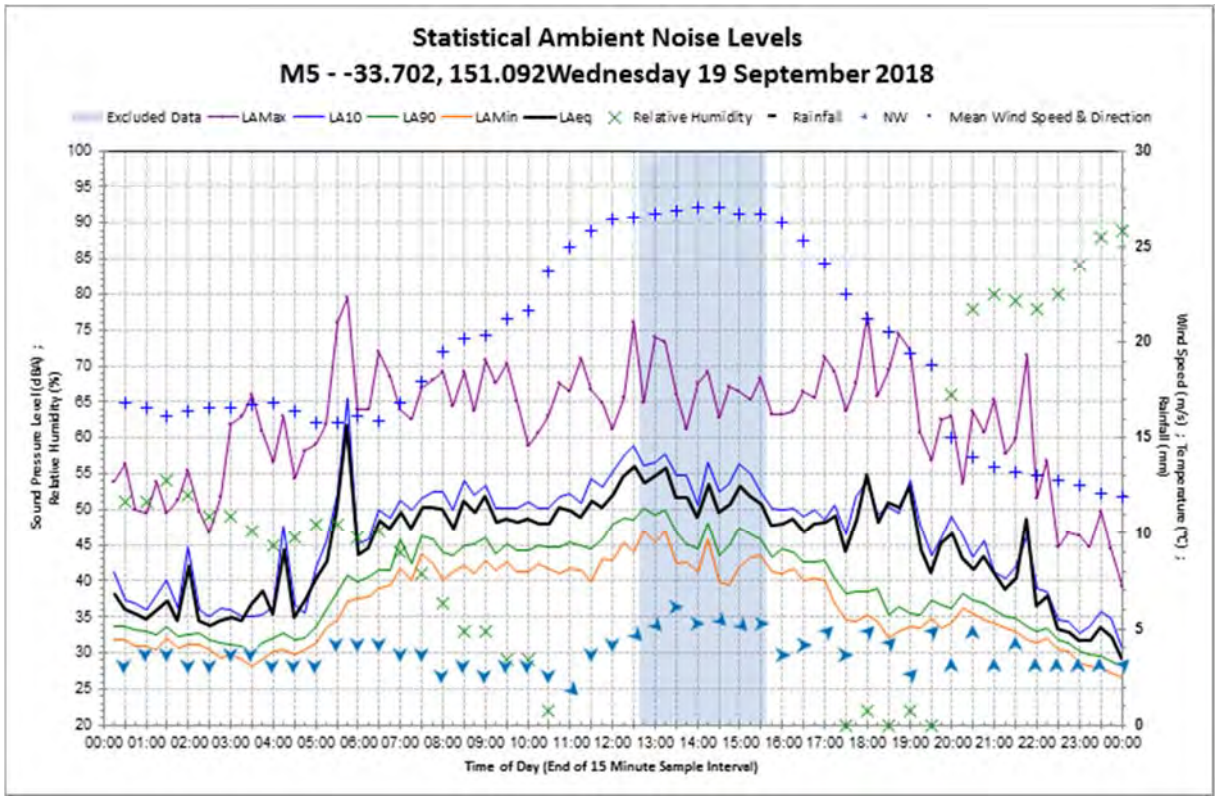

Statistical Ambient Noise Levels
M4 - 30 Lowanna Place Tuesday 25 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

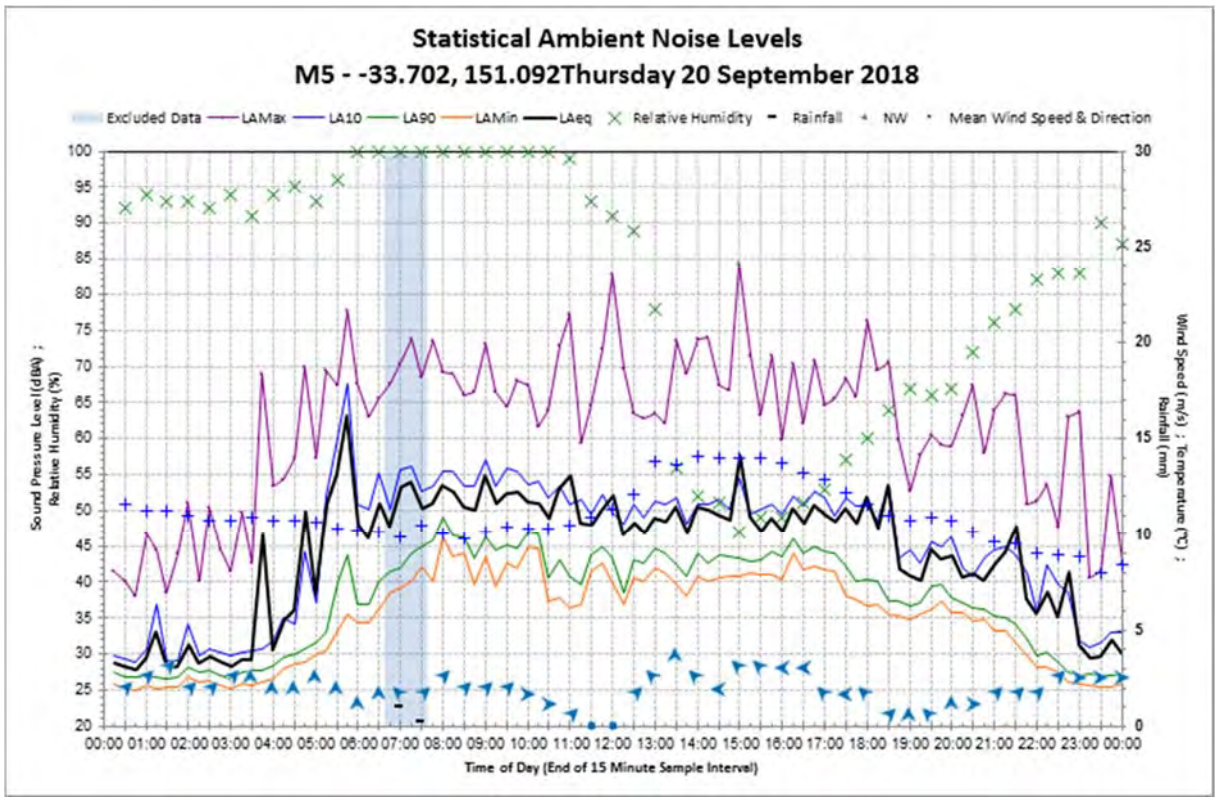

Statistical Ambient Noise Levels
M4 - 30 Lowanna Place Wednesday 26 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

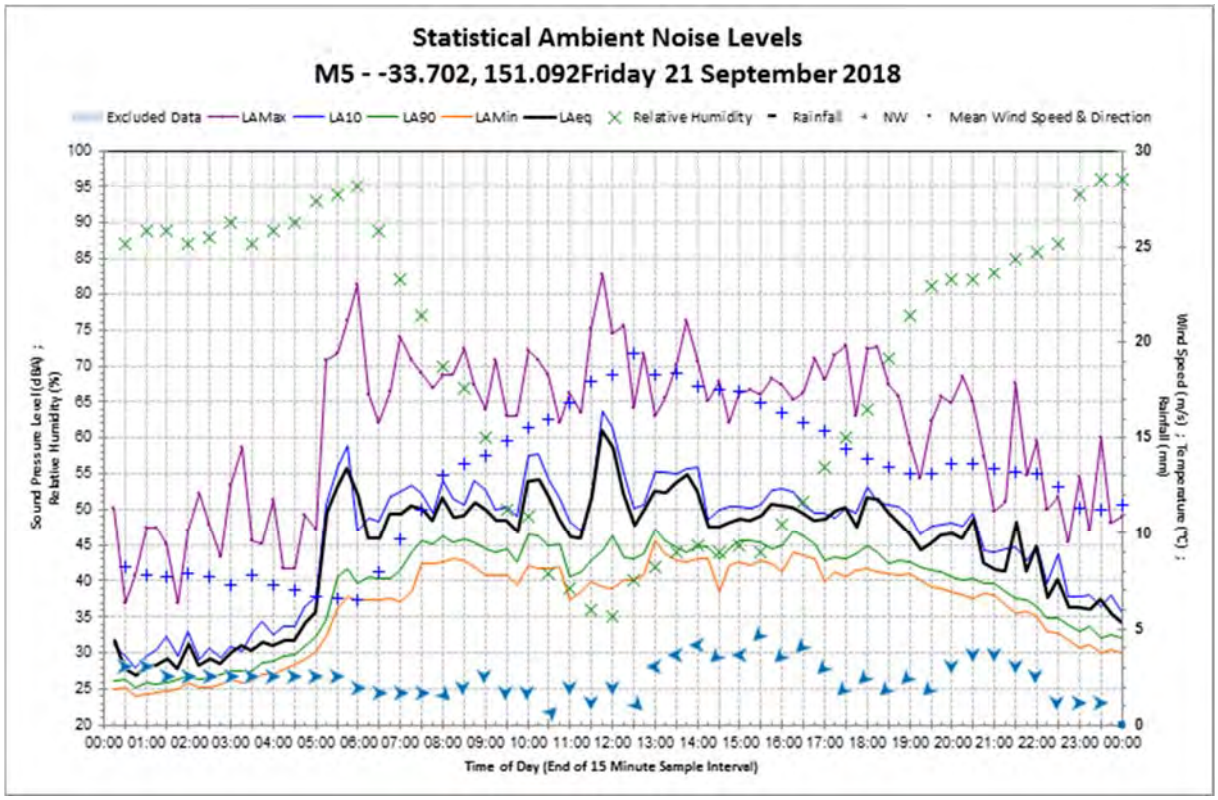

Statistical Ambient Noise Levels
M4 - 30 Lowanna Place Thursday 27 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
'A'-Weighted Sound Pressure Level (dB)
Time of Day (End of 15 Minute Sample Interval)

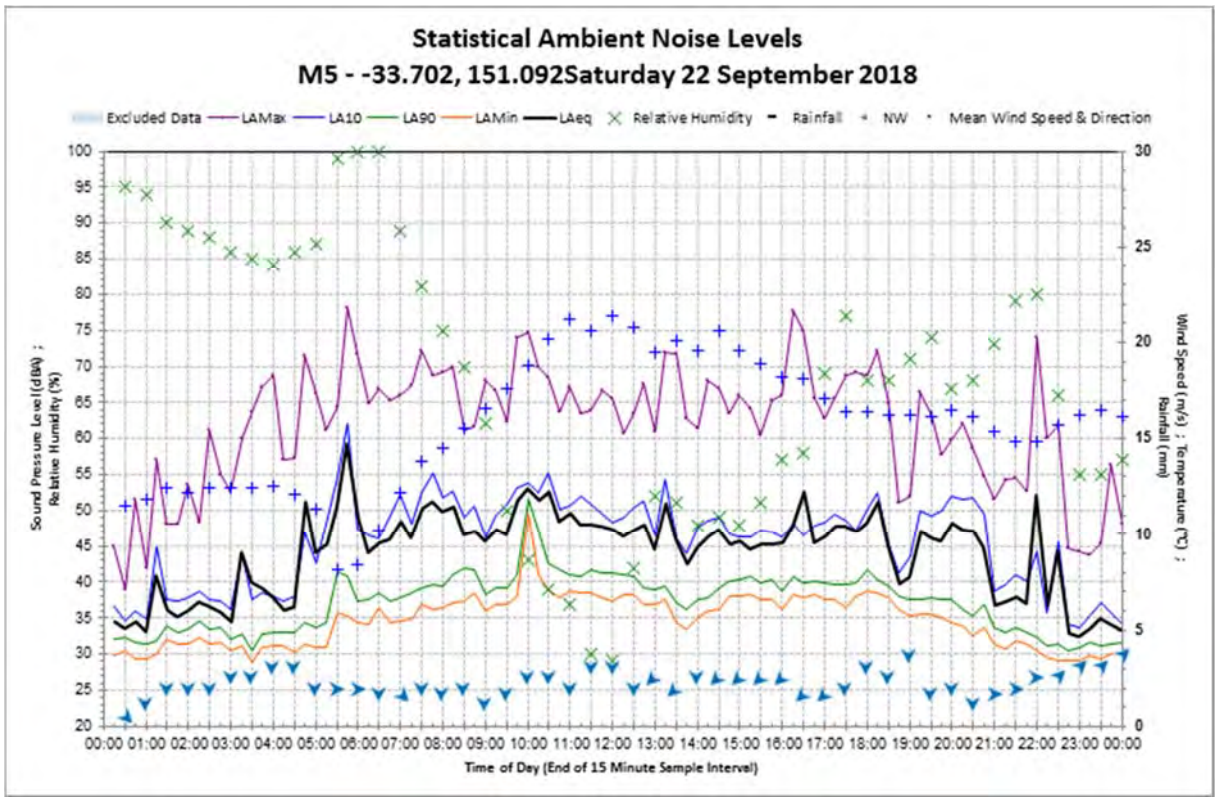

Statistical Ambient Noise Levels
M5 - -33.702, 151.092Monday 17 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

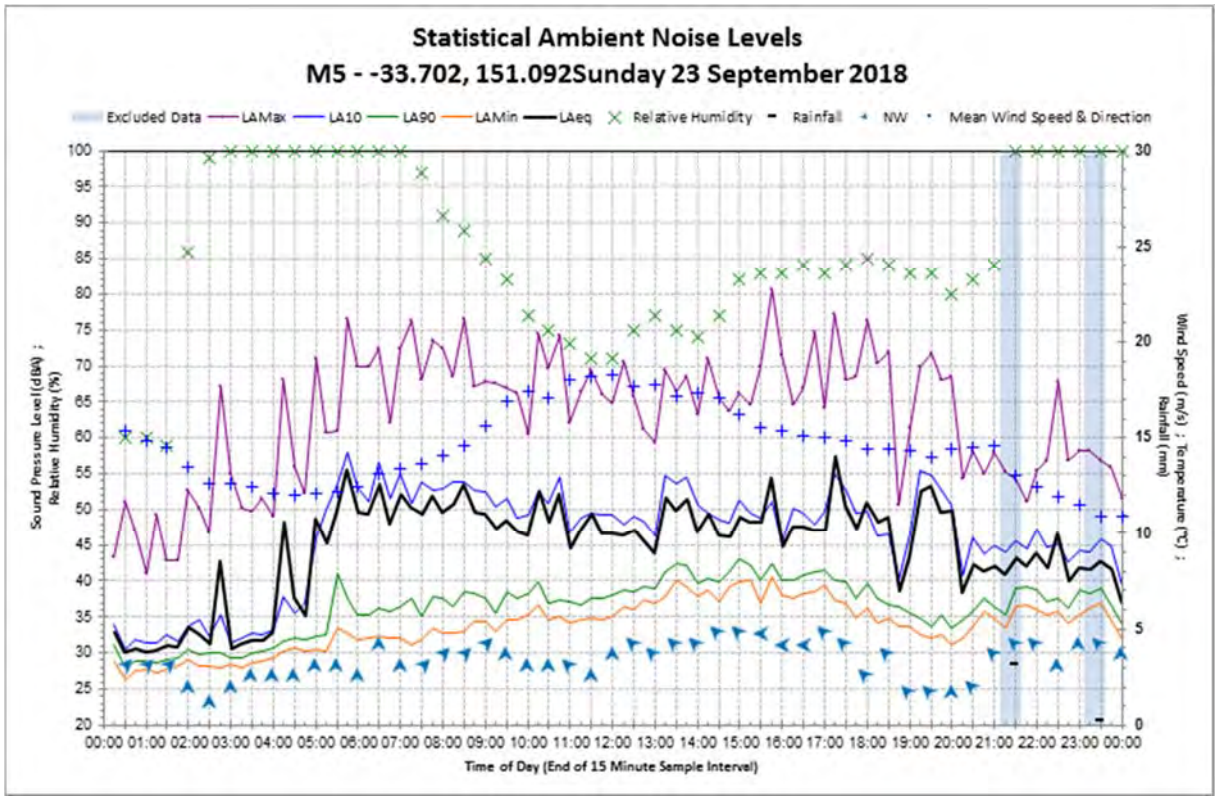

Statistical Ambient Noise Levels
M5 - -33.702, 151.092Tuesday 18 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

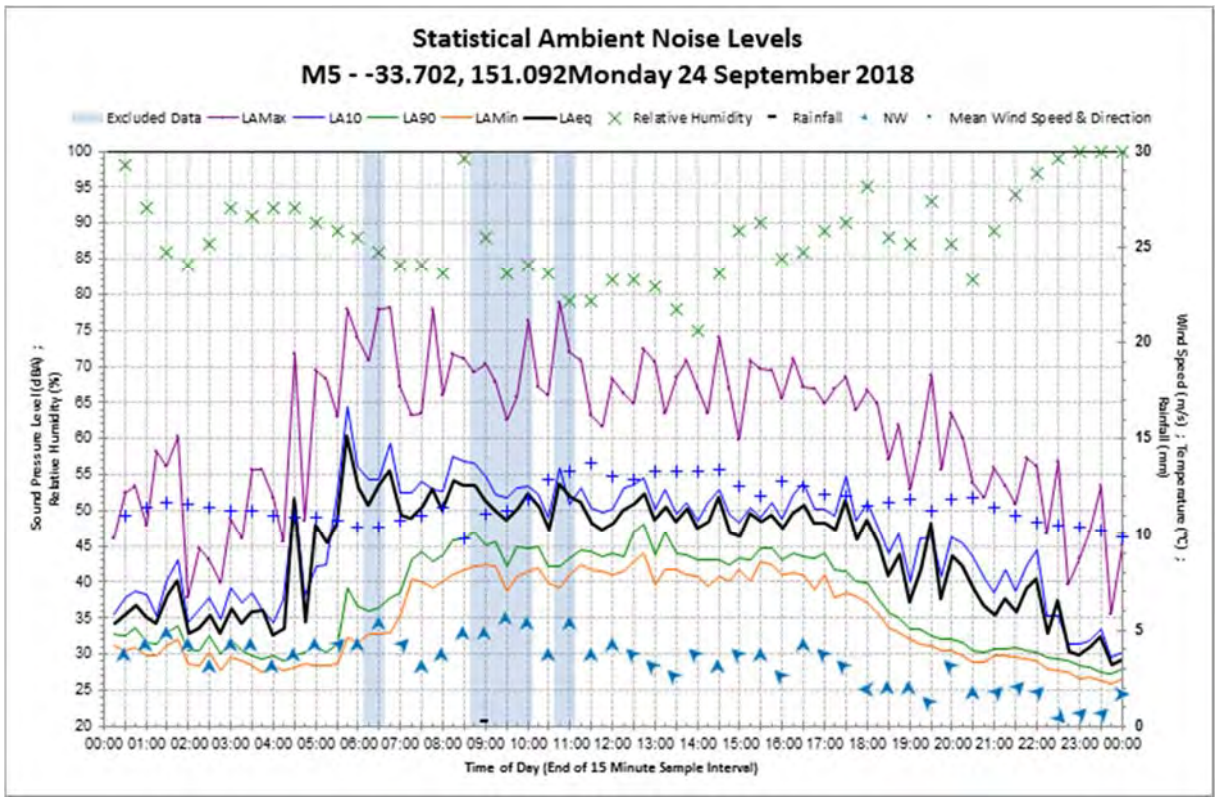

Statistical Ambient Noise Levels
M5 - -33.702, 151.092Wednesday 19 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

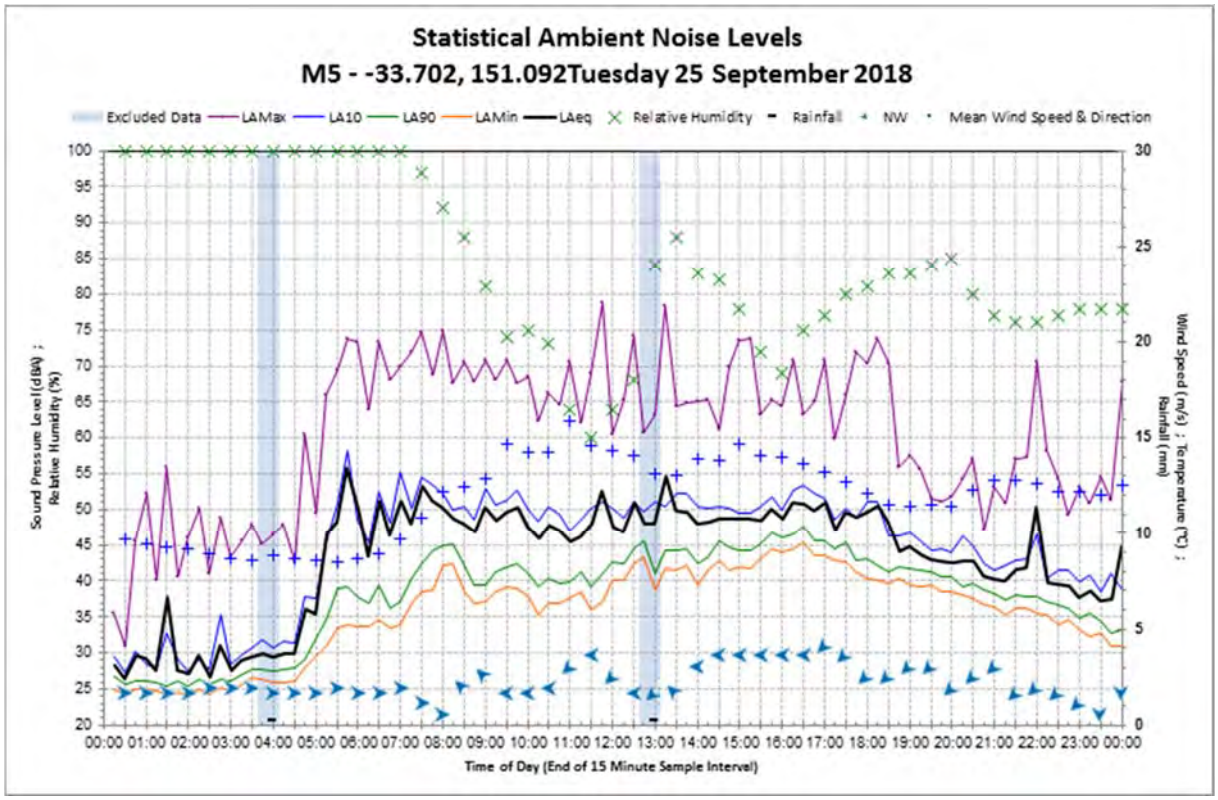

Statistical Ambient Noise Levels
M5 - -33.702, 151.092Thursday 20 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

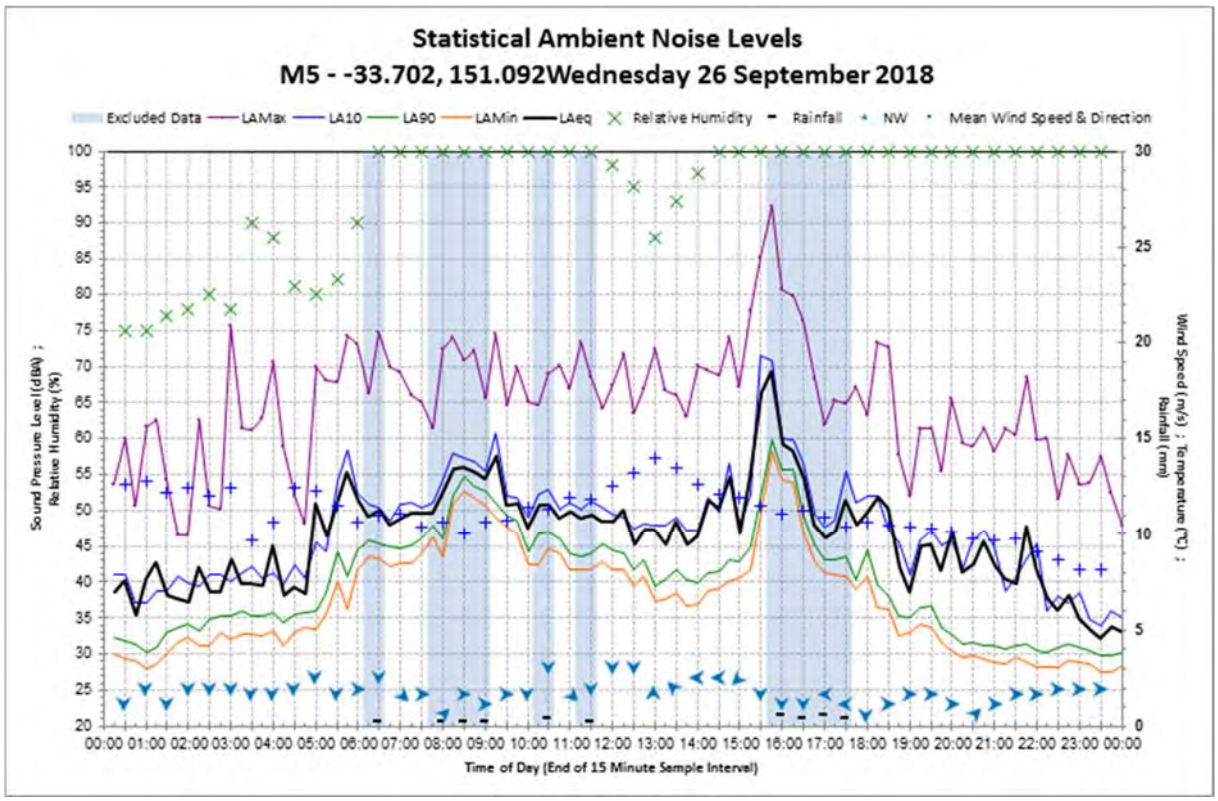

Statistical Ambient Noise Levels
M5 - -33.702, 151.092Friday 21 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

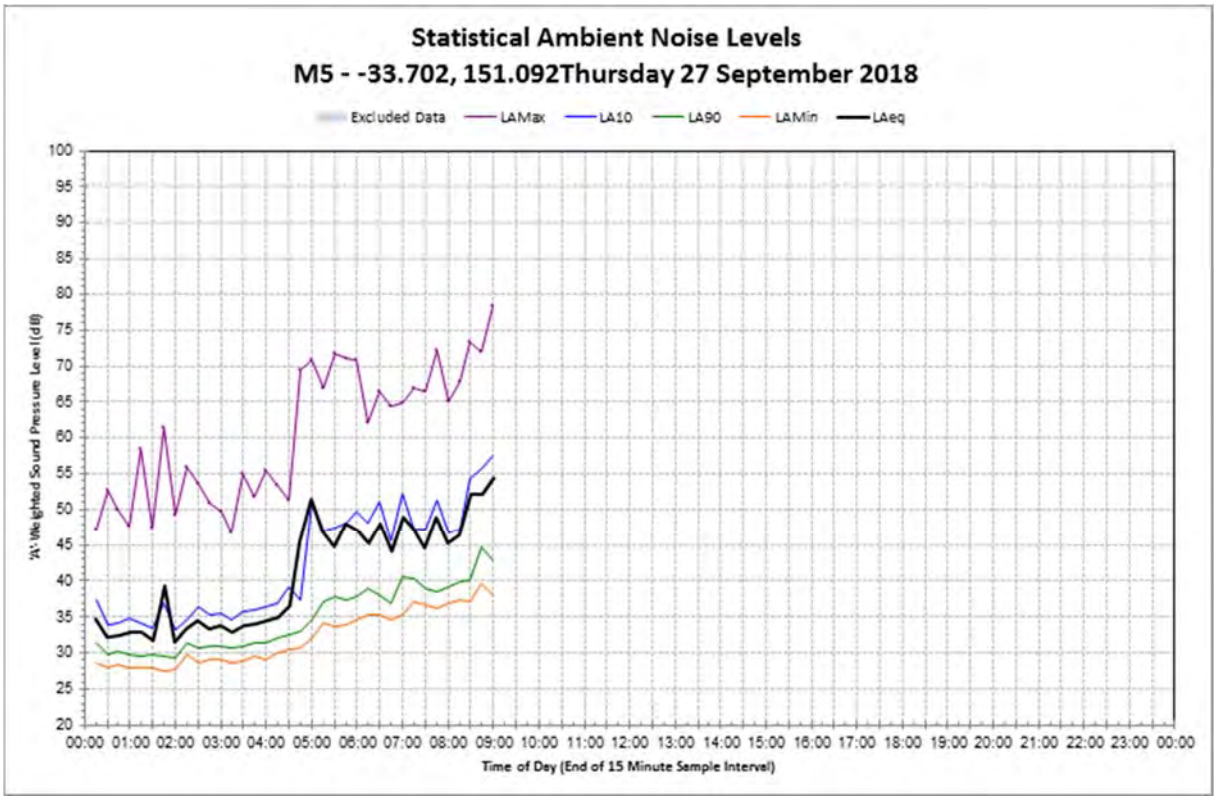

Statistical Ambient Noise Levels
M5 - -33.702, 151.092Saturday 22 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
M5 - -33.702, 151.092Sunday 23 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

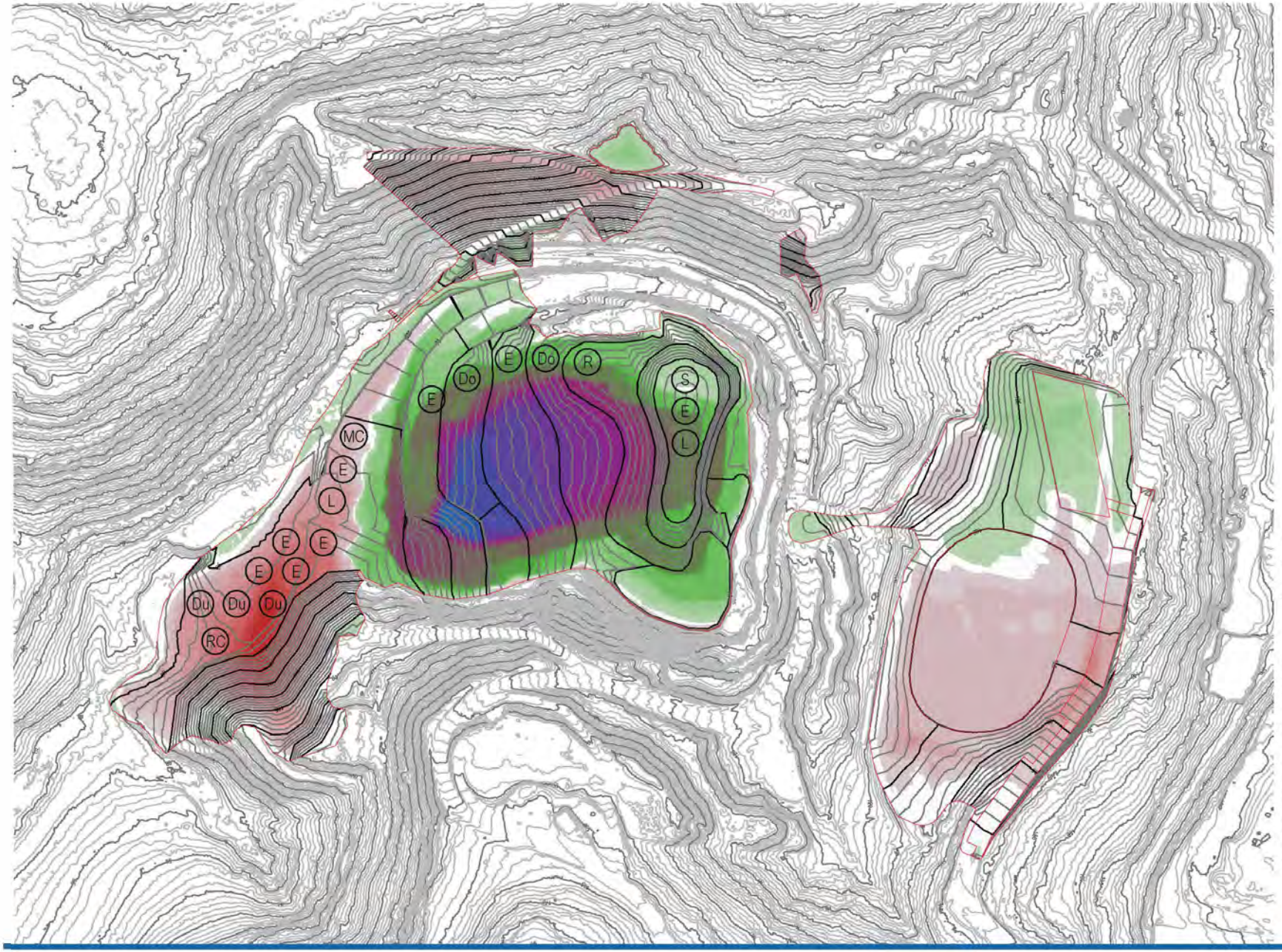

Statistical Ambient Noise Levels
M5 - -33.702, 151.092Monday 24 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
M5 - -33.702, 151.092Tuesday 25 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
M5 - -33.702, 151.092Wednesday 26 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
M5 - -33.702, 151.092Thursday 27 September 2018
Excluded Data
LAMax
LA10
LA90
LAMin
LAeq
'A' Weighted Sound Pressure Level (dB)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 00:00
Time of Day (End of 15 Minute Sample Interval)

Appendix C – Potential construction scenarios



CUT FILL DEPTH RANGE

- 25m CUT
- 22.5m
- 20m
- 17.5m
- 15m
- 12.5m
- 10m
- 7.5m
- 5m
- 2.5m
- 0
- 2.5m
- 5m
- 7.5m
- 10m
- 12.5m
- 15m
- 17.5m FILL
- 17.5m FILL
- 20m
- 22.5m
- 25m
- 27.5m
- 30m
- 32.5m
- 35m
- 37.5m
- 40m
- 42.5
- 45m
- 47.5m
- 50m
- 52.5m
- 55m
- 57.5m
- 60m FILL

LEGEND

- ASSUMED EXISTING SURFACE
- PIT AREA DESIGN SURFACE
- (E) EXCAVATOR
- (Du) DUMPER
- (Do) DOZER
- (RC) ROCK SAW
- (MC) MOBILE CRUSHER
- (L) LOADER
- (R) ROLLER
- (S) SCREENER

0 30 60 90m

SCALE 1:3000 AT ORIGINAL SIZE

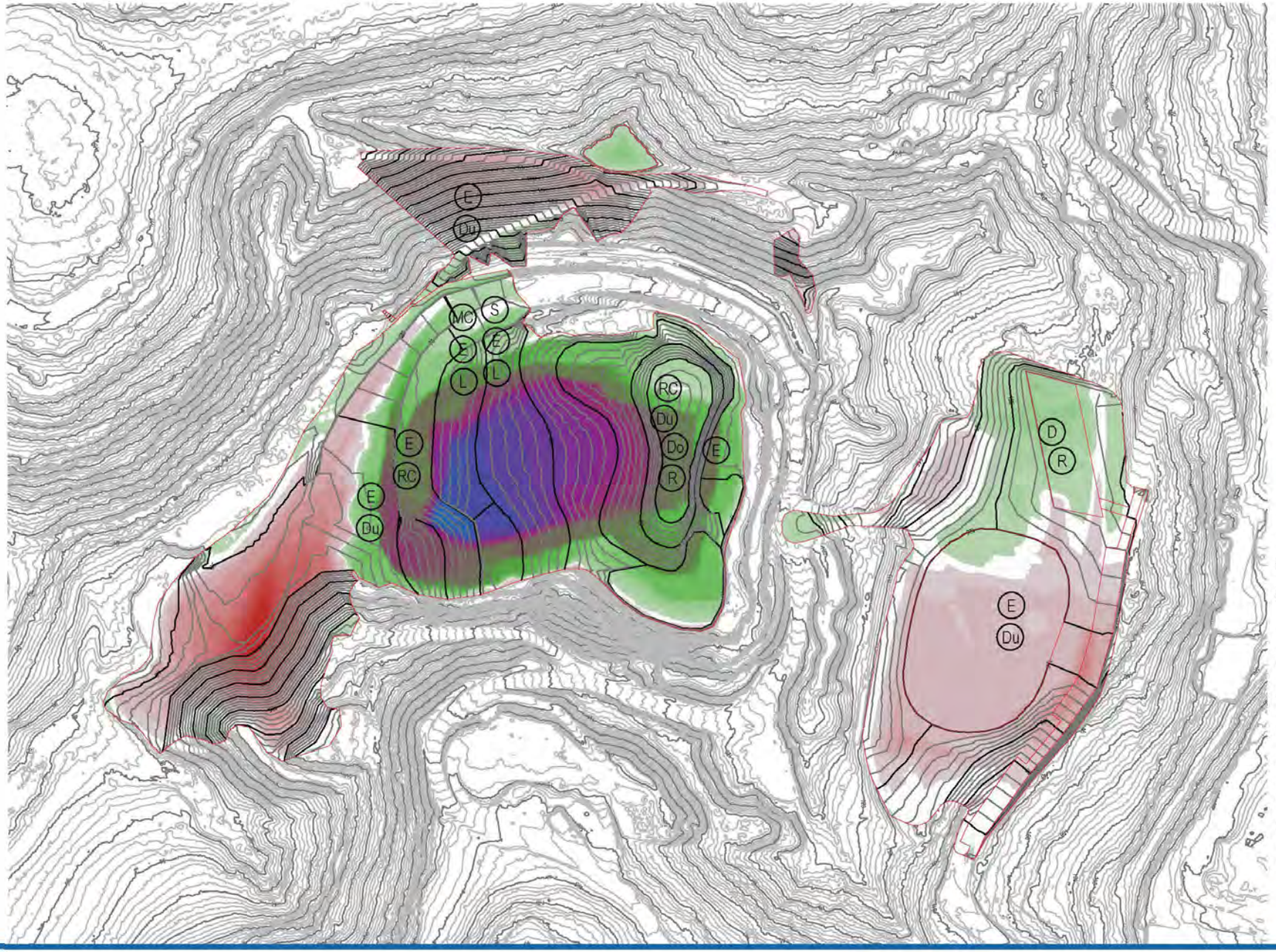
N

HORNSBY SHIRE COUNCIL
HORNSBY QUARRY REHABILITATION
PROJECT FINAL LANDFORM
SCENARIO 1

Job Number	21-26457
Revision	A
Date	SEP 2018

Level 15, 133 Castlereagh Street, Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Plot Date: 12 October 2018 - 10:42 AM Plotted by: Rashnith Grewal Cad File No: G:\21\26457\CADD\Drawings\21-26457-FIG4.1.dwg



CUT FILL DEPTH RANGE

CUT	FILL
25m CUT	17.5m FILL
22.5m	20m
20m	22.5m
17.5m	25m
15m	27.5m
12.5m	30m
10m	32.5m
7.5m	35m
5m	37.5m
2.5m	40m
0	42.5
2.5m	45m
5m	47.5m
7.5m	50m
10m	52.5m
12.5m	55m
15m	57.5m
17.5m FILL	60m FILL

LEGEND

- ASSUMED EXISTING SURFACE
- PIT AREA DESIGN SURFACE
- (E) EXCAVATOR
- (Du) DUMPER
- (Do) DOZER
- (RC) ROCK SAW
- (MC) MOBILE CRUSHER
- (L) LOADER
- (R) ROLLER
- (S) SCREENER

0 30 60 90m

SCALE 1:3000 AT ORIGINAL SIZE

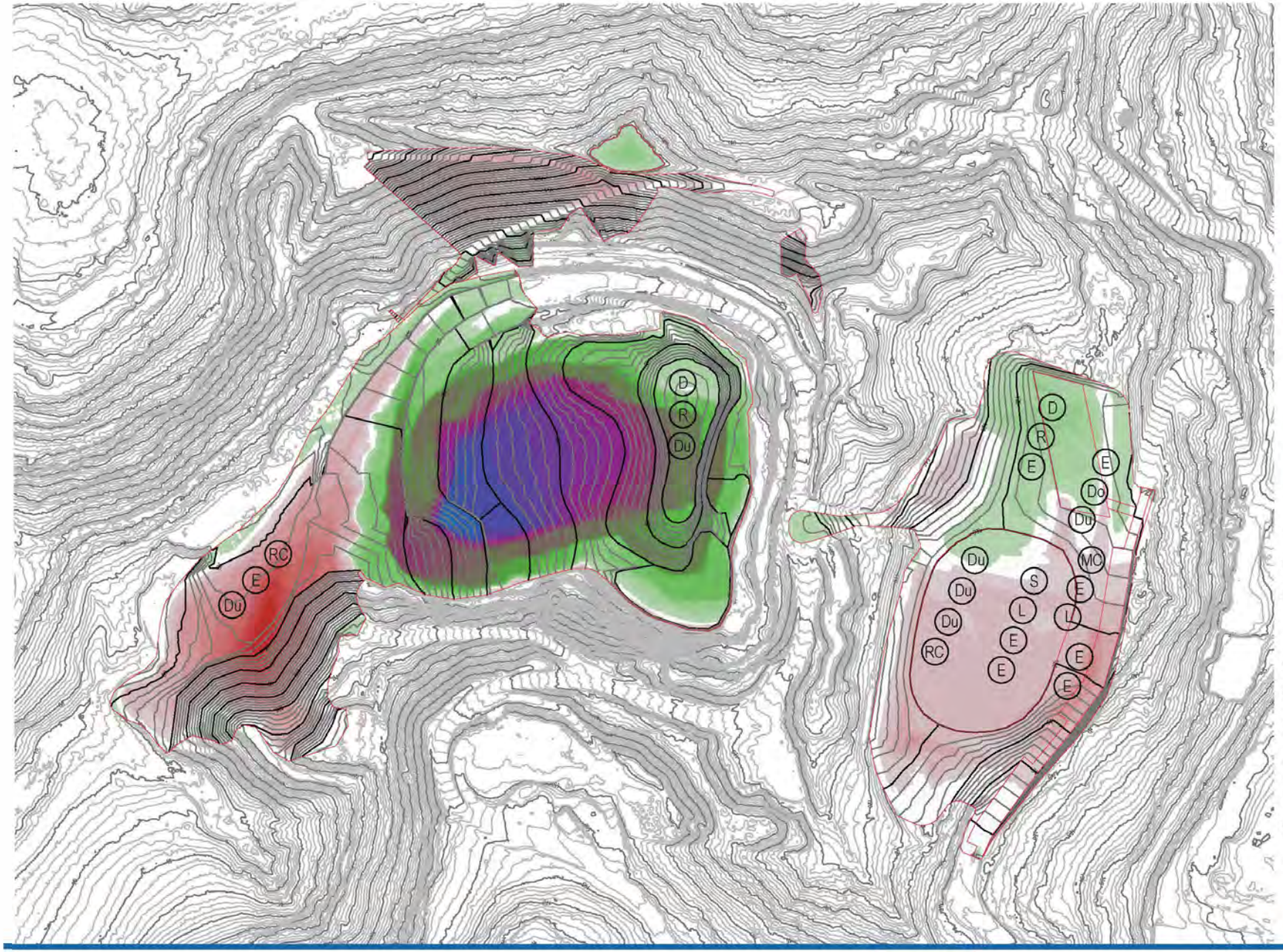
N

HORNSBY SHIRE COUNCIL
HORNSBY QUARRY REHABILITATION
PROJECT FINAL LANDFORM
SCENARIO 2

Job Number	21-26457
Revision	A
Date	SEP 2018

Level 15, 133 Castlereagh Street, Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Plot Date: 12-October 2018 - 10:50 AM Plotted by: Reshnith Grewal Cad File No: G:\21\26457\CAD\Drawings\21-26457-FIG4.1.dwg



CUT FILL DEPTH RANGE

25m CUT	17.5m FILL
22.5m	20m
20m	22.5m
17.5m	25m
15m	27.5m
12.5m	30m
10m	32.5m
7.5m	35m
5m	37.5m
2.5m	40m
0	42.5
2.5m	45m
5m	47.5m
7.5m	50m
10m	52.5m
12.5m	55m
15m	57.5m
17.5m FILL	60m FILL

LEGEND

- ASSUMED EXISTING SURFACE
- PIT AREA DESIGN SURFACE
- (E) EXCAVATOR
- (Du) DUMPER
- (Do) DOZER
- (RC) ROCK SAW
- (MC) MOBILE CRUSHER
- (L) LOADER
- (R) ROLLER
- (S) SCREENER

0 30 60 90m

SCALE 1:3000 AT ORIGINAL SIZE

N

HORNSBY SHIRE COUNCIL
HORNSBY QUARRY REHABILITATION
PROJECT FINAL LANDFORM
SCENARIO 3

Job Number	21-26457
Revision	A
Date	SEP 2018

Level 15, 133 Castlereagh Street, Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Plot Date: 12 October 2018 - 10:57 AM Plotted by: Reshnith Grewal Cad File No: G:\21\26457\CADD\Drawings\21-26457-F\G4.1.dwg

Appendix D – Predicted construction noise levels against the ICNG NMLs

Predicted construction noise levels (ICNG): Standard construction hours

Receiver ID	Noise Management Level (NML)	Receiver Type	NCA	CS1A	CS1B	CS1C	CS1D	CS2A	CS2B	CS2C	CS2D	CS3A	CS3B	CS3C	CS3D
Residential: Exceeds noise management level **Bold** Highly noise affected															
Non-residential: Exceeds noise management level															
R0001	65	Active Recreation	Active Recreation	60	60	60	60	61	61	61	61	61	69	61	69
R0002	70	Commercial	Commercial	40	46	40	43	34	40	34	40	35	42	35	42
R0003	70	Commercial	Commercial	44	50	44	50	43	50	44	50	42	47	42	47
R0004	70	Commercial	Commercial	60	60	60	60	61	61	61	61	61	69	61	69
R0005	70	Commercial	Commercial	46	50	46	50	47	52	47	52	47	55	47	55
R0006	55	Place of worship	Place of worship	44	50	44	50	44	50	44	50	42	48	42	47
R0007	70	Commercial	Commercial	44	50	44	49	45	50	45	50	45	53	45	53
R0008	70	Commercial	Commercial	44	47	44	47	43	50	43	50	42	50	42	50
R0009	70	Commercial	Commercial	45	51	45	51	45	50	44	50	45	53	44	52
R0010	70	Commercial	Commercial	41	47	41	45	38	43	39	43	37	41	37	41
R0011	70	Commercial	Commercial	43	49	44	49	44	49	45	49	42	50	42	50
R0012	70	Commercial	Commercial	38	43	38	43	35	42	35	42	35	40	35	40
R0013	70	Commercial	Commercial	41	47	41	47	39	47	39	47	39	45	39	46
R0014	70	Commercial	Commercial	44	49	44	49	45	48	45	48	45	53	45	53
R0015	70	Commercial	Commercial	38	44	38	44	37	42	37	42	37	45	37	45
R0016	70	Commercial	Commercial	36	42	36	42	35	38	37	37	34	40	34	40
R0017	70	Commercial	Commercial	37	43	37	43	35	39	35	40	35	41	35	41
R0018	70	Commercial	Commercial	35	38	35	38	36	39	36	39	36	44	36	44
R0019	70	Commercial	Commercial	36	38	36	38	37	37	37	37	37	45	37	45
R0020	70	Commercial	Commercial	39	45	39	45	33	38	33	38	37	39	37	40
R0021	70	Commercial	Commercial	40	42	42	42	41	41	43	43	41	49	43	51
R0022	70	Commercial	Commercial	47	52	47	52	48	48	48	48	48	56	48	56
R0023	70	Commercial	Commercial	41	47	41	47	34	39	34	39	39	39	39	40
R0024	70	Commercial	Commercial	40	46	40	46	30	33	31	34	38	38	38	39
R0025	70	Commercial	Commercial	37	43	37	43	30	35	30	35	35	38	35	38
R0026	70	Commercial	Commercial	38	42	38	42	39	41	39	41	37	45	37	45
R0027	70	Commercial	Commercial	45	51	45	51	41	47	41	48	43	46	43	49
R0028	70	Commercial	Commercial	48	54	48	54	47	54	49	54	47	55	49	57
R0029	70	Commercial	Commercial	39	45	39	45	33	37	34	37	37	39	37	39
R0030	70	Commercial	Commercial	36	41	36	41	37	38	37	38	37	45	37	45
R0031	70	Commercial	Commercial	35	41	35	41	32	38	32	37	33	38	33	38
R0032	70	Commercial	Commercial	40	46	40	46	41	42	41	43	38	46	38	46
R0033	70	Commercial	Commercial	32	38	33	38	30	34	31	34	30	38	30	38
R0034	70	Commercial	Commercial	40	45	40	45	41	41	41	41	37	44	37	44
R0035	70	Commercial	Commercial	33	39	34	39	31	36	32	36	31	38	31	38
R0036	70	Commercial	Commercial	33	39	33	39	31	34	32	34	31	38	31	38
R0037	70	Commercial	Commercial	34	37	34	37	35	36	35	36	35	43	35	43
R0038	70	Commercial	Commercial	37	41	37	41	38	41	38	41	38	46	38	46
R0039	70	Commercial	Commercial	44	50	44	50	45	50	45	50	45	53	45	53
R0040	70	Commercial	Commercial	34	40	34	40	31	34	32	34	32	38	32	38
R0041	70	Commercial	Commercial	32	38	33	39	30	33	31	33	31	38	31	38
R0042	70	Commercial	Commercial	43	49	43	49	42	49	42	49	41	48	41	48
R0043	70	Commercial	Commercial	34	40	34	38	32	34	32	34	30	37	30	37
R0044	70	Commercial	Commercial	45	51	45	51	43	50	43	50	43	50	43	50
R0045	70	Commercial	Commercial	33	39	33	39	34	38	34	38	34	42	34	42
R0046	70	Commercial	Commercial	40	46	40	43	39	42	39	42	35	42	35	42
R0047	70	Commercial	Commercial	34	39	34	39	35	38	35	38	34	42	34	42
R0048	70	Commercial	Commercial	37	37	37	35	35	37	35	37	29	37	29	37
R0049	70	Commercial	Commercial	44	50	44	50	42	44	42	44	42	50	42	50
R0050	70	Commercial	Commercial	47	53	47	53	40	46	40	46	45	47	45	47
R0051	70	Commercial	Commercial	35	37	36	37	32	33	33	33	29	36	29	36
R0052	70	Commercial	Commercial	36	37	37	37	33	33	34	34	29	36	29	36
R0053	70	Commercial	Commercial	51	57	51	57	45	50	45	50	49	53	49	53
R0054	70	Commercial	Commercial	40	46	39	45	37	45	37	45	38	42	37	42
R0055	70	Commercial	Commercial	42	48	42	48	40	43	40	43	40	43	40	44
R0056	70	Commercial	Commercial	47	53	47	53	44	51	44	51	45	50	45	51
R0057	70	Commercial	Commercial	34	40	34	40	35	40	35	39	32	39	32	39
R0058	70	Commercial	Commercial	44	50	44	50	40	44	40	44	42	44	42	44
R0059	70	Commercial	Commercial	47	53	47	53	43	51	43	51	45	46	45	48
R0060	70	Commercial	Commercial	38	44	38	44	35	38	35	38	36	40	36	40
R0061	70	Commercial	Commercial	43	49	43	49	43	48	43	48	41	48	41	48
R0062	70	Commercial	Commercial	34	40	34	40	29	35	29	35	32	36	32	36
R0063	70	Commercial	Commercial	41	47	41	47	36	43	36	43	39	41	39	41
R0064	70	Commercial	Commercial	38	44	38	44	35	41	35	41	36	40	36	40
R0065	70	Commercial	Commercial	42	48	42	48	38	45	39	45	40	42	40	43
R0066	70	Commercial	Commercial	41	47	41	47	36	43	37	43	39	40	39	40
R0067	70	Commercial	Commercial	36	42	36	41	32	36	33	36	33	37	33	37
R0068	70	Commercial	Commercial	35	41	35	41	29	32	29	32	33	37	33	37
R0069	70	Commercial	Commercial	51	57	51	57	42	49	42	49	49	49	49	49
R0070	70	Commercial	Commercial	48	54	48	54	43	50	43	50	46	51	46	51
R0071	70	Commercial	Commercial	47	53	47	53	44	51	44	51	45	50	45	50
R0072	70	Commercial	Commercial	38	44	38	44	36	42	36	42	36	42	36	42
R0073	70	Commercial	Commercial	36	39	36	39	37	37	37	37	37	45	37	45
R0074	70	Commercial	Commercial	38	42	38	42	37	40	38	40	34	38	34	39
R0075	70	Commercial	Commercial	33	39	33	39	32	34	32	35	31	37	31	37
R0076	70	Commercial	Commercial	49	55	49	55	47	52	47	52	47	55	47	55
R0077	70	Commercial	Commercial	44	50	44	50	45	49	45	49	45	53	45	53
R0078	70	Commercial	Commercial	38	44	38	44	36	44	36	44	36	44	36	44
R0079	70	Commercial	Commercial	44	50	44	50	40	48	40	48	42	44	42	44
R0080	70	Commercial	Commercial	44	50	44	50	44	49	44	49	44	52	44	52
R0081	70	Commercial	Commercial	43	49	43	49	44	49	44	49	44	52	44	52
R0082	70	Commercial	Commercial	42	48	42	48	37	45	37	45	40	40	40	40
R0083	70	Commercial	Commercial	37	43	37	43	34	37	34	37	35	35	35	36
R0084	70	Commercial	Commercial	43	49	43	49	44	48	44	48	44	52	44	52
R0085	70	Commercial	Commercial	40	46	40	46	36	43	36	42	38	43	38	43
R0086	70	Commercial	Commercial	42	48	42	48	35	42	35	42	40	43	40	43
R0087	70	Commercial	Commercial	44	50	44	50	45	48	45	48	45	53	45	53
R0088	70	Commercial	Commercial	36	40	36	39	33	36	33	36	31	36	31	36
R0089	70	Commercial	Commercial	42	48	42	47	38	46	38	46	39	44	39	44
R0090	70	Commercial	Commercial	42	48	42	45	40	45	40	45	40	48	40	48
R0091	70	Commercial	Commercial	40	46	40	44	39	44	38	44	38	46	38	46
R0092	70	Commercial	Commercial	40	46	40	44	40	44	41	44	37	45	40	48
R0093	70	Commercial	Commercial	38	41	38	38	39	39	39	39	39	47	39	47
R0094	70	Commercial	Commercial	38	42	38	40	39	41	39	41	39	47	39	47
R0095	70	Commercial	Commercial	42	48	42	46	41	45	41	46	39	47	39	47
R0096	70	Commercial	Commercial	38	44	38	44	36	42	36	42	36	43	36	43
R0097	70	Commercial	Commercial	35	40	35	40	35	39	35	38	32	39	32	39
R0098	70	Commercial	Commercial	41	47	41	44	41	44	41	44	41	49	41	49
R0099	70	Commercial	Commercial	43	49	43	49	38	43	38	43	41	44	41	44
R0100	70	Commercial	Commercial	47	53	47	53	43	50	43	50	45	48	45	50
R0101	70	Commercial	Commercial	46	52	46	52	42	48	42	48	44	47	44	48
R0102	70	Commercial	Commercial	45	51	45	51	42	48	42	48	43	48	43	49
R0103	70	Commercial	Commercial	46	52	46	52	45	48	45	48	45	53	45	53
R0104	55	Educational institute	Educational institute	47	52	47	52	48	52	48	52	48	56	48	56
R0105	55	Educational institute	Educational institute	65	65	65	65	66	66	66	66	66	74	66	74
R0106	55	Educational institute	Educational institute	71	71	71	71	72	72	72	72	72	80	72	80
R0107	55	Educational institute	Educational institute	63	63	63	63	64	64	64	64	64	72	64	72
R0108	70	Commercial	Commercial	44	48	44	48	44	48	45	48	45	53	45	53
R0109	55	Educational institute	Educational institute	63	63	63	63	64	64	64	64	64	72	64	72
R0110	55	Educational institute	Educational institute	63	63	63	63	64	64	64	64	64	72	64	72
R0111	70	Commercial	Commercial	48	52	47	52	49	51	48	51	49	57	48	56
R0112	55	Educational institute	Educational institute	59	59	59	59	60	60	60	60	60	68	60	68
R0113	55	Medical facility	Medical facility	44	50	44	50	43	43	43	43	43	51	43	51
R0114	55	Medical facility	Medical facility	46	52	46	52	44	48	44	48	44	52	44	52
R0115	55	Medical facility	Medical facility	44	50	44	50	42	45	42	45	42	50	42	50
R0116	55	Medical facility	Medical facility	50	56	50	56	49	55	49	55	48	56	48	56
R0117	55	Medical facility	Medical facility	49	55	50	55	50	53	51	53	49	57	49	57
R0118	55	Medical facility	Medical facility	49	55	49	54	47	52	47	52	47	55	47	55
R0119	55	Medical facility	Medical facility	44	50	44	50	44	44	44	44	44	52	44	52
R0120	70	Commercial	Commercial	37	43	37	43	37	37	37	37	37	45	37	45
R0121	75	Industrial	Industrial	67	73	67	74	59	66	59	66	66	67	66	67
R0122	70	Commercial	Commercial	40	46	40	43	37	42	37	42	37	45	37	45
R0123	70	Commercial	Commercial	40	46	40	43	34	39	34	39	35	42	35	42
R0124	70	Commercial	Commercial	39	41	40	41	40	44	41	44	36	42	36	42
R0125	70	Commercial	Commercial	37	42	37	42	38	39	38	39	35	43	35	43
R0126	70	Commercial	Commercial	38	44	38	44	35	41	35	41	36	43	36	43
R0127	70	Commercial	Commercial	33	37	33	37	34	37	34	37	34	42	34	42
R0128	70	Commercial	Commercial	34	38	34	40	35	38	35	38	35	43	35	43
R0129	70	Commercial	Commercial	32	33	32	33	33	33	33	33	33	41	33	41
R0130	70	Commercial	Commercial	38	38	39	39	36	40	40	40	33	41	33	41
R0131	70	Commercial	Commercial	34	40	34	40	35	40	35	40	32	39	32	39
R0132	70	Commercial	Commercial	42	48	42	48	34	41	37	41	40	40	40	40
R0133	75	Industrial	Industrial	52	58	52	58	41	49	44	52	50	50	50	50
R0134	70	Commercial	Commercial	40	46	40	46	33	38	33	38	38	39	38	39
R0135	70	Commercial	Commercial	37	43	37	43	35	40	35	40	35	39	35	39

Predicted construction noise levels (ICNG): Standard construction hours

Receiver ID	Noise Management Level (NML)	Receiver Type	NCA	CS1A	CS1B	CS1C	CS1D	CS2A	CS2B	CS2C	CS2D	CS3A	CS3B	CS3C	CS3D
Residential: Exceeds noise management level **Bold** Highly noise affected															
Non-residential: Exceeds noise management level															
R0136	70	Commercial	Commercial	38	44	38	44	35	39	35	39	36	38	36	39
R0137	75	Industrial	Industrial	48	54	47	53	34	34	34	34	46	46	45	45
R0138	75	Industrial	Industrial	50	56	50	56	34	34	34	34	48	48	48	48
R0139	75	Industrial	Industrial	51	57	51	57	35	39	35	41	49	49	49	49
R0140	75	Industrial	Industrial	42	48	42	48	24	30	24	31	40	40	40	40
R0141	75	Industrial	Industrial	50	56	50	56	34	35	34	37	48	48	48	48
R0142	75	Industrial	Industrial	49	55	49	55	42	45	43	51	47	47	47	47
R0143	75	Industrial	Industrial	44	50	45	51	33	33	33	33	42	42	43	43
R0144	75	Industrial	Industrial	40	46	40	46	30	30	30	30	38	38	38	38
R0145	75	Industrial	Industrial	41	47	41	47	32	32	31	31	39	40	39	39
R0146	55	Educational institute	Educational institute	64	64	64	64	65	65	65	65	65	73	65	73
R0147	55	Place of worship	Place of worship	51	53	51	53	52	53	52	52	52	60	52	60
R0148	35	Residential	NCA01	37	43	37	39	32	32	32	32	32	40	32	40
R0149	35	Residential	NCA01	37	43	37	40	32	32	32	32	32	40	32	40
R0150	35	Residential	NCA01	35	41	35	38	32	32	32	32	32	40	32	40
R0151	35	Residential	NCA01	31	37	31	34	30	30	30	30	30	38	30	38
R0152	35	Residential	NCA01	33	39	33	36	31	31	31	31	31	39	31	39
R0153	35	Residential	NCA01	35	41	35	37	30	31	30	31	30	38	30	38
R0154	35	Residential	NCA01	29	35	29	32	26	27	26	28	26	34	26	34
R0155	35	Residential	NCA01	35	41	35	37	32	32	32	32	32	40	32	40
R0156	35	Residential	NCA01	36	42	36	38	34	34	34	34	34	42	34	42
R0157	35	Residential	NCA01	36	42	36	39	34	34	34	34	34	42	34	42
R0158	35	Residential	NCA01	37	43	37	40	32	32	32	32	32	40	32	40
R0159	35	Residential	NCA01	37	43	37	39	31	32	31	32	31	39	31	39
R0160	35	Residential	NCA01	35	41	35	37	31	31	31	31	31	39	31	39
R0161	35	Residential	NCA01	38	44	38	40	29	35	29	35	32	37	32	37
R0162	35	Residential	NCA01	32	36	32	30	30	30	30	30	30	38	30	38
R0163	35	Residential	NCA01	37	43	37	39	34	34	34	34	34	42	34	42
R0164	35	Residential	NCA01	37	38	37	37	38	38	38	38	38	46	38	46
R0165	35	Residential	NCA01	37	37	37	35	36	36	36	36	36	44	36	44
R0166	35	Residential	NCA01	34	39	34	37	31	31	31	32	31	39	31	39
R0167	35	Residential	NCA01	34	40	34	36	30	31	30	31	30	38	30	38
R0168	35	Residential	NCA01	37	37	37	37	38	38	38	38	38	46	38	46
R0169	35	Residential	NCA01	33	39	33	36	28	31	28	31	28	34	28	34
R0170	35	Residential	NCA01	33	39	33	36	32	32	32	32	32	40	32	40
R0171	35	Residential	NCA01	36	42	36	38	35	35	35	35	35	43	35	43
R0172	35	Residential	NCA01	37	38	37	37	36	36	36	36	36	44	36	44
R0173	35	Residential	NCA01	31	37	31	35	25	29	25	30	27	32	27	32
R0174	35	Residential	NCA01	31	37	32	34	26	30	26	30	24	31	26	31
R0175	35	Residential	NCA01	30	36	30	33	28	29	28	30	28	36	28	36
R0176	35	Residential	NCA01	40	44	40	41	41	41	41	41	41	49	41	49
R0177	35	Residential	NCA01	27	33	27	32	27	29	27	29	27	35	27	35
R0178	35	Residential	NCA01	37	37	37	33	34	34	34	34	34	42	34	42
R0179	35	Residential	NCA01	33	35	33	29	30	30	30	30	30	38	30	38
R0180	35	Residential	NCA01	37	37	37	33	34	34	34	34	34	42	34	42
R0181	35	Residential	NCA01	37	43	37	39	34	35	34	35	34	42	34	42
R0182	35	Residential	NCA01	32	38	32	34	29	32	29	32	29	37	29	37
R0183	35	Residential	NCA01	36	42	36	39	34	34	34	34	34	42	34	42
R0184	35	Residential	NCA01	39	40	39	38	38	38	38	38	38	46	38	46
R0185	35	Residential	NCA01	38	40	38	39	40	40	40	40	40	48	40	48
R0186	35	Residential	NCA01	32	38	32	34	26	32	26	32	26	34	26	34
R0187	35	Residential	NCA01	34	40	34	37	27	34	27	34	29	34	29	34
R0188	35	Residential	NCA01	36	42	36	39	34	35	34	35	34	42	34	42
R0189	35	Residential	NCA01	32	38	32	35	30	31	30	31	30	38	30	38
R0190	35	Residential	NCA01	34	38	34	35	31	33	31	33	31	39	31	39
R0191	35	Residential	NCA01	38	38	38	35	36	36	36	36	36	44	36	44
R0192	35	Residential	NCA01	38	38	38	38	39	39	39	39	39	47	39	47
R0193	35	Residential	NCA01	33	39	33	36	30	33	30	33	30	38	30	38
R0194	35	Residential	NCA01	33	39	33	36	30	32	30	32	30	38	30	38
R0195	35	Residential	NCA01	38	44	38	42	39	39	39	39	39	47	39	47
R0196	35	Residential	NCA01	32	38	32	34	29	32	29	32	29	37	29	37
R0197	35	Residential	NCA01	34	38	34	35	31	33	31	33	31	39	31	39
R0198	35	Residential	NCA01	37	43	37	39	32	35	32	35	32	40	32	40
R0199	35	Residential	NCA01	33	38	33	35	30	32	30	32	30	38	30	38
R0200	35	Residential	NCA01	39	45	39	41	36	37	35	37	35	43	35	43
R0201	35	Residential	NCA01	41	47	41	44	42	42	42	42	42	50	42	50
R0202	35	Residential	NCA01	41	47	41	43	42	42	42	42	42	50	42	50
R0203	35	Residential	NCA01	33	39	33	38	28	33	28	33	30	36	30	36
R0204	35	Residential	NCA01	41	44	41	41	42	42	42	42	42	50	42	50
R0205	35	Residential	NCA01	31	36	31	36	29	32	29	32	29	37	29	37
R0206	35	Residential	NCA01	34	40	34	40	33	34	33	34	33	41	33	41
R0207	35	Residential	NCA01	33	39	33	39	29	34	29	34	31	37	31	37
R0208	35	Residential	NCA01	41	41	41	41	42	42	42	42	42	50	42	50
R0209	35	Residential	NCA01	33	39	33	37	28	33	28	33	29	35	29	35
R0210	35	Residential	NCA01	35	41	35	40	30	36	30	36	32	38	32	38
R0211	35	Residential	NCA01	33	39	33	37	29	32	29	32	29	37	29	37
R0212	35	Residential	NCA01	33	38	33	38	32	33	32	33	32	40	32	40
R0213	35	Residential	NCA01	39	44	39	41	40	40	40	40	40	48	40	48
R0214	35	Residential	NCA01	34	35	34	35	33	33	33	33	33	41	33	41
R0215	35	Residential	NCA01	32	37	32	37	30	33	30	33	30	38	30	38
R0216	35	Residential	NCA01	39	43	39	39	39	40	40	40	40	48	40	48
R0217	35	Residential	NCA01	31	37	31	37	29	32	29	32	29	37	29	37
R0218	35	Residential	NCA01	41	41	41	40	42	41	41	41	41	49	41	49
R0219	35	Residential	NCA01	31	37	31	37	28	33	28	33	29	36	29	36
R0220	35	Residential	NCA01	34	38	34	37	32	34	32	34	32	40	32	40
R0221	35	Residential	NCA01	31	36	31	36	31	32	30	32	30	38	30	38
R0222	35	Residential	NCA01	36	42	36	42	29	36	29	36	34	37	34	37
R0223	35	Residential	NCA01	37	43	37	40	38	39	38	39	38	46	38	46
R0224	35	Residential	NCA01	31	37	31	36	28	32	29	32	28	36	28	36
R0225	35	Residential	NCA01	40	45	40	42	41	41	41	41	41	49	41	49
R0226	35	Residential	NCA01	33	39	33	39	31	34	31	34	31	39	31	39
R0227	35	Residential	NCA01	36	36	36	36	37	37	37	37	37	45	37	45
R0228	35	Residential	NCA01	41	44	41	43	42	42	42	42	42	50	42	50
R0229	35	Residential	NCA01	43	48	43	48	44	44	44	44	44	52	44	52
R0230	35	Residential	NCA01	34	40	34	40	34	34	34	34	34	42	34	42
R0231	35	Residential	NCA01	44	48	44	44	45	45	45	45	45	53	45	53
R0232	35	Residential	NCA01	35	41	35	41	32	36	32	36	33	40	33	40
R0233	35	Residential	NCA01	40	42	40	42	41	41	41	41	41	49	41	49
R0234	35	Residential	NCA01	41	41	41	41	42	42	42	42	42	50	42	50
R0235	35	Residential	NCA01	32	37	32	37	30	32	30	32	30	38	30	38
R0236	35	Residential	NCA01	33	39	34	39	31	35	31	35	31	39	31	39
R0237	35	Residential	NCA01	38	44	38	44	31	37	30	37	36	38	36	38
R0238	35	Residential	NCA01	31	37	31	35	31	33	31	33	31	39	31	39
R0239	35	Residential	NCA01	28	34	28	34	29	32	29	32	29	37	29	37
R0240	35	Residential	NCA01	29	35	29	35	30	32	30	32	30	38	30	38
R0241	35	Residential	NCA01	30	35	30	35	31	31	29	32	29	37	29	37
R0242	35	Residential	NCA01	31	37	31	35	29	32	29	32	29	37	29	37
R0243	35	Residential	NCA01	32	38	32	38	30	34	30	34	30	38	30	38
R0244	35	Residential	NCA01	40	40	40	40	41	41	41	41	41	49	41	49
R0245	35	Residential	NCA01	31	37	35	37	32	34	32	34	29	35	29	35
R0246	35	Residential	NCA01	35	41	35	41	33	35	33	35	33	41	33	41
R0247	35	Residential	NCA01	44	47	44	47	45	45	45	45	45	53	45	53
R0248	35	Residential	NCA01	44	47	44	47	45	45	45	45	45	53	45	53
R0249	35	Residential	NCA01	39	39	39	39	40	40	40	40	40	48	40	48
R0250	35	Residential	NCA01	35	41	35	41	30	35	30	35	33	38	33	38
R0251	35	Residential	NCA01	32	37	35	37	33	33	33	33	33	41	33	41
R0252	35	Residential	NCA01	45	48	45	48	46	46	46	46	46	54	46	54
R0253	35	Residential	NCA01	41	41	41	41	42	42	42	42	42	50	42	50
R0254	35	Residential	NCA01	31	37	31	37	29	33	29	33	29	36	29	36
R0255	35	Residential	NCA01	45	48	45	48	46	46	46	46	46	54	46	54
R0256	35	Residential	NCA01	43	45	43	45	44	44	44	44	44	52	44	52
R0257	35	Residential	NCA01	32	38	32	38	32	33	32	33	32	40	32	40
R0258	35	Residential	NCA01	42	48	42	48	43	45	43	45	43	51	43	51
R0259	35	Residential	NCA01	30	32	30	32	31	32	31	32	31	39	31	39
R0260	35	Residential	NCA01	34	40	34	40	32	35	33	35	33	41	33	41
R0261	35	Residential	NCA01	46	48	46	48	47	47	47	47	47	55	47	55
R0262	35	Residential	NCA01	33	39	33	39	33	34	33	34	33	41	33	41
R0263	35	Residential	NCA01	29	34	29	34	30	32	30	32	30	38	30	38
R0264	35	Residential	NCA01	35	38	35	38	36	36	36	36	36	44	36	44
R0265	35	Residential	NCA01	29	35	29	35	29	33	29	33	28	36	28	36
R0266	35	Residential	NCA01	44	46	44	46	45	45	45	45	45	53	45	53
R0267	35	Residential	NCA01	42	48	42	48	43	43	43	43	43	51	43	51
R0268	35	Residential	NCA01	30	36	30	36	29	33	29	33	29	37	29	37
R0269	35	Residential	NCA01	33	39	33	39	34	35	34	35	34	42	34	42
R0270	35	Residential	NCA01	42	42	42	42	43	43	43	43	43	51	43	51

Predicted construction noise levels (ICNG): Standard construction hours

Receiver ID	Noise Management Level (NML)	Receiver Type	NCA	CS1A	CS1B	CS1C	CS1D	CS2A	CS2B	CS2C	CS2D	CS3A	CS3B	CS3C	CS3D
Residential: Exceeds noise management level **Bold** Highly noise affected															
Non-residential: Exceeds noise management level															
R0271	35	Residential	NCA01	42	48	42	48	43	43	43	43	43	51	43	51
R0272	35	Residential	NCA01	35	41	35	41	32	36	32	36	33	40	33	40
R0273	35	Residential	NCA01	40	40	40	40	41	41	41	41	41	49	41	49
R0274	35	Residential	NCA01	49	49	49	49	50	50	50	50	50	58	50	58
R0275	35	Residential	NCA01	41	47	41	47	42	42	42	42	42	50	42	50
R0276	35	Residential	NCA01	44	50	44	50	36	44	36	44	42	42	42	42
R0277	35	Residential	NCA01	48	48	48	48	49	49	49	49	49	57	49	57
R0278	35	Residential	NCA01	47	47	47	47	48	48	48	48	48	56	48	56
R0279	35	Residential	NCA01	48	48	48	48	49	49	49	49	49	57	49	57
R0280	35	Residential	NCA01	44	50	44	50	36	42	36	42	42	44	42	44
R0281	35	Residential	NCA01	45	51	45	51	40	48	40	48	43	47	43	47
R0282	35	Residential	NCA01	46	47	46	47	47	47	47	47	47	55	47	55
R0283	35	Residential	NCA01	45	45	45	45	46	46	46	46	46	54	46	54
R0284	35	Residential	NCA01	43	49	43	49	38	44	38	44	41	46	41	46
R0285	35	Residential	NCA01	46	48	46	48	47	47	47	47	47	55	47	55
R0286	35	Residential	NCA01	46	52	46	52	41	48	41	48	44	49	44	49
R0287	35	Residential	NCA01	45	51	45	51	38	43	38	43	43	46	43	46
R0288	35	Residential	NCA01	47	47	47	47	48	48	48	48	48	56	48	56
R0289	35	Residential	NCA01	46	52	46	52	45	48	45	48	45	53	45	53
R0290	35	Residential	NCA01	46	51	46	51	47	48	47	48	47	55	47	55
R0291	35	Residential	NCA01	45	51	45	51	39	47	39	47	43	47	43	47
R0292	35	Residential	NCA01	46	52	46	52	43	49	43	49	44	51	44	51
R0293	35	Residential	NCA01	50	50	50	50	51	51	51	51	51	59	51	59
R0294	35	Residential	NCA01	44	50	44	50	40	41	40	42	42	48	42	48
R0295	35	Residential	NCA01	50	51	50	51	51	51	51	51	51	59	51	59
R0296	35	Residential	NCA01	48	54	48	54	44	51	44	51	46	52	46	52
R0297	35	Residential	NCA01	52	52	52	52	53	53	53	53	53	61	53	61
R0298	35	Residential	NCA01	39	45	39	45	35	40	35	40	37	42	37	42
R0299	35	Residential	NCA01	51	51	51	51	52	52	52	52	52	60	52	60
R0300	35	Residential	NCA01	52	58	52	58	48	55	48	55	50	56	50	56
R0301	35	Residential	NCA01	53	56	53	56	54	54	54	54	54	62	54	62
R0302	35	Residential	NCA01	53	55	53	55	54	54	54	54	54	62	54	62
R0303	35	Residential	NCA01	52	58	52	58	50	54	50	54	50	53	50	53
R0304	35	Residential	NCA01	45	51	45	51	43	43	43	43	43	51	43	51
R0305	35	Residential	NCA01	53	58	53	58	53	59	53	59	53	61	53	61
R0306	35	Residential	NCA01	56	60	56	61	57	59	57	60	53	61	53	61
R0307	35	Residential	NCA01	51	57	51	57	52	54	52	54	49	55	49	55
R0308	35	Residential	NCA01	50	55	49	55	51	53	50	53	47	55	47	55
R0309	35	Residential	NCA01	58	61	58	61	59	61	59	62	53	60	54	60
R0310	35	Residential	NCA01	39	45	39	45	40	42	40	42	40	48	40	48
R0311	35	Residential	NCA01	59	60	59	60	60	60	60	61	53	61	53	61
R0312	35	Residential	NCA01	56	60	56	60	57	60	57	60	52	57	52	57
R0313	35	Residential	NCA01	41	46	41	46	42	42	42	42	42	50	42	50
R0314	35	Residential	NCA01	53	56	53	56	54	56	54	56	54	62	54	62
R0315	35	Residential	NCA01	38	42	38	42	39	39	39	39	34	40	34	40
R0316	35	Residential	NCA01	56	59	57	59	57	59	58	59	51	58	51	58
R0317	35	Residential	NCA01	54	57	54	57	55	60	55	60	55	63	55	63
R0318	35	Residential	NCA01	61	61	61	62	62	62	62	62	56	64	56	64
R0319	35	Residential	NCA01	38	42	38	42	39	39	39	39	39	47	39	47
R0320	35	Residential	NCA01	54	56	54	57	55	56	55	56	48	56	49	56
R0321	35	Residential	NCA01	56	58	56	58	57	61	57	61	56	64	56	64
R0322	35	Residential	NCA01	59	61	59	62	60	61	60	62	53	61	54	61
R0323	35	Residential	NCA01	39	42	39	42	40	40	40	40	38	46	38	46
R0324	35	Residential	NCA01	50	56	50	56	51	54	51	54	48	53	48	53
R0325	35	Residential	NCA01	41	41	41	41	42	42	42	42	42	50	42	50
R0326	35	Residential	NCA01	59	61	58	62	60	60	59	62	53	57	54	57
R0327	35	Residential	NCA01	56	59	56	59	57	59	57	59	57	65	57	65
R0328	35	Residential	NCA01	48	54	48	54	45	49	45	49	46	52	46	52
R0329	35	Residential	NCA01	50	56	50	56	50	54	50	54	48	54	48	54
R0330	35	Residential	NCA01	34	37	34	36	35	36	35	35	35	43	35	43
R0331	35	Residential	NCA01	41	42	41	42	42	42	42	42	42	50	42	50
R0332	35	Residential	NCA01	41	47	41	47	40	40	40	40	40	48	40	48
R0333	35	Residential	NCA01	58	60	58	60	59	61	59	62	57	65	57	65
R0334	35	Residential	NCA01	49	54	49	54	50	52	50	52	46	52	46	52
R0335	35	Residential	NCA01	49	55	49	55	46	53	46	53	47	53	47	53
R0336	35	Residential	NCA01	39	43	39	43	40	41	40	41	40	48	40	48
R0337	35	Residential	NCA01	39	43	39	43	40	40	40	40	40	48	40	48
R0338	35	Residential	NCA01	30	36	30	36	30	35	30	35	28	34	28	34
R0339	35	Residential	NCA01	43	44	43	44	44	46	44	46	44	52	44	52
R0340	35	Residential	NCA01	56	60	56	60	57	57	57	57	52	57	52	57
R0341	35	Residential	NCA01	48	54	48	54	47	50	47	50	46	53	46	53
R0342	35	Residential	NCA01	54	56	54	56	55	56	55	56	49	57	49	57
R0343	35	Residential	NCA01	37	39	37	39	37	37	37	37	37	45	37	45
R0344	35	Residential	NCA01	47	52	47	52	48	51	48	51	44	52	44	52
R0345	35	Residential	NCA01	34	40	34	40	31	35	31	36	32	36	32	36
R0346	35	Residential	NCA01	46	52	46	52	44	46	44	46	44	52	44	52
R0347	35	Residential	NCA01	65	65	65	65	66	66	66	66	55	59	55	59
R0348	35	Residential	NCA01	34	40	34	40	35	36	35	36	35	43	35	43
R0349	35	Residential	NCA01	53	56	53	56	54	55	54	55	48	56	48	56
R0350	35	Residential	NCA01	64	64	64	64	65	65	65	65	55	59	56	59
R0351	35	Residential	NCA01	61	61	61	61	62	62	62	62	59	67	59	67
R0352	35	Residential	NCA01	46	52	46	52	43	47	43	47	44	51	44	51
R0353	35	Residential	NCA01	38	44	38	44	38	39	38	39	38	46	38	46
R0354	35	Residential	NCA01	63	64	63	64	64	64	64	64	56	59	56	59
R0355	35	Residential	NCA01	50	56	50	56	50	54	50	54	49	57	49	57
R0356	35	Residential	NCA01	42	48	42	48	42	44	42	44	42	50	42	50
R0357	35	Residential	NCA01	62	63	62	62	63	63	63	63	55	58	54	58
R0358	35	Residential	NCA01	51	57	51	57	48	55	48	55	49	56	49	56
R0359	35	Residential	NCA01	60	64	60	60	61	64	61	61	56	59	53	59
R0360	35	Residential	NCA01	48	54	48	54	48	53	49	53	48	56	48	56
R0361	35	Residential	NCA01	40	46	40	46	36	38	36	38	38	44	38	44
R0362	35	Residential	NCA01	58	62	58	62	59	61	59	61	54	56	54	56
R0363	35	Residential	NCA01	63	66	63	66	64	67	64	66	59	59	58	59
R0364	35	Residential	NCA01	45	51	45	51	45	45	45	45	43	50	43	50
R0365	35	Residential	NCA01	62	62	62	62	63	63	63	63	63	71	63	71
R0366	35	Residential	NCA01	62	67	62	67	63	67	63	66	59	59	59	59
R0367	35	Residential	NCA01	58	61	58	61	59	62	59	62	54	59	54	59
R0368	35	Residential	NCA01	55	61	55	61	49	57	49	57	53	55	53	55
R0369	39	Residential	NCA02	64	64	64	64	65	65	65	65	65	73	65	73
R0370	35	Residential	NCA01	52	58	52	58	50	54	50	54	50	55	50	55
R0371	35	Residential	NCA01	59	62	58	62	60	61	59	61	54	58	54	58
R0372	35	Residential	NCA01	51	57	51	57	52	55	52	55	49	56	49	56
R0373	35	Residential	NCA01	51	57	51	57	43	43	43	43	49	50	49	50
R0374	35	Residential	NCA01	59	62	58	62	60	62	59	62	54	58	54	58
R0375	35	Residential	NCA01	52	58	52	58	46	52	46	52	50	54	50	54
R0376	35	Residential	NCA01	54	60	54	60	47	55	47	55	52	55	52	55
R0377	35	Residential	NCA01	58	63	57	63	57	64	57	63	56	59	55	59
R0378	35	Residential	NCA01	58	64	58	64	53	61	53	61	56	58	56	58
R0379	35	Residential	NCA01	51	57	51	57	41	44	41	44	49	49	49	49
R0380	35	Residential	NCA01	62	68	62	68	60	66	60	67	60	60	60	60
R0381	35	Residential	NCA01	60	66	60	66	58	64	58	66	58	59	58	59
R0382	35	Residential	NCA01	52	58	52	58	43	46	43	46	50	51	50	51
R0383	35	Residential	NCA01	61	67	61	67	56	64	58	66	59	59	59	59
R0384	35	Residential	NCA01	58	64	58	64	53	61	53	61	56	56	56	56
R0385	35	Residential	NCA01	60	66	60	66	57	65	58	66	58	60	58	60
R0386	35	Residential	NCA01	58	64	59	65	56	64	57	65	56	58	57	58
R0387	35	Residential	NCA01	57	63	57	63	49	57	49	57	55	55	55	55
R0388	35	Residential	NCA01	59	65	59	65	55	63	55	63	57	57	57	57
R0389	35	Residential	NCA01	66	66	66	66	67	67	67	67	55	59	54	59
R0390	35	Residential	NCA01	66	66	66	66	67	67	67	67	55	59	54	59
R0391	35	Residential	NCA01	67	67	67	67	68	68	68	68	54	60	54	60
R0392	35	Residential	NCA01	66	66	66	66	67	67	67	67	54	60	55	60
R0393	35	Residential	NCA01	65	65	65	65	66	66	66	66	55	60	56	60
R0394	35	Residential	NCA01	64	64	64	64	65	65	65	65	54	60	56	60
R0395	35	Residential	NCA01	64	64	64	64	65	65	65	65	55	60	56	60
R0396	35	Residential	NCA01	62	63	62	64	63	63	63	65	55	62	57	62
R0397	35	Residential	NCA01	62	62	62	63	63	63	63	63	54	62	55	62
R0398	35	Residential	NCA01	60	61	60	62	61	61	61	61	53	60	54	60
R0399	35	Residential	NCA01	62	62	62	63	63	63	63	63	54	62	55	62
R0400	35	Residential	NCA01	59	65	59	65	60	65	60	65	57	59	57	59
R0401	35	Residential	NCA01	60	62	60	62	61	62	61	64	56	64	56	64
R0402	35	Residential	NCA01	62	62	62	62	63	63	63	64	56	64	56	64
R0403	35	Residential	NCA01	65	65	65	65	66	66	66	66	60	68	60	68
R0404	35	Residential	NCA01	66	66	66	66	67	67	67	67	61	69	61	69
R0405	35	Residential	NCA01	65	65	65	65	66	66	66	66	62	70	62	70

Predicted construction noise levels (ICNG): Standard construction hours

Receiver ID	Noise Management Level (NML)	Receiver Type	NCA	CS1A	CS1B	CS1C	CS1D	CS2A	CS2B	CS2C	CS2D	CS3A	CS3B	CS3C	CS3D
Residential: Exceeds noise management level **Bold** Highly noise affected															
Non-residential: Exceeds noise management level															
R0406	35	Residential	NCA01	63	63	63	63	64	64	64	64	64	72	64	72
R0407	35	Residential	NCA01	63	63	63	63	64	64	64	64	64	72	64	72
R0408	35	Residential	NCA01	63	63	63	63	64	64	64	64	64	72	64	72
R0409	39	Residential	NCA02	65	65	65	65	66	66	66	66	66	74	66	74
R0410	35	Residential	NCA01	55	57	55	57	56	59	56	59	56	64	56	64
R0411	35	Residential	NCA01	54	57	54	57	55	58	55	58	55	63	55	63
R0412	35	Residential	NCA01	53	53	53	53	54	54	54	54	54	62	54	62
R0413	35	Residential	NCA01	53	55	53	55	54	54	54	54	54	62	54	62
R0414	55	Medical facility	Medical facility	37	43	37	43	37	37	37	37	37	45	37	45
R0415	35	Residential	NCA01	31	37	32	37	29	33	29	33	29	33	29	33
R0416	35	Residential	NCA01	32	38	32	34	29	31	29	31	29	37	29	37
R0417	35	Residential	NCA01	30	36	30	31	26	29	26	30	26	34	26	34
R0418	35	Residential	NCA01	32	37	32	29	30	30	30	30	30	38	30	38
R0419	35	Residential	NCA01	30	36	30	27	24	28	24	27	22	30	22	30
R0420	35	Residential	NCA01	32	38	32	27	23	26	23	27	23	31	23	31
R0421	35	Residential	NCA01	38	44	38	40	36	36	36	36	36	44	36	44
R0422	35	Residential	NCA01	43	48	44	48	44	49	45	49	43	51	43	51
R0423	35	Residential	NCA01	60	66	60	66	56	64	57	65	58	58	58	58
R0424	35	Residential	NCA01	33	39	33	36	31	31	31	31	31	39	31	39
R0425	35	Residential	NCA01	36	42	36	39	32	32	32	32	32	40	32	40
R0426	35	Residential	NCA01	34	40	34	37	32	32	32	32	32	40	32	40
R0427	35	Residential	NCA01	34	40	34	37	30	30	29	30	29	37	29	37
R0428	35	Residential	NCA01	38	44	38	40	37	37	37	37	37	45	37	45
R0429	35	Residential	NCA01	37	37	37	33	34	34	34	34	34	42	34	42
R0430	35	Residential	NCA01	39	45	39	42	39	39	39	39	39	47	39	47
R0431	35	Residential	NCA01	36	42	36	39	36	36	36	36	36	44	36	44
R0432	39	Residential	NCA02	35	41	35	37	35	35	35	35	35	43	35	43
R0433	39	Residential	NCA02	40	46	40	44	34	40	34	40	36	42	36	42
R0434	39	Residential	NCA02	35	37	35	33	32	32	32	32	32	40	32	40
R0435	39	Residential	NCA02	37	43	37	39	35	35	35	35	35	43	35	43
R0436	39	Residential	NCA02	36	42	36	41	34	34	34	34	34	42	34	42
R0437	39	Residential	NCA02	40	46	40	44	34	35	34	35	36	42	36	42
R0438	39	Residential	NCA02	38	44	38	41	31	39	31	39	33	39	33	39
R0439	39	Residential	NCA02	39	45	39	41	31	34	31	34	33	39	33	39
R0440	39	Residential	NCA02	37	40	37	40	38	38	38	38	38	46	38	46
R0441	39	Residential	NCA02	36	38	36	35	35	35	35	35	35	43	35	43
R0442	39	Residential	NCA02	37	37	37	34	35	35	35	35	35	43	35	43
R0443	39	Residential	NCA02	39	45	39	41	32	39	32	39	33	40	33	40
R0444	39	Residential	NCA02	38	44	38	41	31	39	31	39	33	38	33	39
R0445	39	Residential	NCA02	34	39	34	34	34	34	34	34	34	42	34	42
R0446	39	Residential	NCA02	38	44	38	40	31	33	31	33	32	39	32	39
R0447	39	Residential	NCA02	37	43	37	39	34	34	34	34	34	42	34	42
R0448	39	Residential	NCA02	38	44	38	40	33	34	33	34	33	41	33	41
R0449	39	Residential	NCA02	37	38	37	35	36	36	36	36	36	44	36	44
R0450	39	Residential	NCA02	37	42	37	38	34	34	34	34	34	42	34	42
R0451	39	Residential	NCA02	36	42	36	38	31	34	30	34	30	38	30	38
R0452	39	Residential	NCA02	40	46	40	43	34	36	34	36	35	42	35	42
R0453	39	Residential	NCA02	38	44	38	41	33	37	33	37	33	41	33	41
R0454	39	Residential	NCA02	37	43	37	39	25	32	25	32	31	33	31	33
R0455	39	Residential	NCA02	36	42	36	39	34	34	34	34	34	42	34	42
R0456	39	Residential	NCA02	39	45	39	42	40	40	40	40	40	48	40	48
R0457	39	Residential	NCA02	35	41	35	39	27	35	27	35	31	31	31	31
R0458	39	Residential	NCA02	37	43	37	36	27	29	27	29	28	35	28	35
R0459	39	Residential	NCA02	39	45	39	39	39	39	39	39	39	47	39	47
R0460	39	Residential	NCA02	40	46	40	42	37	37	37	37	37	45	37	45
R0461	39	Residential	NCA02	40	46	40	42	38	39	38	39	38	46	38	46
R0462	39	Residential	NCA02	38	44	38	40	27	33	27	33	32	35	32	35
R0463	39	Residential	NCA02	39	45	39	42	36	36	36	36	36	44	36	44
R0464	39	Residential	NCA02	40	45	40	42	35	36	36	36	36	44	36	44
R0465	39	Residential	NCA02	40	46	40	43	34	39	34	39	35	42	35	42
R0466	39	Residential	NCA02	39	45	39	42	33	41	34	41	34	39	34	39
R0467	39	Residential	NCA02	40	46	40	42	40	40	41	41	40	48	41	49
R0468	39	Residential	NCA02	41	47	40	43	38	38	38	38	38	46	38	46
R0469	39	Residential	NCA02	39	45	39	42	35	37	35	38	35	43	35	43
R0470	39	Residential	NCA02	42	48	42	45	40	41	41	41	41	49	41	49
R0471	39	Residential	NCA02	36	42	36	41	33	33	33	33	33	41	33	41
R0472	39	Residential	NCA02	40	46	40	44	34	40	34	40	36	42	36	42
R0473	39	Residential	NCA02	40	46	40	43	40	41	40	41	40	48	40	48
R0474	39	Residential	NCA02	38	44	38	40	36	38	36	38	36	44	36	44
R0475	39	Residential	NCA02	40	46	40	42	37	40	37	40	37	45	37	45
R0476	39	Residential	NCA02	42	46	42	42	43	43	43	43	43	51	43	51
R0477	39	Residential	NCA02	40	46	40	44	35	41	35	41	36	43	36	43
R0478	39	Residential	NCA02	40	46	40	42	36	37	36	37	36	44	36	44
R0479	39	Residential	NCA02	41	47	41	43	40	41	40	41	40	48	40	48
R0480	39	Residential	NCA02	39	45	39	42	34	40	34	40	34	42	34	42
R0481	39	Residential	NCA02	42	46	42	45	43	43	43	43	43	51	43	51
R0482	39	Residential	NCA02	41	47	41	43	41	41	41	41	41	49	41	49
R0483	39	Residential	NCA02	38	43	38	42	38	38	38	38	38	46	38	46
R0484	39	Residential	NCA02	41	46	41	43	42	42	42	42	42	50	42	50
R0485	39	Residential	NCA02	42	47	42	44	42	44	43	44	43	51	43	51
R0486	39	Residential	NCA02	39	39	39	39	40	40	40	40	40	48	40	48
R0487	39	Residential	NCA02	42	48	42	44	41	44	41	44	41	49	41	49
R0488	39	Residential	NCA02	44	50	44	49	42	45	42	45	42	50	42	50
R0489	39	Residential	NCA02	41	47	41	43	40	42	40	43	40	48	40	48
R0490	39	Residential	NCA02	42	48	42	44	42	44	42	44	42	50	42	50
R0491	39	Residential	NCA02	47	48	47	47	48	48	48	48	48	56	48	56
R0492	39	Residential	NCA02	47	47	47	47	48	48	48	48	48	56	48	56
R0493	39	Residential	NCA02	43	48	43	48	44	46	44	46	44	52	44	52
R0494	39	Residential	NCA02	47	48	47	47	48	48	48	48	48	56	48	56
R0495	39	Residential	NCA02	45	48	45	45	46	48	46	48	46	54	46	54
R0496	39	Residential	NCA02	45	48	44	45	46	48	45	48	46	54	45	53
R0497	39	Residential	NCA02	44	49	44	45	45	48	45	48	45	53	45	53
R0498	39	Residential	NCA02	46	52	46	48	44	45	44	45	44	52	44	52
R0499	39	Residential	NCA02	43	49	43	44	42	44	41	44	41	49	41	49
R0500	39	Residential	NCA02	48	48	48	48	49	49	49	49	49	57	49	57
R0501	39	Residential	NCA02	45	48	45	48	46	47	46	47	46	54	46	54
R0502	39	Residential	NCA02	44	50	45	46	46	49	46	49	45	53	46	54
R0503	39	Residential	NCA02	46	49	46	48	47	49	47	49	47	55	47	55
R0504	39	Residential	NCA02	44	50	44	45	43	48	43	48	43	51	43	51
R0505	39	Residential	NCA02	44	49	44	49	45	49	45	49	45	53	45	53
R0506	39	Residential	NCA02	48	49	48	49	49	49	49	49	49	57	49	57
R0507	39	Residential	NCA02	48	49	48	49	49	49	49	49	49	57	49	57
R0508	39	Residential	NCA02	46	49	46	49	47	47	47	47	47	55	47	55
R0509	39	Residential	NCA02	43	49	43	46	41	44	41	44	41	49	41	49
R0510	39	Residential	NCA02	41	47	41	44	39	44	39	44	39	47	39	47
R0511	39	Residential	NCA02	39	45	39	41	36	37	36	37	35	43	35	43
R0512	39	Residential	NCA02	44	50	44	45	45	48	45	48	45	53	45	53
R0513	39	Residential	NCA02	34	39	34	36	32	33	32	33	32	40	32	40
R0514	39	Residential	NCA02	47	50	47	49	48	49	48	49	48	56	48	56
R0515	39	Residential	NCA02	49	49	49	49	50	50	50	50	50	58	50	58
R0516	39	Residential	NCA02	38	44	38	42	34	42	34	42	34	42	34	42
R0517	39	Residential	NCA02	40	46	40	43	37	38	37	38	37	45	37	45
R0518	39	Residential	NCA02	48	49	48	49	49	49	49	49	49	57	49	57
R0519	39	Residential	NCA02	46	52	46	52	42	49	42	49	44	50	44	50
R0520	39	Residential	NCA02	40	46	40	42	36	38	36	38	36	44	36	44
R0521	39	Residential	NCA02	41	47	41	45	40	44	40	44	40	48	40	48
R0522	39	Residential	NCA02	42	48	42	46	42	48	42	48	42	50	42	50
R0523	39	Residential	NCA02	46	52	46	52	44	49	44	49	44	52	44	52
R0524	39	Residential	NCA02	45	51	45	48	42	48	42	48	42	50	42	50
R0525	39	Residential	NCA02	31	37	31	34	26	32	26	32	26	34	26	34
R0526	39	Residential	NCA02	47	49	47	49	48	49	48	49	48	56	48	56
R0527	39	Residential	NCA02	40	46	40	44	38	44	38	44	38	46	38	46
R0528	39	Residential	NCA02	46	52	46	52	45	49	45	49	45	53	45	53
R0529	39	Residential	NCA02	49	49	49	49	50	50	50	50	50	58	50	58
R0530	39	Residential	NCA02	35	41	35	40	33	33	33	34	33	41	33	41
R0531	39	Residential	NCA02	40	46	40	43	32	38	32	38	35	40	35	40
R0532	39	Residential	NCA02	46	52	46	52	43	49	43	49	44	51	44	51
R0533	39	Residential	NCA02	40	46	40	42	32	40	32	40	34	38	34	38
R0534	39	Residential	NCA02	41	47	41	44	39	43	39	43	39	47	39	47
R0535	39	Residential	NCA02	38	44	38	41	29	36	30	36	33	37	33	38
R0536	39	Residential	NCA02	43	49	43	49	41	47	41	47	41	49	41	49
R0537	39	Residential	NCA02	37	40	37	38	38	38	38	38	38	46	38	46
R0538	39	Residential	NCA02	42	48	42	48	41	48	41	48	41	49	41	49
R0539	39	Residential	NCA02	46	50	46	50	47	47	47	47	47	55	47	55
R0540	39	Residential	NCA02	32	32	32	31	32	32	32	32	32	40	32	40

Predicted construction noise levels (ICNG): Standard construction hours

Receiver ID	Noise Management Level (NML)	Receiver Type	NCA	CS1A	CS1B	CS1C	CS1D	CS2A	CS2B	CS2C	CS2D	CS3A	CS3B	CS3C	CS3D
Residential: Exceeds noise management level **Bold** Highly noise affected															
Non-residential: Exceeds noise management level															
R0541	39	Residential	NCA02	46	52	46	52	47	50	47	50	47	55	47	55
R0542	39	Residential	NCA02	38	44	38	40	30	37	31	37	32	38	32	38
R0543	39	Residential	NCA02	41	47	41	43	32	40	32	40	35	38	35	38
R0544	39	Residential	NCA02	39	45	39	42	38	40	38	40	38	46	38	46
R0545	39	Residential	NCA02	37	43	38	41	37	40	37	41	37	45	37	45
R0546	39	Residential	NCA02	45	51	45	51	43	48	43	48	43	51	43	51
R0547	39	Residential	NCA02	38	44	38	41	34	37	34	37	34	42	34	42
R0548	39	Residential	NCA02	43	49	43	49	41	48	41	48	41	49	41	49
R0549	39	Residential	NCA02	36	42	36	41	32	39	32	39	34	38	33	38
R0550	39	Residential	NCA02	44	50	44	50	43	48	43	48	43	51	43	51
R0551	39	Residential	NCA02	36	42	36	39	32	35	32	36	32	40	32	40
R0552	39	Residential	NCA02	50	51	50	51	51	51	51	51	51	59	51	59
R0553	39	Residential	NCA02	42	48	42	45	40	46	41	46	41	49	41	49
R0554	39	Residential	NCA02	47	53	47	53	46	51	46	51	46	54	46	54
R0555	39	Residential	NCA02	47	53	47	53	48	51	48	51	48	56	48	56
R0556	39	Residential	NCA02	34	40	34	39	28	35	28	35	31	35	31	36
R0557	39	Residential	NCA02	45	51	45	51	44	50	44	50	44	52	44	52
R0558	39	Residential	NCA02	43	49	43	49	40	45	40	45	41	48	41	48
R0559	39	Residential	NCA02	47	53	47	53	47	51	48	51	48	56	48	56
R0560	39	Residential	NCA02	40	46	40	43	38	42	38	42	38	46	38	46
R0561	39	Residential	NCA02	35	41	36	38	30	37	31	37	30	36	30	36
R0562	39	Residential	NCA02	33	38	33	35	31	33	31	33	31	39	31	39
R0563	39	Residential	NCA02	48	54	48	54	49	50	49	50	49	57	49	57
R0564	39	Residential	NCA02	43	49	43	49	42	49	42	49	42	50	42	50
R0565	39	Residential	NCA02	38	44	38	41	33	37	33	37	33	41	33	41
R0566	39	Residential	NCA02	43	49	43	49	41	46	41	46	41	49	41	49
R0567	39	Residential	NCA02	35	41	35	38	30	31	30	31	30	38	30	38
R0568	39	Residential	NCA02	47	47	47	47	48	48	48	48	48	56	48	56
R0569	39	Residential	NCA02	48	53	48	53	47	54	47	54	47	55	47	55
R0570	39	Residential	NCA02	35	41	35	39	32	35	32	35	32	40	32	40
R0571	39	Residential	NCA02	35	41	35	37	32	32	32	32	32	40	32	40
R0572	39	Residential	NCA02	51	54	51	54	51	52	52	52	52	60	52	60
R0573	39	Residential	NCA02	39	45	38	42	34	40	35	40	34	42	34	42
R0574	39	Residential	NCA02	43	49	43	49	40	47	40	47	41	48	41	48
R0575	39	Residential	NCA02	47	53	47	53	44	50	44	50	45	52	45	52
R0576	39	Residential	NCA02	48	54	48	54	49	54	49	54	49	57	49	57
R0577	39	Residential	NCA02	32	38	32	36	30	32	30	32	30	38	30	38
R0578	39	Residential	NCA02	47	50	47	50	48	51	48	51	48	56	48	56
R0579	39	Residential	NCA02	49	54	49	54	50	53	50	53	50	58	50	58
R0580	39	Residential	NCA02	35	41	34	38	31	34	31	34	31	39	31	39
R0581	39	Residential	NCA02	47	53	47	53	45	52	45	52	45	53	45	53
R0582	39	Residential	NCA02	38	44	38	41	36	40	37	39	33	40	33	40
R0583	39	Residential	NCA02	34	40	34	37	33	34	34	34	34	42	34	42
R0584	39	Residential	NCA02	35	39	35	36	33	33	33	33	32	40	32	40
R0585	39	Residential	NCA02	53	55	53	55	54	54	54	54	54	62	54	62
R0586	39	Residential	NCA02	48	54	48	54	49	53	49	53	49	57	49	57
R0587	39	Residential	NCA02	45	51	44	50	44	50	44	49	43	51	43	51
R0588	39	Residential	NCA02	47	53	47	53	45	51	45	51	45	53	45	53
R0589	39	Residential	NCA02	33	39	33	36	32	32	32	32	32	40	32	40
R0590	39	Residential	NCA02	34	40	34	39	35	35	36	36	31	37	31	37
R0591	39	Residential	NCA02	36	42	36	42	35	35	36	36	34	38	34	38
R0592	39	Residential	NCA02	48	54	48	54	47	54	47	54	47	55	47	55
R0593	39	Residential	NCA02	34	40	34	37	31	32	32	32	31	39	31	39
R0594	39	Residential	NCA02	40	46	40	46	41	42	41	42	39	47	39	47
R0595	39	Residential	NCA02	46	52	46	52	43	51	44	51	44	50	44	51
R0596	39	Residential	NCA02	33	39	33	35	31	31	31	31	31	39	31	39
R0597	39	Residential	NCA02	39	45	39	45	34	41	35	41	37	40	37	40
R0598	39	Residential	NCA02	40	46	40	46	39	42	39	42	38	46	38	46
R0599	39	Residential	NCA02	39	45	39	45	37	41	37	41	37	45	37	45
R0600	39	Residential	NCA02	37	43	37	40	35	39	35	39	32	37	32	37
R0601	39	Residential	NCA02	34	39	34	38	35	38	35	36	30	38	30	38
R0602	39	Residential	NCA02	50	55	50	55	51	55	51	55	51	59	51	59
R0603	39	Residential	NCA02	49	55	49	55	50	55	50	55	50	58	50	58
R0604	39	Residential	NCA02	33	39	33	36	32	33	32	33	32	40	32	40
R0605	39	Residential	NCA02	34	40	34	36	31	33	31	33	31	39	31	39
R0606	39	Residential	NCA02	31	37	31	37	32	33	32	33	32	40	32	40
R0607	39	Residential	NCA02	45	51	45	51	46	50	46	50	45	53	45	53
R0608	39	Residential	NCA02	34	40	34	37	30	33	30	33	30	38	30	38
R0609	39	Residential	NCA02	34	40	34	37	30	32	30	32	30	38	30	38
R0610	39	Residential	NCA02	34	40	34	37	31	32	32	32	32	40	32	40
R0611	39	Residential	NCA02	44	50	44	50	44	49	45	49	44	52	44	52
R0612	39	Residential	NCA02	50	55	50	55	51	55	51	55	51	59	51	59
R0613	39	Residential	NCA02	43	49	43	49	41	47	41	46	41	47	41	47
R0614	39	Residential	NCA02	30	36	30	36	30	32	30	32	30	38	30	38
R0615	39	Residential	NCA02	29	34	29	34	30	34	30	34	29	37	29	37
R0616	39	Residential	NCA02	33	39	33	39	30	36	30	36	31	38	31	38
R0617	39	Residential	NCA02	29	35	29	35	30	33	30	33	30	38	30	38
R0618	39	Residential	NCA02	43	49	43	49	40	48	41	48	41	49	41	49
R0619	39	Residential	NCA02	33	39	33	35	27	33	29	33	27	35	27	35
R0620	39	Residential	NCA02	33	39	33	35	30	32	30	32	30	38	30	38
R0621	39	Residential	NCA02	53	55	53	55	54	56	54	56	54	62	54	62
R0622	39	Residential	NCA02	33	39	33	39	31	35	31	35	31	39	31	39
R0623	39	Residential	NCA02	32	38	32	34	31	32	31	32	30	38	30	38
R0624	39	Residential	NCA02	30	36	30	36	29	32	29	32	29	37	29	37
R0625	39	Residential	NCA02	31	37	31	37	31	35	31	35	31	39	31	39
R0626	39	Residential	NCA02	32	38	32	38	31	37	31	37	31	39	31	39
R0627	39	Residential	NCA02	43	49	43	49	41	48	42	48	41	48	41	48
R0628	39	Residential	NCA02	48	54	48	54	49	54	49	54	48	56	48	56
R0629	39	Residential	NCA02	29	35	29	35	28	32	28	32	28	36	28	36
R0630	39	Residential	NCA02	36	37	36	37	36	37	37	37	30	38	30	38
R0631	39	Residential	NCA02	44	48	44	48	45	48	45	48	45	53	45	53
R0632	39	Residential	NCA02	48	54	48	54	47	52	47	52	47	55	47	55
R0633	39	Residential	NCA02	32	38	32	38	28	33	28	33	30	36	30	36
R0634	39	Residential	NCA02	42	47	42	47	43	47	43	47	39	45	39	46
R0635	39	Residential	NCA02	34	38	36	38	35	36	37	37	34	42	34	42
R0636	39	Residential	NCA02	31	37	31	37	29	35	30	35	29	37	29	37
R0637	39	Residential	NCA02	44	50	44	50	43	47	43	47	43	51	43	51
R0638	39	Residential	NCA02	30	36	30	36	29	35	29	35	29	37	29	37
R0639	39	Residential	NCA02	31	37	31	37	29	36	30	36	29	37	29	37
R0640	39	Residential	NCA02	30	36	30	34	30	33	30	33	30	38	30	38
R0641	39	Residential	NCA02	50	55	50	55	51	55	51	55	51	59	51	59
R0642	39	Residential	NCA02	41	46	41	46	42	45	42	45	38	42	38	42
R0643	39	Residential	NCA02	31	37	31	37	30	32	31	32	31	39	31	39
R0644	39	Residential	NCA02	35	41	35	41	30	34	30	34	33	38	33	38
R0645	39	Residential	NCA02	41	47	41	47	39	45	39	45	39	47	39	47
R0646	39	Residential	NCA02	32	38	32	38	29	33	29	33	30	37	30	37
R0647	39	Residential	NCA02	30	36	30	36	28	34	30	34	28	36	30	38
R0648	39	Residential	NCA02	39	45	39	44	37	41	37	41	36	42	36	42
R0649	39	Residential	NCA02	31	37	31	37	29	34	30	34	29	35	29	35
R0650	39	Residential	NCA02	50	55	50	55	51	55	51	55	50	58	50	58
R0651	39	Residential	NCA02	38	44	38	43	33	41	34	41	35	41	35	41
R0652	39	Residential	NCA02	29	33	29	33	30	31	30	31	29	37	29	37
R0653	39	Residential	NCA02	30	36	30	36	29	33	29	33	28	36	28	36
R0654	39	Residential	NCA02	30	36	30	35	31	35	31	35	31	39	31	39
R0655	39	Residential	NCA02	53	56	53	56	54	55	54	55	54	62	54	62
R0656	39	Residential	NCA02	45	51	45	51	44	51	45	51	44	52	45	53
R0657	39	Residential	NCA02	33	39	33	39	32	35	32	35	31	38	31	38
R0658	39	Residential	NCA02	42	48	42	48	42	43	42	43	40	43	40	43
R0659	39	Residential	NCA02	39	44	39	44	40	44	40	44	37	45	37	45
R0660	39	Residential	NCA02	30	36	30	36	29	33	29	33	28	36	28	36
R0661	39	Residential	NCA02	56	56	56	56	57	57	57	57	57	65	57	65
R0662	39	Residential	NCA02	32	38	32	38	28	34	28	34	30	36	30	36
R0663	39	Residential	NCA02	33	39	33	39	29	35	29	35	31	36	31	36
R0664	39	Residential	NCA02	48	52	48	52	49	52	49	52	49	57	49	57
R0665	39	Residential	NCA02	43	49	43	49	42	48	42	48	41	46	41	46
R0666	39	Residential	NCA02	38	44	38	45	35	40	35	40	37	40	37	40
R0667	39	Residential	NCA02	54	57	54	57	55	57	55	57	55	63	55	63
R0668	39	Residential	NCA02	35	41	35	41	32	39	32	39	33	40	33	40
R0669	39	Residential	NCA02	33	39	33	38	29	35	29	35	30	37	30	37
R0670	39	Residential	NCA02	52	55	52	55	53	56	53	56	53	61	53	61
R0671	39	Residential	NCA02	53	56	53	56	54	56	54	56	54	62	54	62
R0672	39	Residential	NCA02	41	47	41	47	39	43	39	43	39	47	39	47
R0673	39	Residential	NCA02	59	59	59	59	60	60	60	60	60	68	60	68
R0674	39	Residential	NCA02	59	59	59	59	60	60	60	60	60	68	60	68
R0675	39	Residential	NCA02	33	38	33	38	34	35	34	35	30	38	30	38

Predicted construction noise levels (ICNG): Standard construction hours

Receiver ID	Noise Management Level (NML)	Receiver Type	NCA	CS1A	CS1B	CS1C	CS1D	CS2A	CS2B	CS2C	CS2D	CS3A	CS3B	CS3C	CS3D
Residential: Exceeds noise management level **Bold** Highly noise affected															
Non-residential: Exceeds noise management level															
R0676	39	Residential	NCA02	47	53	47	53	47	50	47	50	47	55	47	55
R0677	39	Residential	NCA02	43	49	43	49	43	45	43	45	43	51	43	51
R0678	39	Residential	NCA02	36	41	36	41	37	37	37	37	33	38	33	38
R0679	39	Residential	NCA02	47	53	47	53	46	51	46	51	46	54	46	54
R0680	39	Residential	NCA02	59	59	59	59	60	60	60	60	60	68	60	68
R0681	39	Residential	NCA02	47	52	47	52	48	53	48	53	45	52	45	52
R0682	39	Residential	NCA02	47	52	46	52	48	51	47	51	48	56	47	55
R0683	39	Residential	NCA02	44	50	44	50	42	47	42	47	42	50	42	50
R0684	39	Residential	NCA02	58	58	58	58	59	59	59	59	59	67	59	67
R0685	39	Residential	NCA02	34	35	34	35	35	35	35	35	31	39	31	39
R0686	39	Residential	NCA02	36	42	36	42	36	38	37	39	34	41	34	41
R0687	39	Residential	NCA02	38	44	38	44	35	37	35	38	36	40	36	40
R0688	39	Residential	NCA02	51	57	51	57	51	54	51	54	51	59	51	59
R0689	39	Residential	NCA02	58	58	58	58	59	59	59	59	59	67	59	67
R0690	39	Residential	NCA02	43	49	43	49	39	47	40	47	41	47	41	48
R0691	39	Residential	NCA02	43	49	43	49	39	46	39	46	41	45	41	45
R0692	39	Residential	NCA02	40	46	40	46	38	43	38	43	38	41	38	41
R0693	39	Residential	NCA02	42	48	42	48	40	44	40	45	40	45	40	43
R0694	39	Residential	NCA02	60	60	60	60	61	61	61	61	61	69	61	69
R0695	39	Residential	NCA02	50	56	50	56	49	52	50	52	49	57	50	58
R0696	39	Residential	NCA02	61	61	61	61	62	62	62	62	62	70	62	70
R0697	39	Residential	NCA02	50	55	50	55	51	55	51	55	51	59	51	59
R0698	55	Medical facility	Medical facility	50	56	50	56	50	53	50	53	50	58	50	58
R0699	39	Residential	NCA02	62	62	62	62	63	63	63	63	63	71	63	71
R0700	39	Residential	NCA02	30	34	30	34	31	33	31	33	31	39	31	39
R0701	39	Residential	NCA02	48	54	48	54	47	49	46	49	47	55	46	54
R0702	39	Residential	NCA02	37	43	37	43	32	37	32	37	35	40	35	40
R0703	39	Residential	NCA02	46	52	46	52	44	50	43	50	44	52	44	51
R0704	39	Residential	NCA02	61	61	61	61	62	62	62	62	62	70	62	70
R0705	39	Residential	NCA02	62	62	62	62	63	63	63	63	63	71	63	71
R0706	39	Residential	NCA02	63	63	63	63	64	64	64	64	64	72	64	72
R0707	39	Residential	NCA02	57	57	57	57	58	58	58	58	58	66	58	66
R0708	39	Residential	NCA02	64	64	64	64	65	65	65	65	65	73	65	73
R0709	39	Residential	NCA02	55	55	55	55	56	56	56	56	56	64	56	64
R0710	39	Residential	NCA02	59	59	59	59	60	60	60	60	60	68	60	68
R0711	39	Residential	NCA02	60	60	60	60	61	61	61	61	61	69	61	69
R0712	39	Residential	NCA02	60	60	60	60	61	61	61	61	61	69	61	69
R0713	39	Residential	NCA02	60	60	60	60	61	61	61	61	61	69	61	69
R0714	55	Place of worship	Place of worship	56	56	56	56	57	57	57	57	57	65	57	65
R0715	55	Place of worship	Place of worship	61	61	61	61	62	62	62	62	62	70	62	70
R0716	39	Residential	NCA02	57	57	57	57	58	58	58	58	58	66	58	66
R0717	39	Residential	NCA02	55	58	55	58	56	56	56	56	56	64	56	64
R0718	39	Residential	NCA02	56	58	56	58	57	57	57	57	57	65	57	65
R0719	39	Residential	NCA02	56	56	56	56	57	57	57	57	57	65	57	65
R0720	39	Residential	NCA02	55	55	55	55	56	56	56	56	56	64	56	64
R0721	55	Educational institute	Educational institute	47	53	47	53	45	53	45	53	45	52	45	52
R0722	39	Residential	NCA02	53	57	53	57	54	54	54	54	54	62	54	62
R0723	39	Residential	NCA02	50	54	50	54	51	54	51	54	51	59	51	59
R0724	39	Residential	NCA02	47	50	47	50	48	50	48	50	48	56	48	56
R0725	39	Residential	NCA02	49	52	49	52	50	52	50	52	50	58	50	58
R0726	39	Residential	NCA02	44	49	44	49	45	50	45	50	45	53	45	53
R0727	39	Residential	NCA02	52	52	52	52	53	53	53	53	53	61	53	61
R0728	39	Residential	NCA02	40	43	40	43	41	42	41	42	41	49	41	49
R0729	39	Residential	NCA02	41	45	41	45	42	46	42	46	42	50	42	50
R0730	39	Residential	NCA02	40	46	40	46	38	43	38	44	38	44	38	44
R0731	39	Residential	NCA02	45	45	45	45	46	46	46	46	46	54	46	54
R0732	39	Residential	NCA02	37	43	37	41	37	41	37	41	34	42	33	41
R0733	39	Residential	NCA02	38	42	38	42	39	41	39	42	37	45	37	45
R0734	39	Residential	NCA02	40	40	40	40	41	41	41	41	41	49	41	49
R0735	39	Residential	NCA02	39	41	39	39	40	40	40	40	40	48	40	48
R0736	39	Residential	NCA02	37	38	36	36	38	39	37	38	39	47	37	45
R0737	39	Residential	NCA02	35	38	35	37	36	38	36	38	31	39	33	41
R0738	39	Residential	NCA02	36	36	36	36	36	39	36	39	36	44	36	44
R0739	39	Residential	NCA02	31	34	31	33	32	34	32	34	31	39	31	39
R0740	39	Residential	NCA02	40	40	40	40	41	41	41	41	41	49	41	49
R0741	39	Residential	NCA02	32	35	32	35	33	35	33	35	31	39	31	39
R0742	39	Residential	NCA02	34	34	33	34	35	35	35	35	35	43	35	43
R0743	39	Residential	NCA02	30	34	30	33	30	32	30	32	26	34	27	35
R0744	39	Residential	NCA02	32	32	32	32	33	33	33	33	33	41	33	41
R0745	39	Residential	NCA02	31	34	31	32	32	34	32	34	29	37	29	37
R0746	39	Residential	NCA02	31	34	31	32	31	33	31	33	29	37	29	37
R0747	39	Residential	NCA02	30	33	30	32	31	34	31	34	29	37	29	37
R0748	39	Residential	NCA02	32	32	32	32	33	33	33	33	33	41	33	41
R0749	39	Residential	NCA02	33	33	32	32	34	34	33	33	34	42	33	41
R0750	39	Residential	NCA02	32	32	32	30	31	32	31	32	29	37	29	37
R0751	39	Residential	NCA02	28	30	28	30	27	31	27	31	27	35	27	35
R0752	39	Residential	NCA02	27	29	27	29	28	31	28	31	28	36	28	36
R0753	39	Residential	NCA02	60	60	60	60	61	61	61	61	61	69	61	69
R0754	39	Residential	NCA02	60	60	60	60	61	61	61	61	61	69	61	69
R0755	39	Residential	NCA02	61	61	61	61	62	62	62	62	62	70	62	70
R0756	39	Residential	NCA02	61	61	61	61	62	62	62	62	62	70	62	70
R0757	39	Residential	NCA02	61	61	61	61	62	62	62	62	62	70	62	70
R0758	39	Residential	NCA02	61	61	61	61	62	62	62	62	62	70	62	70
R0759	39	Residential	NCA02	60	60	60	60	61	61	61	61	61	69	61	69
R0760	39	Residential	NCA02	51	56	51	56	52	56	52	56	52	60	52	60
R0761	39	Residential	NCA02	54	56	54	56	55	56	55	56	55	63	55	63
R0762	39	Residential	NCA02	53	56	53	56	54	57	54	57	54	62	54	62
R0763	39	Residential	NCA02	56	56	56	56	57	57	57	57	57	65	57	65
R0764	39	Residential	NCA02	56	57	56	57	57	58	57	58	57	65	57	65
R0765	39	Residential	NCA02	63	63	63	63	64	64	64	64	64	72	64	72
R0766	39	Residential	NCA02	38	44	38	44	37	43	37	44	36	42	36	42
R0767	39	Residential	NCA02	41	47	41	47	37	45	37	45	39	43	39	44
R0768	39	Residential	NCA02	42	48	42	48	39	43	39	43	40	44	40	44
R0769	39	Residential	NCA02	41	47	41	47	36	44	37	44	39	42	39	44
R0770	39	Residential	NCA02	35	41	35	41	34	36	34	36	33	41	33	41
R0771	39	Residential	NCA02	33	38	34	38	34	34	35	35	32	40	32	40
R0772	39	Residential	NCA02	36	41	36	41	37	38	37	38	33	40	33	40
R0773	39	Residential	NCA02	32	38	32	38	33	35	33	35	30	38	30	38
R0774	39	Residential	NCA02	33	39	33	39	33	35	33	35	31	37	31	37
R0775	39	Residential	NCA02	32	38	32	38	31	37	31	37	31	39	31	39
R0776	39	Residential	NCA02	33	39	33	39	33	38	33	38	33	41	33	41
R0777	39	Residential	NCA02	30	34	30	34	31	33	31	33	31	39	31	39
R0778	39	Residential	NCA02	33	39	33	39	31	37	33	37	31	39	31	39
R0779	39	Residential	NCA02	34	38	34	38	35	35	35	35	31	39	31	39
R0780	39	Residential	NCA02	33	39	33	35	29	32	30	32	28	36	28	36
R0781	39	Residential	NCA02	41	47	41	45	37	43	37	43	37	45	37	45
R0782	39	Residential	NCA02	38	44	38	41	34	34	34	34	34	42	34	42
R0783	39	Residential	NCA02	39	45	39	41	32	40	32	40	33	39	33	39
R0784	39	Residential	NCA02	38	44	38	41	35	35	35	35	35	43	35	43
R0785	39	Residential	NCA02	38	44	38	42	32	33	32	33	34	40	34	40
R0786	39	Residential	NCA02	38	42	38	38	35	35	35	35	35	43	35	43
R0787	39	Residential	NCA02	48	49	48	49	49	49	49	49	49	57	49	57
R0788	39	Residential	NCA02	45	50	45	50	47	50	46	50	46	54	46	54
R0789	39	Residential	NCA02	47	51	47	51	48	51	48	51	48	56	48	56
R0790	39	Residential	NCA02	45	51	45	51	45	50	45	50	45	53	45	53
R0791	39	Residential	NCA02	52	52	52	52	53	53	53	53	53	61	53	61
R0792	39	Residential	NCA02	49	50	49	50	50	50	50	50	50	58	50	58
R0793	39	Residential	NCA02	48	53	48	53	49	52	49	52	49	57	49	57
R0794	39	Residential	NCA02	53	55	53	55	54	56	54	56	54	62	54	62
R0795	39	Residential	NCA02	52	55	52	55	53	56	53	56	53	61	53	61
R0796	39	Residential	NCA02	46	50	46	50	47	50	47	50	47	55	47	55
R0797	39	Residential	NCA02	39	45	39	42	40	40	40	40	40	48	40	48
R0798	39	Residential	NCA02	47	51	47	51	48	52	48	52	44	49	44	49
R0799	39	Residential	NCA02	34	40	34	40	33	34	33	34	33	41	33	41
R0800	39	Residential	NCA02	37	43	37	41	30	39	31	39	33	36	33	36
R0801	39	Residential	NCA02	34	40	34	40	28	34	27	34	32	35	32	35
R0802	39	Residential	NCA02	33	39	33	38	26	33	26	33	30	34	30	34
R0803	39	Residential	NCA02	25	31	25	29	24	28	24	28	24	32	24	32
R0804	39	Residential	NCA02	27	33	27	32	25	32	25	32	25	33	25	33
R0805	39	Residential	NCA02	29	35	29	34	27	32	29	32	29	37	29	37
R0806	39	Residential	NCA02	31	37	31	35	32	32	32	32	32	40	32	40
R0807	39	Residential	NCA02	31	36	31	33	31	31	31	31	31	39	31	39
R0808	39	Residential	NCA02	31	37	31	36	29	32	29	32	29	37	29	37
R0809	39	Residential	NCA02	31	32	31	31	32	32	32	32	32	40	32	40
R0810	39	Residential	NCA02	37	43	37	40	32	36	32	36	32	40	32	40

Predicted construction noise levels (ICNG): Standard construction hours

Receiver ID	Noise Management Level (NML)	Receiver Type	NCA	CS1A	CS1B	CS1C	CS1D	CS2A	CS2B	CS2C	CS2D	CS3A	CS3B	CS3C	CS3D
Residential: Exceeds noise management level **Bold** Highly noise affected															
Non-residential: Exceeds noise management level															
R0811	39	Residential	NCA02	36	42	36	39	32	32	32	32	32	40	32	40
R0812	39	Residential	NCA02	31	37	31	33	30	30	30	30	30	38	30	38
R0813	39	Residential	NCA02	37	43	37	40	32	36	32	36	32	39	32	39
R0814	39	Residential	NCA02	40	46	40	42	37	38	37	38	34	42	34	42
R0815	39	Residential	NCA02	36	42	36	38	27	35	28	35	30	36	30	36
R0816	37	Residential	NCA03	33	33	33	30	31	31	31	31	31	39	31	39
R0817	37	Residential	NCA03	39	45	39	42	32	34	32	34	34	40	34	40
R0818	37	Residential	NCA03	45	49	45	49	46	49	46	49	46	54	46	54
R0819	37	Residential	NCA03	61	67	61	67	50	56	50	56	59	59	59	59
R0820	37	Residential	NCA03	59	65	59	65	55	56	55	57	57	63	57	63
R0821	37	Residential	NCA03	55	55	55	55	56	56	56	56	56	64	56	64
R0822	37	Residential	NCA03	56	57	56	58	57	57	57	57	57	65	57	65
R0823	37	Residential	NCA03	58	58	58	58	59	59	59	59	59	67	59	67
R0824	37	Residential	NCA03	56	56	56	56	57	57	57	57	57	65	57	65
R0825	37	Residential	NCA03	55	55	55	55	56	56	56	56	56	64	56	64
R0826	37	Residential	NCA03	57	57	57	57	58	59	58	59	58	66	58	66
R0827	37	Residential	NCA03	60	66	60	66	51	59	51	59	58	58	58	58
R0828	37	Residential	NCA03	59	65	59	65	49	55	49	55	57	57	57	57
R0829	37	Residential	NCA03	55	55	55	55	56	56	56	56	56	64	56	64
R0830	37	Residential	NCA03	58	58	58	58	59	59	59	59	59	67	59	67
R0831	37	Residential	NCA03	57	57	57	57	58	58	58	58	58	66	58	66
R0832	37	Residential	NCA03	58	58	58	58	59	59	59	59	59	67	59	67
R0833	37	Residential	NCA03	56	56	56	56	57	58	57	58	57	65	57	65
R0834	37	Residential	NCA03	59	59	59	59	60	60	60	60	60	68	60	68
R0835	37	Residential	NCA03	57	57	57	57	58	58	58	58	58	66	58	66
R0836	37	Residential	NCA03	58	58	58	58	59	59	59	59	59	67	59	67
R0837	37	Residential	NCA03	58	64	58	64	48	53	48	53	56	56	56	56
R0838	37	Residential	NCA03	57	57	57	57	58	58	58	58	58	66	58	66
R0839	37	Residential	NCA03	57	57	57	57	58	58	58	58	58	66	58	66
R0840	37	Residential	NCA03	57	57	57	57	58	58	58	58	58	66	58	66
R0841	37	Residential	NCA03	58	58	58	58	59	59	59	59	59	67	59	67
R0842	37	Residential	NCA03	58	64	58	64	49	56	49	55	56	56	56	56
R0843	37	Residential	NCA03	58	64	58	64	50	58	50	58	56	56	56	56
R0844	37	Residential	NCA03	58	58	58	58	59	59	59	59	59	67	59	67
R0845	37	Residential	NCA03	57	57	57	57	58	58	58	58	58	66	58	66
R0846	37	Residential	NCA03	57	63	57	63	49	57	48	56	55	55	55	55
R0847	37	Residential	NCA03	53	53	53	53	54	54	54	54	54	62	54	62
R0848	37	Residential	NCA03	54	54	54	54	55	56	55	56	55	63	55	63
R0849	37	Residential	NCA03	52	52	52	52	53	53	53	53	53	61	53	61
R0850	37	Residential	NCA03	54	54	54	54	55	55	55	55	55	63	55	63
R0851	37	Residential	NCA03	51	51	51	51	52	52	52	52	52	60	52	60
R0852	37	Residential	NCA03	47	50	47	50	48	53	48	53	48	56	48	56
R0853	37	Residential	NCA03	52	58	52	58	47	47	47	47	50	50	50	50
R0854	37	Residential	NCA03	54	54	54	54	55	55	55	55	55	63	55	63
R0855	37	Residential	NCA03	57	63	57	63	49	57	49	57	55	55	55	55
R0856	37	Residential	NCA03	42	42	42	42	43	43	43	43	43	51	43	51
R0857	37	Residential	NCA03	55	55	55	55	56	56	56	56	56	64	56	64
R0858	37	Residential	NCA03	50	56	50	56	47	51	47	51	48	54	48	54
R0859	37	Residential	NCA03	54	54	54	54	55	56	55	56	55	63	55	63
R0860	37	Residential	NCA03	56	56	56	56	57	57	57	57	57	65	57	65
R0861	37	Residential	NCA03	48	54	49	55	45	51	45	51	46	47	47	47
R0862	37	Residential	NCA03	51	57	51	57	45	50	44	50	49	50	49	50
R0863	37	Residential	NCA03	41	41	41	41	42	42	42	42	42	50	42	50
R0864	37	Residential	NCA03	53	53	53	53	54	54	54	55	54	62	54	62
R0865	37	Residential	NCA03	54	54	54	54	55	55	55	55	55	63	55	63
R0866	37	Residential	NCA03	54	54	54	54	55	55	55	55	55	63	55	63
R0867	37	Residential	NCA03	52	52	52	52	53	54	53	54	53	61	53	61
R0868	37	Residential	NCA03	41	43	41	43	42	45	42	45	40	48	39	47
R0869	37	Residential	NCA03	50	56	50	56	44	51	44	51	48	48	48	48
R0870	37	Residential	NCA03	53	53	53	53	54	54	54	54	54	62	54	62
R0871	37	Residential	NCA03	43	43	43	43	44	44	44	44	44	52	44	52
R0872	37	Residential	NCA03	48	48	48	48	49	51	49	51	49	57	49	57
R0873	37	Residential	NCA03	42	46	42	46	43	45	43	45	38	44	38	44
R0874	37	Residential	NCA03	37	37	38	38	38	38	39	39	34	42	34	42
R0875	37	Residential	NCA03	55	55	55	55	56	56	56	56	56	64	56	64
R0876	37	Residential	NCA03	51	51	51	51	52	52	52	52	52	60	52	60
R0877	37	Residential	NCA03	48	48	48	48	49	49	49	49	49	57	49	57
R0878	37	Residential	NCA03	48	48	48	48	49	49	49	49	49	57	49	57
R0879	37	Residential	NCA03	50	56	50	56	43	51	43	50	48	48	48	48
R0880	37	Residential	NCA03	44	45	44	45	45	48	45	48	45	53	45	53
R0881	37	Residential	NCA03	43	43	43	43	44	44	44	44	44	52	44	52
R0882	37	Residential	NCA03	55	55	55	55	56	56	56	56	56	64	56	64
R0883	37	Residential	NCA03	42	44	42	44	43	47	43	47	43	51	43	51
R0884	37	Residential	NCA03	47	53	47	53	43	49	43	49	45	45	45	45
R0885	37	Residential	NCA03	47	47	47	47	48	48	48	48	48	56	48	56
R0886	37	Residential	NCA03	45	45	45	45	46	46	46	46	46	54	46	54
R0887	37	Residential	NCA03	46	46	46	46	47	47	47	47	47	55	47	55
R0888	37	Residential	NCA03	41	47	41	47	42	44	42	44	41	49	41	49
R0889	37	Residential	NCA03	45	45	45	45	46	46	46	46	46	54	46	54
R0890	37	Residential	NCA03	41	41	41	41	42	42	42	44	42	50	42	50
R0891	37	Residential	NCA03	45	51	45	51	44	50	45	50	43	49	43	49
R0892	37	Residential	NCA03	43	43	43	43	44	44	44	44	44	52	44	52
R0893	37	Residential	NCA03	42	48	42	48	39	40	39	40	40	47	40	46
R0894	37	Residential	NCA03	46	46	46	46	47	47	47	48	47	55	47	55
R0895	37	Residential	NCA03	50	50	50	50	51	51	51	51	51	59	51	59
R0896	37	Residential	NCA03	42	48	42	48	43	46	43	46	40	46	40	46
R0897	37	Residential	NCA03	46	46	46	46	47	48	47	48	47	55	47	55
R0898	37	Residential	NCA03	47	47	47	47	48	48	48	48	48	56	48	56
R0899	37	Residential	NCA03	40	42	40	42	41	45	41	45	41	49	41	49
R0900	37	Residential	NCA03	44	46	44	46	45	49	45	49	45	53	45	53
R0901	37	Residential	NCA03	46	52	46	52	41	47	41	47	44	45	44	45
R0902	37	Residential	NCA03	44	45	44	45	45	48	45	48	45	53	45	53
R0903	37	Residential	NCA03	40	43	40	43	41	42	41	42	35	41	35	41
R0904	37	Residential	NCA03	40	40	40	40	41	41	41	41	41	49	41	49
R0905	37	Residential	NCA03	40	41	40	41	41	41	41	41	35	43	35	43
R0906	37	Residential	NCA03	39	40	39	40	40	40	40	40	33	41	33	41
R0907	37	Residential	NCA03	38	38	38	38	39	39	39	39	39	47	39	47
R0908	37	Residential	NCA03	40	40	40	40	41	41	41	41	33	41	33	41
R0909	37	Residential	NCA03	36	36	36	36	37	37	37	37	37	45	37	45
R0910	37	Residential	NCA03	39	45	39	45	38	45	40	45	37	41	37	41
R0911	37	Residential	NCA03	39	44	39	44	40	40	40	41	36	38	36	38
R0912	37	Residential	NCA03	32	36	32	36	33	33	33	33	33	41	33	41
R0913	37	Residential	NCA03	33	39	33	39	34	35	34	34	34	42	34	42
R0914	37	Residential	NCA03	42	48	44	50	41	46	41	46	40	45	42	45
R0915	37	Residential	NCA03	36	36	36	36	37	37	37	37	36	44	36	44
R0916	37	Residential	NCA03	40	42	40	42	41	43	41	43	37	45	37	45
R0917	37	Residential	NCA03	37	37	37	37	38	38	38	38	38	46	38	46
R0918	37	Residential	NCA03	37	37	37	37	38	38	38	38	38	46	38	46
R0919	37	Residential	NCA03	40	40	40	40	41	41	41	41	41	49	41	49
R0920	37	Residential	NCA03	39	39	39	39	40	41	40	42	40	48	40	48
R0921	37	Residential	NCA03	32	35	32	35	33	36	33	36	32	40	32	40
R0922	37	Residential	NCA03	38	38	38	38	39	39	39	39	39	47	39	47
R0923	37	Residential	NCA03	36	36	36	36	37	37	37	37	37	45	37	45
R0924	37	Residential	NCA03	41	41	39	39	42	42	40	40	42	50	40	48
R0925	37	Residential	NCA03	38	44	41	47	38	39	39	39	37	45	39	45
R0926	37	Residential	NCA03	36	42	36	42	35	37	35	37	34	39	34	39
R0927	37	Residential	NCA03	42	42	41	41	43	43	42	42	43	51	42	50
R0928	37	Residential	NCA03	35	38	35	38	36	36	36	36	36	44	36	44
R0929	37	Residential	NCA03	37	37	37	37	38	38	38	38	38	46	38	46
R0930	37	Residential	NCA03	41	41	41	41	42	42	42	43	42	50	42	50
R0931	37	Residential	NCA03	40	41	40	41	41	44	41	44	41	49	41	49
R0932	37	Residential	NCA03	31	35	31	35	32	34	32	34	32	40	32	40
R0933	37	Residential	NCA03	38	39	38	39	39	42	39	42	39	47	39	47
R0934	37	Residential	NCA03	39	39	39	39	40	40	40	40	40	48	40	48
R0935	37	Residential	NCA03	43	49	45	51	39	45	39	45	41	41	43	43
R0936	37	Residential	NCA03	39	39	39	39	40	40	40	40	40	48	40	48
R0937	37	Residential	NCA03	46	52	46	52	43	50	43	50	44	44	44	44
R0938	37	Residential	NCA03	39	44	39	44	39	44	40	43	36	42	36	42
R0939	37	Residential	NCA03	42	42	42	42	43	43	43	43	43	51	43	51
R0940	37	Residential	NCA03	33	33	33	33	35	34	34	34	34	42	34	42
R0941	37	Residential	NCA03	39	39	39	39	40	40	40	40	40	48	40	48
R0942	37	Residential	NCA03	36	37	36	37	37	37	37	37	37	45	37	45
R0943	37	Residential	NCA03	34	34	34	34	35	36	35	36	32	40	32	40
R0944	37	Residential	NCA03	39	42	39	44	39	45	39	45	37	37	37	37
R0945	37	Residential	NCA03	29	35	29	35	30	33	30	33	30	38	30	38

Predicted construction noise levels (ICNG): Standard construction hours

Receiver ID	Noise Management Level (NML)	Receiver Type	NCA	CS1A	CS1B	CS1C	CS1D	CS2A	CS2B	CS2C	CS2D	CS3A	CS3B	CS3C	CS3D
Residential: Exceeds noise management level **Bold** Highly noise affected															
Non-residential: Exceeds noise management level															
R0946	37	Residential	NCA03	31	35	31	35	32	32	32	32	32	40	32	40
R0947	37	Residential	NCA03	34	35	34	35	35	35	35	35	35	43	35	43
R0948	37	Residential	NCA03	33	34	33	34	34	35	34	35	34	42	34	42
R0949	37	Residential	NCA03	33	36	35	36	34	36	36	36	32	40	32	40
R0950	37	Residential	NCA03	36	36	36	36	37	37	37	37	34	42	34	42
R0951	37	Residential	NCA03	35	35	35	35	36	36	36	36	32	40	32	40
R0952	37	Residential	NCA03	38	38	38	38	38	39	39	39	39	47	39	47
R0953	37	Residential	NCA03	38	42	37	42	39	39	38	39	34	37	34	37
R0954	37	Residential	NCA03	35	35	35	35	36	36	36	36	36	44	36	44
R0955	37	Residential	NCA03	37	37	37	37	38	38	38	38	38	46	38	46
R0956	37	Residential	NCA03	35	35	35	35	36	36	36	36	36	44	36	44
R0957	37	Residential	NCA03	35	37	35	37	36	36	36	36	32	40	31	39
R0958	37	Residential	NCA03	34	34	34	34	35	35	35	35	35	43	35	43
R0959	37	Residential	NCA03	36	36	36	36	37	37	37	37	37	45	37	45
R0960	37	Residential	NCA03	37	38	37	38	38	38	38	38	35	43	35	43
R0961	37	Residential	NCA03	49	55	49	55	42	50	42	50	47	47	47	47
R0962	37	Residential	NCA03	33	33	33	33	34	35	34	35	34	42	34	42
R0963	37	Residential	NCA03	30	35	30	35	31	31	31	31	31	39	31	39
R0964	37	Residential	NCA03	36	36	36	36	37	37	37	37	37	45	37	45
R0965	37	Residential	NCA03	47	53	47	53	41	47	41	47	45	45	45	45
R0966	37	Residential	NCA03	34	37	34	37	35	35	35	35	35	43	35	43
R0967	37	Residential	NCA03	37	43	38	44	32	37	32	37	35	35	36	36
R0968	37	Residential	NCA03	33	37	33	37	34	34	34	34	34	42	34	42
R0969	37	Residential	NCA03	36	36	36	36	37	37	37	37	36	44	36	44
R0970	37	Residential	NCA03	31	35	31	35	31	35	31	35	31	39	31	39
R0971	37	Residential	NCA03	38	42	38	42	39	42	39	41	34	41	34	41
R0972	37	Residential	NCA03	37	40	37	40	37	40	37	40	32	40	32	40
R0973	37	Residential	NCA03	45	51	46	52	43	49	43	49	43	43	44	44
R0974	37	Residential	NCA03	35	35	35	35	36	36	36	36	36	44	36	44
R0975	37	Residential	NCA03	44	50	45	51	42	47	42	47	42	42	43	43
R0976	37	Residential	NCA03	37	37	34	34	38	38	35	35	38	46	35	43
R0977	37	Residential	NCA03	29	35	29	35	30	30	30	30	30	38	30	38
R0978	37	Residential	NCA03	31	35	31	35	32	32	32	32	32	40	32	40
R0979	37	Residential	NCA03	30	36	30	36	31	32	31	32	31	39	31	39
R0980	37	Residential	NCA03	45	51	44	50	39	44	39	44	43	43	42	42
R0981	37	Residential	NCA03	42	48	43	49	40	46	40	46	40	43	41	43
R0982	37	Residential	NCA03	40	43	40	43	41	44	41	44	36	36	36	36
R0983	37	Residential	NCA03	29	35	29	35	29	31	29	31	29	37	29	37
R0984	37	Residential	NCA03	32	34	31	34	30	33	30	33	30	38	30	38
R0985	37	Residential	NCA03	36	36	36	36	37	37	37	37	37	45	37	45
R0986	37	Residential	NCA03	29	35	29	35	28	31	28	31	28	36	28	36
R0987	37	Residential	NCA03	29	34	29	34	30	31	30	31	30	38	30	38
R0988	37	Residential	NCA03	30	33	33	33	31	33	31	33	31	39	31	39
R0989	37	Residential	NCA03	30	36	30	36	29	30	29	30	29	37	29	37
R0990	37	Residential	NCA03	34	34	34	34	35	35	35	35	35	43	35	43
R0991	37	Residential	NCA03	30	34	30	34	31	31	31	31	31	39	31	39
R0992	37	Residential	NCA03	30	32	31	32	31	31	32	32	31	39	32	40
R0993	37	Residential	NCA03	32	32	32	32	33	33	33	33	33	41	33	41
R0994	37	Residential	NCA03	37	43	37	43	38	39	38	39	35	35	35	35
R0995	37	Residential	NCA03	32	32	32	32	33	33	33	33	33	41	33	41
R0996	37	Residential	NCA03	28	34	28	34	27	31	27	31	27	35	27	35
R0997	37	Residential	NCA03	29	34	29	34	30	30	30	30	30	38	30	38
R0998	37	Residential	NCA03	37	38	37	39	35	38	34	38	30	36	31	36
R0999	37	Residential	NCA03	30	31	30	31	31	31	31	31	31	39	31	39
R1000	37	Residential	NCA03	29	35	28	34	27	30	27	30	27	35	27	35
R1001	37	Residential	NCA03	36	42	37	41	35	42	35	42	34	35	34	35
R1002	37	Residential	NCA03	27	33	27	33	26	30	26	30	26	34	26	34
R1003	37	Residential	NCA03	33	33	33	33	34	34	34	34	34	42	34	42
R1004	37	Residential	NCA03	31	35	31	35	31	31	31	31	31	39	31	39
R1005	37	Residential	NCA03	28	32	28	32	29	29	29	29	29	37	29	37
R1006	37	Residential	NCA03	28	34	28	34	29	29	29	29	29	37	29	37
R1007	37	Residential	NCA03	25	31	25	31	26	30	26	30	26	34	26	34
R1008	37	Residential	NCA03	26	32	26	32	26	29	26	29	26	34	26	34
R1009	37	Residential	NCA03	25	30	25	30	26	29	26	29	26	34	26	34
R1010	37	Residential	NCA03	25	29	25	29	26	29	26	29	26	34	26	34
R1011	37	Residential	NCA03	27	33	27	33	28	29	28	29	28	36	28	36
R1012	37	Residential	NCA03	26	32	26	32	27	31	26	31	27	35	26	34
R1013	37	Residential	NCA03	26	32	26	32	25	30	25	30	25	33	25	33
R1014	37	Residential	NCA03	27	33	27	33	25	28	26	28	26	34	26	34
R1015	37	Residential	NCA03	26	32	26	32	26	29	26	29	26	34	26	34
R1016	37	Residential	NCA03	25	31	25	31	26	29	26	29	26	34	26	34
R1017	37	Residential	NCA03	26	32	26	32	26	31	26	31	26	34	26	34
R1018	37	Residential	NCA03	26	32	26	32	27	29	27	29	27	35	27	35
R1019	37	Residential	NCA03	27	33	27	33	28	29	28	29	28	36	28	36
R1020	37	Residential	NCA03	25	31	25	31	26	29	26	29	26	34	26	34
R1021	37	Residential	NCA03	27	33	27	33	25	29	26	29	26	34	26	34
R1022	37	Residential	NCA03	26	32	26	32	26	29	26	29	26	34	26	34
R1023	37	Residential	NCA03	26	32	26	32	25	29	25	29	25	33	25	33
R1024	37	Residential	NCA03	24	30	25	31	25	29	25	29	25	33	25	33
R1025	37	Residential	NCA03	27	33	27	33	26	30	26	30	26	34	26	34
R1026	37	Residential	NCA03	26	32	26	32	27	31	27	31	27	35	27	35
R1027	37	Residential	NCA03	26	32	26	32	26	29	26	29	26	34	26	34
R1028	37	Residential	NCA03	25	31	25	31	26	29	26	29	26	34	26	34
R1029	37	Residential	NCA03	26	32	26	32	25	29	25	29	25	33	25	33
R1030	37	Residential	NCA03	26	32	26	32	27	30	27	30	27	35	27	35
R1031	35	Residential	NCA04	25	31	26	31	26	29	25	29	25	33	25	33
R1032	35	Residential	NCA04	26	32	26	32	26	29	26	29	26	34	26	34
R1033	35	Residential	NCA04	31	31	31	31	32	32	32	32	32	40	32	40
R1034	35	Residential	NCA04	59	65	59	65	48	51	49	57	57	57	57	57
R1035	35	Residential	NCA04	62	68	62	68	49	50	51	57	60	60	60	60
R1036	35	Residential	NCA04	62	68	62	68	48	48	50	52	60	60	60	60
R1037	35	Residential	NCA04	57	63	57	64	48	53	48	55	56	56	56	56
R1038	35	Residential	NCA04	55	61	55	61	48	55	48	56	53	53	53	53
R1039	35	Residential	NCA04	57	63	57	63	48	54	48	56	55	55	55	55
R1040	35	Residential	NCA04	60	66	60	66	48	50	49	57	58	58	58	58
R1041	35	Residential	NCA04	62	68	62	68	48	49	49	52	60	60	60	60
R1042	35	Residential	NCA04	61	67	61	67	49	51	50	58	59	59	59	59
R1043	35	Residential	NCA04	55	61	55	61	47	55	47	55	53	53	53	53
R1044	35	Residential	NCA04	55	61	55	61	47	52	47	52	53	53	53	53
R1045	35	Residential	NCA04	53	59	53	59	48	53	47	55	51	51	51	51
R1046	35	Residential	NCA04	56	62	56	62	47	55	47	55	54	54	54	54
R1047	35	Residential	NCA04	57	63	57	63	48	49	48	53	55	55	55	55
R1048	35	Residential	NCA04	56	62	56	62	47	55	47	55	54	54	54	54
R1049	35	Residential	NCA04	58	64	58	64	48	52	48	56	56	56	56	56
R1050	35	Residential	NCA04	58	64	58	64	48	51	48	56	56	56	56	56
R1051	35	Residential	NCA04	59	65	59	65	48	48	48	55	57	57	57	57
R1052	35	Residential	NCA04	55	61	55	62	49	53	49	57	54	54	54	54
R1053	35	Residential	NCA04	57	63	57	63	47	50	47	52	55	55	55	55
R1054	35	Residential	NCA04	58	64	58	64	46	47	47	52	56	56	56	56
R1055	35	Residential	NCA04	58	64	58	64	47	53	48	56	56	56	56	56
R1056	35	Residential	NCA04	55	61	55	61	44	44	44	49	53	53	53	53
R1057	35	Residential	NCA04	57	63	57	63	47	52	48	56	55	55	55	55
R1058	35	Residential	NCA04	54	60	54	60	44	49	44	47	52	52	52	52
R1059	35	Residential	NCA04	60	66	60	66	50	58	51	59	58	58	58	58
R1060	35	Residential	NCA04	57	63	57	63	47	52	47	55	55	55	55	55
R1061	35	Residential	NCA04	57	63	57	63	47	50	47	53	55	55	55	55
R1062	35	Residential	NCA04	55	61	55	61	47	53	47	55	53	53	53	53
R1063	35	Residential	NCA04	41	47	44	50	34	36	34	37	39	39	42	42
R1064	35	Residential	NCA04	56	62	56	62	44	47	44	50	54	54	54	54
R1065	35	Residential	NCA04	56	62	56	62	47	54	47	55	54	54	54	54
R1066	35	Residential	NCA04	58	64	58	64	46	52	46	53	56	56	56	56
R1067	35	Residential	NCA04	58	64	58	64	47	52	47	54	56	56	56	56
R1068	35	Residential	NCA04	55	61	55	61	47	55	47	55	53	53	53	53
R1069	35	Residential	NCA04	59	65	59	65	50	58	49	57	57	57	57	57
R1070	35	Residential	NCA04	57	63	57	63	47	53	48	56	55	55	55	55
R1071	35	Residential	NCA04	59	65	59	65	49	54	49	57	57	57	57	57
R1072	35	Residential	NCA04	59	65	59	65	48	56	48	56	57	57	57	57
R1073	35	Residential	NCA04	42	48	47	53	41	41	41	41	40	40	45	45
R1074	35	Residential	NCA04	53	59	53	59	46	54	46	54	51	51	51	51
R1075	35	Residential	NCA04	55	61	55	61	46	54	47	55	53	53	53	53
R1076	35	Residential	NCA04	56	62	56	62	48	53	49	57	54	54	54	54
R1077	35	Residential	NCA04	55	61	55	61	46	54	47	55	53	53	53	53
R1078	35	Residential	NCA04	51	57	51	57	45	53	45	53	49	49	49	49
R1079	35	Residential	NCA04	50	56	50	56	45	53	45	53	48	48	48	48
R1080	35	Residential	NCA04	57	63	57	63	47	49	47	50	55	55	55	55

Predicted construction noise levels (ICNG): Standard construction hours

Receiver ID	Noise Management Level (NML)	Receiver Type	NCA	CS1A	CS1B	CS1C	CS1D	CS2A	CS2B	CS2C	CS2D	CS3A	CS3B	CS3C	CS3D
Residential: Exceeds noise management level Bold Highly noise affected															
Non-residential: Exceeds noise management level															
R1081	35	Residential	NCA04	52	58	52	58	45	52	45	53	50	50	50	50
R1082	35	Residential	NCA04	56	62	56	62	46	52	47	55	54	54	54	54
R1083	35	Residential	NCA04	56	62	56	62	47	50	47	52	54	54	54	54
R1084	35	Residential	NCA04	56	62	56	62	48	54	48	54	54	54	54	54
R1085	35	Residential	NCA04	50	56	50	56	45	52	45	52	48	48	48	48
R1086	35	Residential	NCA04	55	61	55	61	48	51	47	51	53	53	53	53
R1087	35	Residential	NCA04	54	60	54	60	47	55	47	55	52	52	52	52
R1088	35	Residential	NCA04	57	63	57	63	46	50	47	53	55	55	55	55
R1089	35	Residential	NCA04	55	61	55	61	47	52	47	55	53	53	53	53
R1090	35	Residential	NCA04	57	63	57	63	46	51	47	55	55	55	55	55
R1091	35	Residential	NCA04	52	58	52	59	46	54	46	54	51	51	51	51
R1092	35	Residential	NCA04	56	62	56	62	47	51	47	55	54	54	54	54
R1093	35	Residential	NCA04	49	55	49	55	45	51	45	51	47	47	47	47
R1094	35	Residential	NCA04	55	61	55	61	45	53	46	54	53	53	53	53
R1095	35	Residential	NCA04	53	59	53	59	46	54	46	54	51	51	51	51
R1096	35	Residential	NCA04	54	60	54	60	46	54	46	54	52	52	52	52
R1097	35	Residential	NCA04	55	61	55	61	46	51	47	55	53	53	53	53
R1098	35	Residential	NCA04	55	61	55	61	46	52	47	55	53	53	53	53
R1099	35	Residential	NCA04	57	63	57	63	47	51	47	55	55	55	55	55
R1100	35	Residential	NCA04	56	62	56	62	47	51	47	54	54	54	54	54
R1101	35	Residential	NCA04	57	63	57	63	47	51	47	55	55	55	55	55
R1102	35	Residential	NCA04	54	60	54	60	47	54	47	54	52	52	52	52
R1103	35	Residential	NCA04	54	60	54	60	46	54	47	55	52	52	52	52
R1104	35	Residential	NCA04	53	59	53	59	45	49	45	51	51	51	51	51
R1105	35	Residential	NCA04	56	62	56	62	47	51	47	55	54	54	54	54
R1106	35	Residential	NCA04	47	53	49	55	41	44	41	44	45	45	47	47
R1107	35	Residential	NCA04	53	59	53	59	45	53	45	53	51	51	51	51
R1108	35	Residential	NCA04	54	60	54	60	45	53	46	54	52	52	52	52
R1109	35	Residential	NCA04	41	47	44	50	39	39	39	39	39	39	42	42
R1110	35	Residential	NCA04	53	59	53	59	45	53	46	54	51	51	51	51
R1111	35	Residential	NCA04	55	61	55	61	46	54	47	55	53	53	53	53
R1112	35	Residential	NCA04	48	54	48	54	42	47	42	47	46	46	46	46
R1113	35	Residential	NCA04	55	61	55	61	47	55	48	56	53	53	53	53
R1114	35	Residential	NCA04	53	59	53	59	43	51	43	50	51	51	51	51
R1115	35	Residential	NCA04	54	60	54	60	45	53	47	55	52	52	52	52
R1116	35	Residential	NCA04	55	61	55	61	47	55	47	55	53	53	53	53
R1117	35	Residential	NCA04	53	59	52	58	44	51	44	52	51	51	50	50
R1118	35	Residential	NCA04	54	60	54	60	46	51	46	51	52	52	52	52
R1119	35	Residential	NCA04	54	60	54	60	45	53	46	54	52	52	52	52
R1120	35	Residential	NCA04	54	60	54	60	46	50	46	54	52	52	52	52
R1121	35	Residential	NCA04	54	60	54	60	45	52	46	54	52	52	52	52
R1122	35	Residential	NCA04	54	60	54	60	46	51	46	54	52	52	52	52
R1123	35	Residential	NCA04	54	60	54	60	46	51	47	55	52	52	52	52
R1124	35	Residential	NCA04	54	60	54	60	46	54	47	55	52	52	52	52
R1125	35	Residential	NCA04	54	60	54	60	46	54	46	54	52	52	52	52
R1126	35	Residential	NCA04	52	58	52	58	45	50	45	50	50	50	50	50
R1127	35	Residential	NCA04	54	60	54	60	46	54	47	55	52	52	52	52
R1128	35	Residential	NCA04	54	60	54	60	46	54	46	54	52	52	52	52
R1129	35	Residential	NCA04	54	60	54	60	45	51	46	54	52	52	52	52
R1130	35	Residential	NCA04	56	62	56	62	47	55	47	55	54	54	54	54
R1131	35	Residential	NCA04	54	60	54	60	46	54	46	54	52	52	52	52
R1132	35	Residential	NCA04	55	61	55	61	46	51	46	51	53	53	53	53
R1133	35	Residential	NCA04	51	57	51	57	43	50	43	50	49	49	49	49
R1134	35	Residential	NCA04	54	60	54	60	45	52	45	52	52	52	52	52
R1135	35	Residential	NCA04	54	60	54	60	46	54	46	54	52	52	52	52
R1136	35	Residential	NCA04	54	60	54	60	45	52	45	52	52	52	52	52
R1137	35	Residential	NCA04	52	58	52	58	44	50	43	50	50	50	50	50
R1138	35	Residential	NCA04	49	55	49	55	46	51	45	51	47	47	47	47
R0702	39	Residential	NCA02	37	43	37	43	32	37	32	37	35	40	35	40
R0703	39	Residential	NCA02	46	52	46	52	44	50	43	50	44	52	44	51
R0704	39	Residential	NCA02	61	61	61	61	62	62	62	62	62	70	62	70
R0705	39	Residential	NCA02	62	62	62	62	63	63	63	63	63	71	63	71
R0706	39	Residential	NCA02	63	63	63	63	64	64	64	64	64	72	64	72
R0707	39	Residential	NCA02	57	57	57	57	58	58	58	58	58	66	58	66
R0708	39	Residential	NCA02	64	64	64	64	65	65	65	65	65	73	65	73
R0709	39	Residential	NCA02	55	55	55	55	56	56	56	56	56	64	56	64
R0710	39	Residential	NCA02	59	59	59	59	60	60	60	60	60	68	60	68
R0711	39	Residential	NCA02	60	60	60	60	61	61	61	61	61	69	61	69
R0712	39	Residential	NCA02	60	60	60	60	61	61	61	61	61	69	61	69
R0713	39	Residential	NCA02	60	60	60	60	61	61	61	61	61	69	61	69
R0714	55	Place of worship	Place of worship	56	56	56	56	57	57	57	57	57	65	57	65

Appendix E – Predicted construction noise levels against the NPI PNTLs

Predicted noise levels against PNTLs: Noise Policy for Industry

Receiver ID	Project Noise Trigger Level (NPI)	Receiver Type	NCA	CS1A	CS1B	CS1C	CS1D	CS2A	CS2B	CS2C	CS2D	CS3A	CS3B	CS3C	CS3D
			Exceeds Project Noise Trigger Level		Exceeds Project Noise Trigger Level + 10 dBA				Exceeds Project Noise Trigger Level + 20 dBA						
R0001	55	Active Recreation	Active Recreation	60	60	60	60	61	61	61	61	61	69	61	69
R0002	65	Commercial	Commercial	40	46	40	43	34	40	34	40	35	42	35	42
R0003	65	Commercial	Commercial	44	50	44	50	43	50	44	50	42	47	42	47
R0004	65	Commercial	Commercial	60	60	60	60	61	61	61	61	61	69	61	69
R0005	65	Commercial	Commercial	46	50	46	50	47	52	47	52	47	55	47	55
R0006	50	Place of worship	Place of worship	44	50	44	50	44	50	44	50	42	48	42	47
R0007	65	Commercial	Commercial	44	50	44	49	45	50	45	50	45	53	45	53
R0008	65	Commercial	Commercial	44	47	44	47	43	50	43	50	42	50	42	50
R0009	65	Commercial	Commercial	45	51	45	51	45	50	44	50	45	53	44	52
R0010	65	Commercial	Commercial	41	47	41	45	38	43	39	43	37	41	37	41
R0011	65	Commercial	Commercial	43	49	44	49	44	49	45	49	42	50	42	50
R0012	65	Commercial	Commercial	38	43	38	43	35	42	35	42	35	40	35	40
R0013	65	Commercial	Commercial	41	47	41	47	39	47	39	47	39	45	39	46
R0014	65	Commercial	Commercial	44	49	44	49	45	48	45	48	45	53	45	53
R0015	65	Commercial	Commercial	38	44	38	44	37	42	37	42	37	45	37	45
R0016	65	Commercial	Commercial	36	42	36	42	35	38	37	37	34	40	34	40
R0017	65	Commercial	Commercial	37	43	37	43	35	39	35	40	35	41	35	41
R0018	65	Commercial	Commercial	35	38	35	38	36	39	36	39	36	44	36	44
R0019	65	Commercial	Commercial	36	38	36	38	37	37	37	37	37	45	37	45
R0020	65	Commercial	Commercial	39	45	39	45	33	38	33	38	37	39	37	40
R0021	65	Commercial	Commercial	40	42	42	42	41	41	43	43	41	49	43	51
R0022	65	Commercial	Commercial	47	52	47	52	48	48	48	48	48	56	48	56
R0023	65	Commercial	Commercial	41	47	41	47	34	39	34	39	39	39	39	40
R0024	65	Commercial	Commercial	40	46	40	46	30	33	31	34	38	38	38	39
R0025	65	Commercial	Commercial	37	43	37	43	30	35	30	35	35	38	35	38
R0026	65	Commercial	Commercial	38	42	38	42	39	41	39	41	37	45	37	45
R0027	65	Commercial	Commercial	45	51	45	51	41	47	41	48	43	46	43	49
R0028	65	Commercial	Commercial	48	54	48	54	47	54	49	54	47	55	49	57
R0029	65	Commercial	Commercial	39	45	39	45	33	37	34	37	37	39	37	39
R0030	65	Commercial	Commercial	36	41	36	41	37	38	37	38	37	45	37	45
R0031	65	Commercial	Commercial	35	41	35	41	32	38	32	37	33	38	33	38
R0032	65	Commercial	Commercial	40	46	40	46	41	42	41	43	38	46	38	46
R0033	65	Commercial	Commercial	32	38	33	38	30	34	31	34	30	38	30	38
R0034	65	Commercial	Commercial	40	45	40	45	41	41	41	41	37	44	37	44
R0035	65	Commercial	Commercial	33	39	34	39	31	36	32	36	31	38	31	38
R0036	65	Commercial	Commercial	33	39	33	39	31	34	32	34	31	38	31	38
R0037	65	Commercial	Commercial	34	37	34	37	35	36	35	36	35	43	35	43
R0038	65	Commercial	Commercial	37	41	37	41	38	41	38	41	38	46	38	46
R0039	65	Commercial	Commercial	44	50	44	50	45	50	45	50	45	53	45	53
R0040	65	Commercial	Commercial	34	40	34	40	31	34	32	34	32	38	32	38
R0041	65	Commercial	Commercial	32	38	33	39	30	33	31	33	31	38	31	38
R0042	65	Commercial	Commercial	43	49	43	49	42	49	42	49	41	48	41	48
R0043	65	Commercial	Commercial	34	40	34	38	32	34	32	34	30	37	30	37
R0044	65	Commercial	Commercial	45	51	45	51	43	50	43	50	43	50	43	50
R0045	65	Commercial	Commercial	33	39	33	39	34	38	34	38	34	42	34	42
R0046	65	Commercial	Commercial	40	46	40	43	39	42	39	42	35	42	35	42
R0047	65	Commercial	Commercial	34	39	34	39	35	38	35	38	34	42	34	42
R0048	65	Commercial	Commercial	37	37	37	35	35	37	35	37	29	37	29	37
R0049	65	Commercial	Commercial	44	50	44	50	42	44	42	44	42	50	42	50
R0050	65	Commercial	Commercial	47	53	47	53	40	46	40	46	45	47	45	47
R0051	65	Commercial	Commercial	35	37	36	37	32	33	33	33	29	36	29	36
R0052	65	Commercial	Commercial	36	37	37	37	33	33	34	34	29	36	29	36
R0053	65	Commercial	Commercial	51	57	51	57	45	50	45	50	49	53	49	53
R0054	65	Commercial	Commercial	40	46	39	45	37	45	37	45	38	42	37	42
R0055	65	Commercial	Commercial	42	48	42	48	40	43	40	43	40	43	40	44
R0056	65	Commercial	Commercial	47	53	47	53	44	51	44	51	45	50	45	51
R0057	65	Commercial	Commercial	34	40	34	40	35	40	35	39	32	39	32	39
R0058	65	Commercial	Commercial	44	50	44	50	40	44	40	44	42	44	42	44
R0059	65	Commercial	Commercial	47	53	47	53	43	51	43	51	45	46	45	48
R0060	65	Commercial	Commercial	38	44	38	44	35	38	35	38	36	40	36	40
R0061	65	Commercial	Commercial	43	49	43	49	43	48	43	48	41	48	41	48
R0062	65	Commercial	Commercial	34	40	34	40	29	35	29	35	32	36	32	36
R0063	65	Commercial	Commercial	41	47	41	47	36	43	36	43	39	41	39	41
R0064	65	Commercial	Commercial	38	44	38	44	35	41	35	41	36	40	36	40
R0065	65	Commercial	Commercial	42	48	42	48	38	45	39	45	40	42	40	43
R0066	65	Commercial	Commercial	41	47	41	47	36	43	37	43	39	40	39	40
R0067	65	Commercial	Commercial	36	42	36	41	32	36	33	36	33	37	33	37
R0068	65	Commercial	Commercial	35	41	35	41	29	32	29	32	33	37	33	37
R0069	65	Commercial	Commercial	51	57	51	57	42	49	42	49	49	49	49	49
R0070	65	Commercial	Commercial	48	54	48	54	43	50	43	50	46	51	46	51
R0071	65	Commercial	Commercial	47	53	47	53	44	51	44	51	45	50	45	50
R0072	65	Commercial	Commercial	38	44	38	44	36	42	36	42	36	42	36	42
R0073	65	Commercial	Commercial	36	39	36	39	37	37	37	37	37	45	37	45
R0074	65	Commercial	Commercial	38	42	38	42	37	40	38	40	34	38	34	39
R0075	65	Commercial	Commercial	33	39	33	39	32	34	32	35	31	37	31	37
R0076	65	Commercial	Commercial	49	55	49	55	47	52	47	52	47	55	47	55
R0077	65	Commercial	Commercial	44	50	44	50	45	49	45	49	45	53	45	53
R0078	65	Commercial	Commercial	38	44	38	44	36	44	36	44	36	44	36	44
R0079	65	Commercial	Commercial	44	50	44	50	40	48	40	48	42	44	42	44
R0080	65	Commercial	Commercial	44	50	44	50	44	49	44	49	44	52	44	52
R0081	65	Commercial	Commercial	43	49	43	49	44	49	44	49	44	52	44	52
R0082	65	Commercial	Commercial	42	48	42	48	37	45	37	45	40	40	40	40
R0083	65	Commercial	Commercial	37	43	37	43	34	37	34	37	35	35	35	36
R0084	65	Commercial	Commercial	43	49	43	49	44	48	44	48	44	52	44	52
R0085	65	Commercial	Commercial	40	46	40	46	36	43	36	42	38	43	38	43
R0086	65	Commercial	Commercial	42	48	42	48	35	42	35	42	40	43	40	43
R0087	65	Commercial	Commercial	44	50	44	50	45	48	45	48	45	53	45	53
R0088	65	Commercial	Commercial	36	40	36	39	33	36	33	36	31	36	31	36
R0089	65	Commercial	Commercial	42	48	42	47	38	46	38	46	39	44	39	44
R0090	65	Commercial	Commercial	42	48	42	45	40	45	40	45	40	48	40	48
R0091	65	Commercial	Commercial	40	46	40	44	39	44	38	44	38	46	38	46
R0092	65	Commercial	Commercial	40	46	40	44	40	44	41	44	37	45	40	48
R0093	65	Commercial	Commercial	38	41	38	38	39	39	39	39	39	47	39	47
R0094	65	Commercial	Commercial	38	42	38	40	39	41	39	41	39	47	39	47
R0095	65	Commercial	Commercial	42	48	42	46	41	45	41	46	39	47	39	47
R0096	65	Commercial	Commercial	38	44	38	44	36	42	36	42	36	43	36	43
R0097	65	Commercial	Commercial	35	40	35	40	35	39	35	38	32	39	32	39
R0098	65	Commercial	Commercial	41	47	41	44	41	44	41	44	41	49	41	49
R0099	65	Commercial	Commercial	43	49	43	49	38	43	38	43	41	44	41	44
R0100	65	Commercial	Commercial	47	53	47	53	43	50	43	50	45	48	45	50
R0101	65	Commercial	Commercial	46	52	46	52	42	48	42	48	44	47	44	48
R0102	65	Commercial	Commercial	45	51	45	51	42	48	42	48	43	48	43	49
R0103	65	Commercial	Commercial	46	52	46	52	45	48	45	48	45	53	45	53
R0104	55	Educational institute	Educational institute	47	52	47	52	48	52	48	52	48	56	48	56
R0105	55	Educational institute	Educational institute	65	65	65	65	66	66	66	66	66	74	66	74
R0106	55	Educational institute	Educational institute	71	71	71	71	72	72	72	72	72	80	72	80
R0107	55	Educational institute	Educational institute	63	63	63	63	64	64	64	64	64	72	64	72
R0108	65	Commercial	Commercial	44	48	44	48	44	48	45	48	45	53	45	53
R0109	55	Educational institute	Educational institute	63	63	63	63	64	64	64	64	64	72	64	72
R0110	55	Educational institute	Educational institute	63	63	63	63	64	64	64	64	64	72	64	72
R0111	65	Commercial	Commercial	48	52	47	52	49	51	48	51	49	57	48	56
R0112	55	Educational institute	Educational institute	59	59	59	59	60	60	60	60	60	68	60	68
R0113	50	Medical facility	Medical facility	44	50	44	50	43	43	43	43	43	51	43	51
R0114	50	Medical facility	Medical facility	46	52	46	52	44	48	44	48	44	52	44	52
R0115	50	Medical facility	Medical facility	44	50	44	50	42	45	42	45	42	50	42	50
R0116	50	Medical facility	Medical facility	50	56	50	56	49	55	49	55	48	56	48	56
R0117	50	Medical facility	Medical facility	49	55	50	55	50	53	51	53	49	57	49	57
R0118	50	Medical facility	Medical facility	49	55	49	54	47	52	47	52	47	55	47	55
R0119	50	Medical facility	Medical facility	44	50	44	50	44	44	44	44	44	52	44	52
R0120	65	Commercial	Commercial	37	43	37	43	37	37	37	37	37	45	37	45
R0121	70	Industrial	Industrial	67	73	67	74	59	66	59	66	66	67	66	67
R0122	65	Commercial	Commercial	40	46	40	43	37	42	37	42	37	45	37	45
R0123	65	Commercial	Commercial	40	46	40	43	34	39	34	39	35	42	35	42
R0124	65	Commercial	Commercial	39	41	40	41	40	44	41	44	36	42	36	42
R0125	65	Commercial	Commercial	37	42	37	42	38	39	38	39	35	43	35	43
R0126	65	Commercial	Commercial	38	44	38	44	35	41	35	41	36	43	36	43
R0127	65	Commercial	Commercial	33	37	33	37	34	37	34	37	34	42	34	42
R0128	65	Commercial	Commercial	34	38	34	40	35	38	35	38	35	43	35	43
R0129	65	Commercial	Commercial	32	33	32	33	33	33	33	33	33	41	33	41
R0130	65	Commercial	Commercial	38	38	39	39	36	40	40	40	33	41	33	41
R0131	65	Commercial	Commercial	34	40	34	40	35	40	35	40	32	39	32	39
R0132	65	Commercial	Commercial	42	48	42	48	34	41	37	41	40	40	40	40
R0133	70	Industrial	Industrial	52	58	52	58	41	49	44	52	50	50	50	50
R0134	65	Commercial	Commercial	40	46	40	46	33	38	33	38	38	39	38	39
R0135	65	Commercial	Commercial	37	43	37	43	35	40	35	40	35	39	35	39
R0136	65	Commercial	Commercial	38	44	38	44	35	39	35	39	36	38	36	39
R0137	70	Industrial	Industrial	48	54	47	53	34	34	34	34	46	46	45	45
R0138	70	Industrial	Industrial	50	56	50	56	34	34	34	34	48	48	48	48
R0139	70	Industrial	Industrial	51	57	51	57	35	39	35	41	49	49	49	49
R0140	70	Industrial	Industrial	42	48	42	48	24	30	24	31	40	40	40	40

Predicted noise levels against PNTLs: Noise Policy for Industry

Receiver ID	Project Noise Trigger Level (NPI)	Receiver Type	NCA	CS1A	CS1B	CS1C	CS1D	CS2A	CS2B	CS2C	CS2D	CS3A	CS3B	CS3C	CS3D
			Exceeds Project Noise Trigger Level		Exceeds Project Noise Trigger Level + 10 dBA				Exceeds Project Noise Trigger Level + 20 dBA						
R0141	70	Industrial	Industrial	50	56	50	56	34	35	34	37	48	48	48	48
R0142	70	Industrial	Industrial	49	55	49	55	42	45	43	51	47	47	47	47
R0143	70	Industrial	Industrial	44	50	45	51	33	33	33	33	42	42	43	43
R0144	70	Industrial	Industrial	40	46	40	46	30	30	30	30	38	38	38	38
R0145	70	Industrial	Industrial	41	47	41	47	32	32	31	31	39	40	39	39
R0146	55	Educational institute	Educational institute	64	64	64	64	65	65	65	65	65	73	65	73
R0147	50	Place of worship	Place of worship	51	53	51	53	52	53	52	52	52	60	52	60
R0148	40	Residential	NCA01	37	43	37	39	32	32	32	32	32	40	32	40
R0149	40	Residential	NCA01	37	43	37	40	32	32	32	32	32	40	32	40
R0150	40	Residential	NCA01	35	41	35	38	32	32	32	32	32	40	32	40
R0151	40	Residential	NCA01	31	37	31	34	30	30	30	30	30	38	30	38
R0152	40	Residential	NCA01	33	39	33	36	31	31	31	31	31	39	31	39
R0153	40	Residential	NCA01	35	41	35	37	30	31	30	31	30	38	30	38
R0154	40	Residential	NCA01	29	35	29	32	26	27	26	28	26	34	26	34
R0155	40	Residential	NCA01	35	41	35	37	32	32	32	32	32	40	32	40
R0156	40	Residential	NCA01	36	42	36	38	34	34	34	34	34	42	34	42
R0157	40	Residential	NCA01	36	42	36	39	34	34	34	34	34	42	34	42
R0158	40	Residential	NCA01	37	43	37	40	32	32	32	32	32	40	32	40
R0159	40	Residential	NCA01	37	43	37	39	31	32	31	32	31	39	31	39
R0160	40	Residential	NCA01	35	41	35	37	31	31	31	31	31	39	31	39
R0161	40	Residential	NCA01	38	44	38	40	29	35	29	35	32	37	32	37
R0162	40	Residential	NCA01	32	36	32	30	30	30	30	30	30	38	30	38
R0163	40	Residential	NCA01	37	43	37	39	34	34	34	34	34	42	34	42
R0164	40	Residential	NCA01	37	38	37	37	38	38	38	38	38	46	38	46
R0165	40	Residential	NCA01	37	37	37	35	36	36	36	36	36	44	36	44
R0166	40	Residential	NCA01	34	39	34	37	31	31	31	32	31	39	31	39
R0167	40	Residential	NCA01	34	40	34	36	30	31	30	31	30	38	30	38
R0168	40	Residential	NCA01	37	37	37	37	38	38	38	38	38	46	38	46
R0169	40	Residential	NCA01	33	39	33	36	28	31	28	31	28	34	28	34
R0170	40	Residential	NCA01	33	39	33	36	32	32	32	32	32	40	32	40
R0171	40	Residential	NCA01	36	42	36	38	35	35	35	35	35	43	35	43
R0172	40	Residential	NCA01	37	38	37	37	36	36	36	36	36	44	36	44
R0173	40	Residential	NCA01	31	37	31	35	25	29	25	30	27	32	27	32
R0174	40	Residential	NCA01	31	37	32	34	26	30	26	30	24	31	26	31
R0175	40	Residential	NCA01	30	36	30	33	28	29	28	30	28	36	28	36
R0176	40	Residential	NCA01	40	44	40	41	41	41	41	41	41	49	41	49
R0177	40	Residential	NCA01	27	33	27	32	27	29	27	29	27	35	27	35
R0178	40	Residential	NCA01	37	37	37	33	34	34	34	34	34	42	34	42
R0179	40	Residential	NCA01	33	35	33	29	30	30	30	30	30	38	30	38
R0180	40	Residential	NCA01	37	37	37	33	34	34	34	34	34	42	34	42
R0181	40	Residential	NCA01	37	43	37	39	34	35	34	35	34	42	34	42
R0182	40	Residential	NCA01	32	38	32	34	29	32	29	32	29	37	29	37
R0183	40	Residential	NCA01	36	42	36	39	34	34	34	34	34	42	34	42
R0184	40	Residential	NCA01	39	40	39	38	38	38	38	38	38	46	38	46
R0185	40	Residential	NCA01	38	40	38	39	40	40	40	40	40	48	40	48
R0186	40	Residential	NCA01	32	38	32	34	26	32	26	32	26	34	26	34
R0187	40	Residential	NCA01	34	40	34	37	27	34	27	34	29	34	29	34
R0188	40	Residential	NCA01	36	42	36	39	34	35	34	35	34	42	34	42
R0189	40	Residential	NCA01	32	38	32	35	30	31	30	31	30	38	30	38
R0190	40	Residential	NCA01	34	38	34	35	31	33	31	33	31	39	31	39
R0191	40	Residential	NCA01	38	38	38	35	36	36	36	36	36	44	36	44
R0192	40	Residential	NCA01	38	38	38	38	39	39	39	39	39	47	39	47
R0193	40	Residential	NCA01	33	39	33	36	30	33	30	33	30	38	30	38
R0194	40	Residential	NCA01	33	39	33	36	30	32	30	32	30	38	30	38
R0195	40	Residential	NCA01	38	44	38	42	39	39	39	39	39	47	39	47
R0196	40	Residential	NCA01	32	38	32	34	29	32	29	32	29	37	29	37
R0197	40	Residential	NCA01	34	38	34	35	31	33	31	33	31	39	31	39
R0198	40	Residential	NCA01	37	43	37	39	32	35	32	35	32	40	32	40
R0199	40	Residential	NCA01	33	38	33	35	30	32	30	32	30	38	30	38
R0200	40	Residential	NCA01	39	45	39	41	36	37	35	37	35	43	35	43
R0201	40	Residential	NCA01	41	47	41	44	42	42	42	42	42	50	42	50
R0202	40	Residential	NCA01	41	47	41	43	42	42	42	42	42	50	42	50
R0203	40	Residential	NCA01	33	39	33	38	28	33	28	33	30	36	30	36
R0204	40	Residential	NCA01	41	44	41	41	42	42	42	42	42	50	42	50
R0205	40	Residential	NCA01	31	36	31	36	29	32	29	32	29	37	29	37
R0206	40	Residential	NCA01	34	40	34	40	33	34	33	34	33	41	33	41
R0207	40	Residential	NCA01	33	39	33	39	29	34	29	34	31	37	31	37
R0208	40	Residential	NCA01	41	41	41	41	42	42	42	42	42	50	42	50
R0209	40	Residential	NCA01	33	39	33	37	28	33	28	33	29	35	29	35
R0210	40	Residential	NCA01	35	41	35	40	30	36	30	36	32	38	32	38
R0211	40	Residential	NCA01	33	39	33	37	29	32	29	32	29	37	29	37
R0212	40	Residential	NCA01	33	38	33	38	32	33	32	33	32	40	32	40
R0213	40	Residential	NCA01	39	44	39	41	40	40	40	40	40	48	40	48
R0214	40	Residential	NCA01	34	35	34	35	33	33	33	33	33	41	33	41
R0215	40	Residential	NCA01	32	37	32	37	30	33	30	33	30	38	30	38
R0216	40	Residential	NCA01	39	43	39	39	39	40	40	40	40	48	40	48
R0217	40	Residential	NCA01	31	37	31	37	29	32	29	32	29	37	29	37
R0218	40	Residential	NCA01	41	41	41	40	42	41	41	41	41	49	41	49
R0219	40	Residential	NCA01	31	37	31	37	28	33	28	33	29	36	29	36
R0220	40	Residential	NCA01	34	38	34	37	32	34	32	34	32	40	32	40
R0221	40	Residential	NCA01	31	36	31	36	31	32	30	32	30	38	30	38
R0222	40	Residential	NCA01	36	42	36	42	29	36	29	36	34	37	34	37
R0223	40	Residential	NCA01	37	43	37	40	38	39	38	39	38	46	38	46
R0224	40	Residential	NCA01	31	37	31	36	28	32	29	32	28	36	28	36
R0225	40	Residential	NCA01	40	45	40	42	41	41	41	41	41	49	41	49
R0226	40	Residential	NCA01	33	39	33	39	31	34	31	34	31	39	31	39
R0227	40	Residential	NCA01	36	36	36	36	37	37	37	37	37	45	37	45
R0228	40	Residential	NCA01	41	44	41	43	42	42	42	42	42	50	42	50
R0229	40	Residential	NCA01	43	48	43	48	44	44	44	44	44	52	44	52
R0230	40	Residential	NCA01	34	40	34	40	34	34	34	34	34	42	34	42
R0231	40	Residential	NCA01	44	48	44	44	45	45	45	45	45	53	45	53
R0232	40	Residential	NCA01	35	41	35	41	32	36	32	36	33	40	33	40
R0233	40	Residential	NCA01	40	42	40	42	41	41	41	41	41	49	41	49
R0234	40	Residential	NCA01	41	41	41	41	42	42	42	42	42	50	42	50
R0235	40	Residential	NCA01	32	37	32	37	30	32	30	32	30	38	30	38
R0236	40	Residential	NCA01	33	39	34	39	31	35	31	35	31	39	31	39
R0237	40	Residential	NCA01	38	44	38	44	31	37	30	37	36	38	36	38
R0238	40	Residential	NCA01	31	37	31	35	31	33	31	33	31	39	31	39
R0239	40	Residential	NCA01	28	34	28	34	29	32	29	32	29	37	29	37
R0240	40	Residential	NCA01	29	35	29	35	30	32	30	32	30	38	30	38
R0241	40	Residential	NCA01	30	35	30	35	31	31	29	32	29	37	29	37
R0242	40	Residential	NCA01	31	37	31	35	29	32	29	32	29	37	29	37
R0243	40	Residential	NCA01	32	38	32	38	30	34	30	34	30	38	30	38
R0244	40	Residential	NCA01	40	40	40	40	41	41	41	41	41	49	41	49
R0245	40	Residential	NCA01	31	37	35	37	32	34	32	34	29	35	29	35
R0246	40	Residential	NCA01	35	41	35	41	33	35	33	35	33	41	33	41
R0247	40	Residential	NCA01	44	47	44	47	45	45	45	45	45	53	45	53
R0248	40	Residential	NCA01	44	47	44	47	45	45	45	45	45	53	45	53
R0249	40	Residential	NCA01	39	39	39	39	40	40	40	40	40	48	40	48
R0250	40	Residential	NCA01	35	41	35	41	30	35	30	35	33	38	33	38
R0251	40	Residential	NCA01	32	37	35	37	33	33	33	33	33	41	33	41
R0252	40	Residential	NCA01	45	48	45	48	46	46	46	46	46	54	46	54
R0253	40	Residential	NCA01	41	41	41	41	42	42	42	42	42	50	42	50
R0254	40	Residential	NCA01	31	37	31	37	29	33	29	33	29	36	29	36
R0255	40	Residential	NCA01	45	48	45	48	46	46	46	46	46	54	46	54
R0256	40	Residential	NCA01	43	45	43	45	44	44	44	44	44	52	44	52
R0257	40	Residential	NCA01	32	38	32	38	32	33	32	33	32	40	32	40
R0258	40	Residential	NCA01	42	48	42	48	43	45	43	45	43	51	43	51
R0259	40	Residential	NCA01	30	32	30	32	31	32	31	32	31	39	31	39
R0260	40	Residential	NCA01	34	40	34	40	32	35	33	35	33	41	33	41
R0261	40	Residential	NCA01	46	48	46	48	47	47	47	47	47	55	47	55
R0262	40	Residential	NCA01	33	39	33	39	33	34	33	34	33	41	33	41
R0263	40	Residential	NCA01	29	34	29	34	30	32	30	32	30	38	30	38
R0264	40	Residential	NCA01	35	38	35	38	36	36	36	36	36	44	36	44
R0265	40	Residential	NCA01	29	35	29	35	29	33	29	33	28	36	28	36
R0266	40	Residential	NCA01	44	46	44	46	45	45	45	45	45	53	45	53
R0267	40	Residential	NCA01	42	48	42	48	43	43	43	43	43	51	43	51
R0268	40	Residential	NCA01	30	36	30	36	29	33	29	33	29	37	29	37
R0269	40	Residential	NCA01	33	39	33	39	34	35	34	35	34	42	34	42
R0270	40	Residential	NCA01	42	42	42	42	43	43	43	43	43	51	43	51
R0271	40	Residential	NCA01	42	48	42	48	43	43	43	43	43	51	43	51
R0272	40	Residential	NCA01	35	41	35	41	32	36	32	36	33	40	33	40
R0273	40	Residential	NCA01	40	40	40	40	41	41	41	41	41	49	41	49
R0274	40	Residential	NCA01	49	49	49	49	50	50	50	50	50	58	50	58
R0275	40	Residential	NCA01	41	47	41	47	42	42	42	42	42	50	42	50
R0276	40	Residential	NCA01	44	50	44	50	36	44	36	44	42	42	42	42
R0277	40	Residential	NCA01	48	48	48	48	49	49	49	49	49	57	49	57
R0278	40	Residential	NCA01	47	47	47	47	48	48	48	48	48	56	48	56
R0279	40	Residential	NCA01	48	48	48	48	49	49	49	49	49	57	49	57
R0280	40	Residential	NCA01	44	50	44	50	36	42	36	42	42	44	42	44

Predicted noise levels against PNTLs: Noise Policy for Industry

Receiver ID	Project Noise Trigger Level (NPI)	Receiver Type	NCA	CS1A	CS1B	CS1C	CS1D	CS2A	CS2B	CS2C	CS2D	CS3A	CS3B	CS3C	CS3D
			Exceeds Project Noise Trigger Level		Exceeds Project Noise Trigger Level + 10 dBA				Exceeds Project Noise Trigger Level + 20 dBA						
R0281	40	Residential	NCA01	45	51	45	51	40	48	40	48	43	47	43	47
R0282	40	Residential	NCA01	46	47	46	47	47	47	47	47	47	55	47	55
R0283	40	Residential	NCA01	45	45	45	45	46	46	46	46	46	54	46	54
R0284	40	Residential	NCA01	43	49	43	49	38	44	38	44	41	46	41	46
R0285	40	Residential	NCA01	46	48	46	48	47	47	47	47	47	55	47	55
R0286	40	Residential	NCA01	46	52	46	52	41	48	41	48	44	49	44	49
R0287	40	Residential	NCA01	45	51	45	51	38	43	38	43	43	46	43	46
R0288	40	Residential	NCA01	47	47	47	47	48	48	48	48	48	56	48	56
R0289	40	Residential	NCA01	46	52	46	52	45	48	45	48	45	53	45	53
R0290	40	Residential	NCA01	46	51	46	51	47	48	47	48	47	55	47	55
R0291	40	Residential	NCA01	45	51	45	51	39	47	39	47	43	47	43	47
R0292	40	Residential	NCA01	46	52	46	52	43	49	43	49	44	51	44	51
R0293	40	Residential	NCA01	50	50	50	50	51	51	51	51	51	59	51	59
R0294	40	Residential	NCA01	44	50	44	50	40	41	40	42	42	48	42	48
R0295	40	Residential	NCA01	50	51	50	51	51	51	51	51	51	59	51	59
R0296	40	Residential	NCA01	48	54	48	54	44	51	44	51	46	52	46	52
R0297	40	Residential	NCA01	52	52	52	52	53	53	53	53	53	61	53	61
R0298	40	Residential	NCA01	39	45	39	45	35	40	35	40	37	42	37	42
R0299	40	Residential	NCA01	51	51	51	51	52	52	52	52	52	60	52	60
R0300	40	Residential	NCA01	52	58	52	58	48	55	48	55	50	56	50	56
R0301	40	Residential	NCA01	53	56	53	56	54	54	54	54	54	62	54	62
R0302	40	Residential	NCA01	53	55	53	55	54	54	54	54	54	62	54	62
R0303	40	Residential	NCA01	52	58	52	58	50	54	50	54	50	53	50	53
R0304	40	Residential	NCA01	45	51	45	51	43	43	43	43	43	51	43	51
R0305	40	Residential	NCA01	53	58	53	58	53	59	53	59	53	61	53	61
R0306	40	Residential	NCA01	56	60	56	61	57	59	57	60	53	61	53	61
R0307	40	Residential	NCA01	51	57	51	57	52	54	52	54	49	55	49	55
R0308	40	Residential	NCA01	50	55	49	55	51	53	50	53	47	55	47	55
R0309	40	Residential	NCA01	58	61	58	61	59	61	59	62	53	60	54	60
R0310	40	Residential	NCA01	39	45	39	45	40	42	40	42	40	48	40	48
R0311	40	Residential	NCA01	59	60	59	60	60	60	60	61	53	61	53	61
R0312	40	Residential	NCA01	56	60	56	60	57	60	57	60	52	57	52	57
R0313	40	Residential	NCA01	41	46	41	46	42	42	42	42	42	50	42	50
R0314	40	Residential	NCA01	53	56	53	56	54	56	54	56	54	62	54	62
R0315	40	Residential	NCA01	38	42	38	42	39	39	39	39	34	40	34	40
R0316	40	Residential	NCA01	56	59	57	59	57	59	58	59	51	58	51	58
R0317	40	Residential	NCA01	54	57	54	57	55	60	55	60	55	63	55	63
R0318	40	Residential	NCA01	61	61	61	62	62	62	62	62	56	64	56	64
R0319	40	Residential	NCA01	38	42	38	42	39	39	39	39	39	47	39	47
R0320	40	Residential	NCA01	54	56	54	57	55	56	55	56	48	56	49	56
R0321	40	Residential	NCA01	56	58	56	58	57	61	57	61	56	64	56	64
R0322	40	Residential	NCA01	59	61	59	62	60	61	60	62	53	61	54	61
R0323	40	Residential	NCA01	39	42	39	42	40	40	40	40	38	46	38	46
R0324	40	Residential	NCA01	50	56	50	56	51	54	51	54	48	53	48	53
R0325	40	Residential	NCA01	41	41	41	41	42	42	42	42	42	50	42	50
R0326	40	Residential	NCA01	59	61	58	62	60	60	59	62	53	57	54	57
R0327	40	Residential	NCA01	56	59	56	59	57	59	57	59	57	65	57	65
R0328	40	Residential	NCA01	48	54	48	54	45	49	45	49	46	52	46	52
R0329	40	Residential	NCA01	50	56	50	56	50	54	50	54	48	54	48	54
R0330	40	Residential	NCA01	34	37	34	36	35	36	35	35	35	43	35	43
R0331	40	Residential	NCA01	41	42	41	42	42	42	42	42	42	50	42	50
R0332	40	Residential	NCA01	41	47	41	47	40	40	40	40	40	48	40	48
R0333	40	Residential	NCA01	58	60	58	60	59	61	59	62	57	65	57	65
R0334	40	Residential	NCA01	49	54	49	54	50	52	50	52	46	52	46	52
R0335	40	Residential	NCA01	49	55	49	55	46	53	46	53	47	53	47	53
R0336	40	Residential	NCA01	39	43	39	43	40	41	40	41	40	48	40	48
R0337	40	Residential	NCA01	39	43	39	43	40	40	40	40	40	48	40	48
R0338	40	Residential	NCA01	30	36	30	36	30	35	30	35	28	34	28	34
R0339	40	Residential	NCA01	43	44	43	44	44	46	44	46	44	52	44	52
R0340	40	Residential	NCA01	56	60	56	60	57	57	57	57	52	57	52	57
R0341	40	Residential	NCA01	48	54	48	54	47	50	47	50	46	53	46	53
R0342	40	Residential	NCA01	54	56	54	56	55	56	55	56	49	57	49	57
R0343	40	Residential	NCA01	37	39	37	39	37	37	37	37	37	45	37	45
R0344	40	Residential	NCA01	47	52	47	52	48	51	48	51	44	52	44	52
R0345	40	Residential	NCA01	34	40	34	40	31	35	31	36	32	36	32	36
R0346	40	Residential	NCA01	46	52	46	52	44	46	44	46	44	52	44	52
R0347	40	Residential	NCA01	65	65	65	65	66	66	66	66	55	59	55	59
R0348	40	Residential	NCA01	34	40	34	40	35	36	35	36	35	43	35	43
R0349	40	Residential	NCA01	53	56	53	56	54	55	54	55	48	56	48	56
R0350	40	Residential	NCA01	64	64	64	64	65	65	65	65	55	59	56	59
R0351	40	Residential	NCA01	61	61	61	61	62	62	62	62	59	67	59	67
R0352	40	Residential	NCA01	46	52	46	52	43	47	43	47	44	51	44	51
R0353	40	Residential	NCA01	38	44	38	44	38	39	38	39	38	46	38	46
R0354	40	Residential	NCA01	63	64	63	64	64	64	64	64	56	59	56	59
R0355	40	Residential	NCA01	50	56	50	56	50	54	50	54	49	57	49	57
R0356	40	Residential	NCA01	42	48	42	48	42	44	42	44	42	50	42	50
R0357	40	Residential	NCA01	62	63	62	62	63	63	63	63	55	58	54	58
R0358	40	Residential	NCA01	51	57	51	57	48	55	48	55	49	56	49	56
R0359	40	Residential	NCA01	60	64	60	60	61	64	61	61	56	59	53	59
R0360	40	Residential	NCA01	48	54	48	54	48	53	49	53	48	56	48	56
R0361	40	Residential	NCA01	40	46	40	46	36	38	36	38	38	44	38	44
R0362	40	Residential	NCA01	58	62	58	62	59	61	59	61	54	56	54	56
R0363	40	Residential	NCA01	63	66	63	66	64	67	64	66	59	59	58	59
R0364	40	Residential	NCA01	45	51	45	51	45	45	45	45	43	50	43	50
R0365	40	Residential	NCA01	62	62	62	62	63	63	63	63	63	71	63	71
R0366	40	Residential	NCA01	62	67	62	67	63	67	63	66	59	59	59	59
R0367	40	Residential	NCA01	58	61	58	61	59	62	59	62	54	59	54	59
R0368	40	Residential	NCA01	55	61	55	61	49	57	49	57	53	55	53	55
R0369	44	Residential	NCA02	64	64	64	64	65	65	65	65	65	73	65	73
R0370	40	Residential	NCA01	52	58	52	58	50	54	50	54	50	55	50	55
R0371	40	Residential	NCA01	59	62	58	62	60	61	59	61	54	58	54	58
R0372	40	Residential	NCA01	51	57	51	57	52	55	52	55	49	56	49	56
R0373	40	Residential	NCA01	51	57	51	57	43	43	43	43	49	50	49	50
R0374	40	Residential	NCA01	59	62	58	62	60	62	59	62	54	58	54	58
R0375	40	Residential	NCA01	52	58	52	58	46	52	46	52	50	54	50	54
R0376	40	Residential	NCA01	54	60	54	60	47	55	47	55	52	55	52	55
R0377	40	Residential	NCA01	58	63	57	63	57	64	57	63	56	59	55	59
R0378	40	Residential	NCA01	58	64	58	64	53	61	53	61	56	58	56	58
R0379	40	Residential	NCA01	51	57	51	57	41	44	41	44	49	49	49	49
R0380	40	Residential	NCA01	62	68	62	68	60	66	60	67	60	60	60	60
R0381	40	Residential	NCA01	60	66	60	66	58	64	58	66	58	59	58	59
R0382	40	Residential	NCA01	52	58	52	58	43	46	43	46	50	51	50	51
R0383	40	Residential	NCA01	61	67	61	67	56	64	58	66	59	59	59	59
R0384	40	Residential	NCA01	58	64	58	64	53	61	53	61	56	56	56	56
R0385	40	Residential	NCA01	60	66	60	66	57	65	58	66	58	60	58	60
R0386	40	Residential	NCA01	58	64	59	65	56	64	57	65	56	58	57	58
R0387	40	Residential	NCA01	57	63	57	63	49	57	49	57	55	55	55	55
R0388	40	Residential	NCA01	59	65	59	65	55	63	55	63	57	57	57	57
R0389	40	Residential	NCA01	66	66	66	66	67	67	67	67	55	59	54	59
R0390	40	Residential	NCA01	66	66	66	66	67	67	67	67	55	59	54	59
R0391	40	Residential	NCA01	67	67	67	67	68	68	68	68	54	60	54	60
R0392	40	Residential	NCA01	66	66	66	66	67	67	67	67	54	60	55	60
R0393	40	Residential	NCA01	65	65	65	65	66	66	66	66	55	60	56	60
R0394	40	Residential	NCA01	64	64	64	64	65	65	65	65	54	60	56	60
R0395	40	Residential	NCA01	64	64	64	64	65	65	65	65	55	60	56	60
R0396	40	Residential	NCA01	62	63	62	64	63	63	63	65	55	62	57	62
R0397	40	Residential	NCA01	62	62	62	63	63	63	63	63	54	62	55	62
R0398	40	Residential	NCA01	60	61	60	62	61	61	61	61	53	60	54	60
R0399	40	Residential	NCA01	62	62	62	63	63	63	63	63	54	62	55	62
R0400	40	Residential	NCA01	59	65	59	65	60	65	60	65	57	59	57	59
R0401	40	Residential	NCA01	60	62	60	62	61	62	61	64	56	64	56	64
R0402	40	Residential	NCA01	62	62	62	62	63	63	63	64	56	64	56	64
R0403	40	Residential	NCA01	65	65	65	65	66	66	66	66	60	68	60	68
R0404	40	Residential	NCA01	66	66	66	66	67	67	67	67	61	69	61	69
R0405	40	Residential	NCA01	65	65	65	65	66	66	66	66	62	70	62	70
R0406	40	Residential	NCA01	63	63	63	63	64	64	64	64	64	72	64	72
R0407	40	Residential	NCA01	63	63	63	63	64	64	64	64	64	72	64	72
R0408	40	Residential	NCA01	63	63	63	63	64	64	64	64	64	72	64	72
R0409	44	Residential	NCA02	65	65	65	65	66	66	66	66	66	74	66	74
R0410	40	Residential	NCA01	55	57	55	57	56	59	56	59	56	64	56	64
R0411	40	Residential	NCA01	54	57	54	57	55	58	55	58	55	63	55	63
R0412	40	Residential	NCA01	53	53	53	53	54	54	54	54	54	62	54	62
R0413	40	Residential	NCA01	53	55	53	55	54	54	54	54	54	62	54	62
R0414	50	Medical facility	Medical facility	37	43	37	43	37	37	37	37	37	45	37	45
R0415	40	Residential	NCA01	31	37	32	37	29	33	29	33	29	33	29	33
R0416	40	Residential	NCA01	32	38	32	34	29	31	29	31	29	37	29	37
R0417	40	Residential	NCA01	30	36	30	31	26	29	26	30	26	34	26	34
R0418	40	Residential	NCA01	32	37	32	29	30	30	30	30	30	38	30	38
R0419	40	Residential	NCA01	30	36	30	27	24	28	24	27	22	30	22	30
R0420	40	Residential	NCA01	32	38	32	27	23	26	23	27	23	31	23	31

Predicted noise levels against PNTLs: Noise Policy for Industry

Receiver ID	Project Noise Trigger Level (NPI)	Receiver Type	NCA	CS1A	CS1B	CS1C	CS1D	CS2A	CS2B	CS2C	CS2D	CS3A	CS3B	CS3C	CS3D
			Exceeds Project Noise Trigger Level		Exceeds Project Noise Trigger Level + 10 dBA				Exceeds Project Noise Trigger Level + 20 dBA						
R0421	40	Residential	NCA01	38	44	38	40	36	36	36	36	36	44	36	44
R0422	40	Residential	NCA01	43	48	44	48	44	49	45	49	43	51	43	51
R0423	40	Residential	NCA01	60	66	60	66	56	64	57	65	58	58	58	58
R0424	40	Residential	NCA01	33	39	33	36	31	31	31	31	31	39	31	39
R0425	40	Residential	NCA01	36	42	36	39	32	32	32	32	32	40	32	40
R0426	40	Residential	NCA01	34	40	34	37	32	32	32	32	32	40	32	40
R0427	40	Residential	NCA01	34	40	34	37	30	30	29	30	29	37	29	37
R0428	40	Residential	NCA01	38	44	38	40	37	37	37	37	37	45	37	45
R0429	40	Residential	NCA01	37	37	37	33	34	34	34	34	34	42	34	42
R0430	40	Residential	NCA01	39	45	39	42	39	39	39	39	39	47	39	47
R0431	40	Residential	NCA01	36	42	36	39	36	36	36	36	36	44	36	44
R0432	44	Residential	NCA02	35	41	35	37	35	35	35	35	35	43	35	43
R0433	44	Residential	NCA02	40	46	40	44	34	40	34	40	36	42	36	42
R0434	44	Residential	NCA02	35	37	35	33	32	32	32	32	32	40	32	40
R0435	44	Residential	NCA02	37	43	37	39	35	35	35	35	35	43	35	43
R0436	44	Residential	NCA02	36	42	36	41	34	34	34	34	34	42	34	42
R0437	44	Residential	NCA02	40	46	40	44	34	35	34	35	36	42	36	42
R0438	44	Residential	NCA02	38	44	38	41	31	39	31	39	33	39	33	39
R0439	44	Residential	NCA02	39	45	39	41	31	34	31	34	33	39	33	39
R0440	44	Residential	NCA02	37	40	37	40	38	38	38	38	38	46	38	46
R0441	44	Residential	NCA02	36	38	36	35	35	35	35	35	35	43	35	43
R0442	44	Residential	NCA02	37	37	37	34	35	35	35	35	35	43	35	43
R0443	44	Residential	NCA02	39	45	39	41	32	39	32	39	33	40	33	40
R0444	44	Residential	NCA02	38	44	38	41	31	39	31	39	33	38	33	39
R0445	44	Residential	NCA02	34	39	34	34	34	34	34	34	34	42	34	42
R0446	44	Residential	NCA02	38	44	38	40	31	33	31	33	32	39	32	39
R0447	44	Residential	NCA02	37	43	37	39	34	34	34	34	34	42	34	42
R0448	44	Residential	NCA02	38	44	38	40	33	34	33	34	33	41	33	41
R0449	44	Residential	NCA02	37	38	37	35	36	36	36	36	36	44	36	44
R0450	44	Residential	NCA02	37	42	37	38	34	34	34	34	34	42	34	42
R0451	44	Residential	NCA02	36	42	36	38	31	34	30	34	30	38	30	38
R0452	44	Residential	NCA02	40	46	40	43	34	36	34	36	35	42	35	42
R0453	44	Residential	NCA02	38	44	38	41	33	37	33	37	33	41	33	41
R0454	44	Residential	NCA02	37	43	37	39	25	32	25	32	31	33	31	33
R0455	44	Residential	NCA02	36	42	36	39	34	34	34	34	34	42	34	42
R0456	44	Residential	NCA02	39	45	39	42	40	40	40	40	40	48	40	48
R0457	44	Residential	NCA02	35	41	35	39	27	35	27	35	31	31	31	31
R0458	44	Residential	NCA02	37	43	37	36	27	29	27	29	28	35	28	35
R0459	44	Residential	NCA02	39	45	39	39	39	39	39	39	39	47	39	47
R0460	44	Residential	NCA02	40	46	40	42	37	37	37	37	37	45	37	45
R0461	44	Residential	NCA02	40	46	40	42	38	39	38	39	38	46	38	46
R0462	44	Residential	NCA02	38	44	38	40	27	33	27	33	32	35	32	35
R0463	44	Residential	NCA02	39	45	39	42	36	36	36	36	36	44	36	44
R0464	44	Residential	NCA02	40	45	40	42	35	36	36	36	36	44	36	44
R0465	44	Residential	NCA02	40	46	40	43	34	39	34	39	35	42	35	42
R0466	44	Residential	NCA02	39	45	39	42	33	41	34	41	34	39	34	39
R0467	44	Residential	NCA02	40	46	40	42	40	40	41	41	40	48	41	49
R0468	44	Residential	NCA02	41	47	40	43	38	38	38	38	38	46	38	46
R0469	44	Residential	NCA02	39	45	39	42	35	37	35	38	35	43	35	43
R0470	44	Residential	NCA02	42	48	42	45	40	41	41	41	41	49	41	49
R0471	44	Residential	NCA02	36	42	36	41	33	33	33	33	33	41	33	41
R0472	44	Residential	NCA02	40	46	40	44	34	40	34	40	36	42	36	42
R0473	44	Residential	NCA02	40	46	40	43	40	41	40	41	40	48	40	48
R0474	44	Residential	NCA02	38	44	38	40	36	38	36	38	36	44	36	44
R0475	44	Residential	NCA02	40	46	40	42	37	40	37	40	37	45	37	45
R0476	44	Residential	NCA02	42	46	42	42	43	43	43	43	43	51	43	51
R0477	44	Residential	NCA02	40	46	40	44	35	41	35	41	36	43	36	43
R0478	44	Residential	NCA02	40	46	40	42	36	37	36	37	36	44	36	44
R0479	44	Residential	NCA02	41	47	41	43	40	41	40	41	40	48	40	48
R0480	44	Residential	NCA02	39	45	39	42	34	40	34	40	34	42	34	42
R0481	44	Residential	NCA02	42	46	42	45	43	43	43	43	43	51	43	51
R0482	44	Residential	NCA02	41	47	41	43	41	41	41	41	41	49	41	49
R0483	44	Residential	NCA02	38	43	38	42	38	38	38	38	38	46	38	46
R0484	44	Residential	NCA02	41	46	41	43	42	42	42	42	42	50	42	50
R0485	44	Residential	NCA02	42	47	42	44	42	44	43	44	43	51	43	51
R0486	44	Residential	NCA02	39	39	39	39	40	40	40	40	40	48	40	48
R0487	44	Residential	NCA02	42	48	42	44	41	44	41	44	41	49	41	49
R0488	44	Residential	NCA02	44	50	44	49	42	45	42	45	42	50	42	50
R0489	44	Residential	NCA02	41	47	41	43	40	42	40	43	40	48	40	48
R0490	44	Residential	NCA02	42	48	42	44	42	44	42	44	42	50	42	50
R0491	44	Residential	NCA02	47	48	47	47	48	48	48	48	48	56	48	56
R0492	44	Residential	NCA02	47	47	47	47	48	48	48	48	48	56	48	56
R0493	44	Residential	NCA02	43	48	43	48	44	46	44	46	44	52	44	52
R0494	44	Residential	NCA02	47	48	47	47	48	48	48	48	48	56	48	56
R0495	44	Residential	NCA02	45	48	45	45	46	48	46	48	46	54	46	54
R0496	44	Residential	NCA02	45	48	44	45	46	48	45	48	46	54	45	53
R0497	44	Residential	NCA02	44	49	44	45	45	48	45	48	45	53	45	53
R0498	44	Residential	NCA02	46	52	46	48	44	45	44	45	44	52	44	52
R0499	44	Residential	NCA02	43	49	43	44	42	44	41	44	41	49	41	49
R0500	44	Residential	NCA02	48	48	48	48	49	49	49	49	49	57	49	57
R0501	44	Residential	NCA02	45	48	45	48	46	47	46	47	46	54	46	54
R0502	44	Residential	NCA02	44	50	45	46	46	49	46	49	45	53	46	54
R0503	44	Residential	NCA02	46	49	46	48	47	49	47	49	47	55	47	55
R0504	44	Residential	NCA02	44	50	44	45	43	48	43	48	43	51	43	51
R0505	44	Residential	NCA02	44	49	44	49	45	49	45	49	45	53	45	53
R0506	44	Residential	NCA02	48	49	48	49	49	49	49	49	49	57	49	57
R0507	44	Residential	NCA02	48	49	48	49	49	49	49	49	49	57	49	57
R0508	44	Residential	NCA02	46	49	46	49	47	47	47	47	47	55	47	55
R0509	44	Residential	NCA02	43	49	43	46	41	44	41	44	41	49	41	49
R0510	44	Residential	NCA02	41	47	41	44	39	44	39	44	39	47	39	47
R0511	44	Residential	NCA02	39	45	39	41	36	37	36	37	35	43	35	43
R0512	44	Residential	NCA02	44	50	44	45	45	48	45	48	45	53	45	53
R0513	44	Residential	NCA02	34	39	34	36	32	33	32	33	32	40	32	40
R0514	44	Residential	NCA02	47	50	47	49	48	49	48	49	48	56	48	56
R0515	44	Residential	NCA02	49	49	49	49	50	50	50	50	50	58	50	58
R0516	44	Residential	NCA02	38	44	38	42	34	42	34	42	34	42	34	42
R0517	44	Residential	NCA02	40	46	40	43	37	38	37	38	37	45	37	45
R0518	44	Residential	NCA02	48	49	48	49	49	49	49	49	49	57	49	57
R0519	44	Residential	NCA02	46	52	46	52	42	49	42	49	44	50	44	50
R0520	44	Residential	NCA02	40	46	40	42	36	38	36	38	36	44	36	44
R0521	44	Residential	NCA02	41	47	41	45	40	44	40	44	40	48	40	48
R0522	44	Residential	NCA02	42	48	42	46	42	48	42	48	42	50	42	50
R0523	44	Residential	NCA02	46	52	46	52	44	49	44	49	44	52	44	52
R0524	44	Residential	NCA02	45	51	45	48	42	48	42	48	42	50	42	50
R0525	44	Residential	NCA02	31	37	31	34	26	32	26	32	26	34	26	34
R0526	44	Residential	NCA02	47	49	47	49	48	49	48	49	48	56	48	56
R0527	44	Residential	NCA02	40	46	40	44	38	44	38	44	38	46	38	46
R0528	44	Residential	NCA02	46	52	46	52	45	49	45	49	45	53	45	53
R0529	44	Residential	NCA02	49	49	49	49	50	50	50	50	50	58	50	58
R0530	44	Residential	NCA02	35	41	35	40	33	33	33	34	33	41	33	41
R0531	44	Residential	NCA02	40	46	40	43	32	38	32	38	35	40	35	40
R0532	44	Residential	NCA02	46	52	46	52	43	49	43	49	44	51	44	51
R0533	44	Residential	NCA02	40	46	40	42	32	40	32	40	34	38	34	38
R0534	44	Residential	NCA02	41	47	41	44	39	43	39	43	39	47	39	47
R0535	44	Residential	NCA02	38	44	38	41	29	36	30	36	33	37	33	38
R0536	44	Residential	NCA02	43	49	43	49	41	47	41	47	41	49	41	49
R0537	44	Residential	NCA02	37	40	37	38	38	38	38	38	38	46	38	46
R0538	44	Residential	NCA02	42	48	42	48	41	48	41	48	41	49	41	49
R0539	44	Residential	NCA02	46	50	46	50	47	47	47	47	47	55	47	55
R0540	44	Residential	NCA02	32	32	32	31	32	32	32	32	32	40	32	40
R0541	44	Residential	NCA02	46	52	46	52	47	50	47	50	47	55	47	55
R0542	44	Residential	NCA02	38	44	38	40	30	37	31	37	32	38	32	38
R0543	44	Residential	NCA02	41	47	41	43	32	40	32	40	35	38	35	38
R0544	44	Residential	NCA02	39	45	39	42	38	40	38	40	38	46	38	46
R0545	44	Residential	NCA02	37	43	38	41	37	40	37	41	37	45	37	45
R0546	44	Residential	NCA02	45	51	45	51	43	48	43	48	43	51	43	51
R0547	44	Residential	NCA02	38	44	38	41	34	37	34	37	34	42	34	42
R0548	44	Residential	NCA02	43	49	43	49	41	48	41	48	41	49	41	49
R0549	44	Residential	NCA02	36	42	36	41	32	39	32	39	34	38	33	38
R0550	44	Residential	NCA02	44	50	44	50	43	48	43	48	43	51	43	51
R0551	44	Residential	NCA02	36	42	36	39	32	35	32	36	32	40	32	40
R0552	44	Residential	NCA02	50	51	50	51	51	51	51	51	51	59	51	59
R0553	44	Residential	NCA02	42	48	42	45	40	46	41	46	41	49	41	49
R0554	44	Residential	NCA02	47	53	47	53	46	51	46	51	46	54	46	54
R0555	44	Residential	NCA02	47	53	47	53	48	51	48	51	48	56	48	56
R0556	44	Residential	NCA02	34	40	34	39	28	35	28	35	31	35	31	36
R0557	44	Residential	NCA02	45	51	45	51	44	50	44	50	44	52	44	52
R0558	44	Residential	NCA02	43	49	43	49	40	45	40	45	41	48	41	48
R0559	44	Residential	NCA02	47	53	47	53	47	51	48	51	48	56	48	56
R0560	44	Residential	NCA02	40	46	40	43	38	42	38	42	38	46	38	46

Predicted noise levels against PNTLs: Noise Policy for Industry

Receiver ID	Project Noise Trigger Level (NPI)	Receiver Type	NCA	CS1A	CS1B	CS1C	CS1D	CS2A	CS2B	CS2C	CS2D	CS3A	CS3B	CS3C	CS3D
			Exceeds Project Noise Trigger Level		Exceeds Project Noise Trigger Level + 10 dBA				Exceeds Project Noise Trigger Level + 20 dBA						
R0561	44	Residential	NCA02	35	41	36	38	30	37	31	37	30	36	30	36
R0562	44	Residential	NCA02	33	38	33	35	31	33	31	33	31	39	31	39
R0563	44	Residential	NCA02	48	54	48	54	49	50	49	50	49	57	49	57
R0564	44	Residential	NCA02	43	49	43	49	42	49	42	49	42	50	42	50
R0565	44	Residential	NCA02	38	44	38	41	33	37	33	37	33	41	33	41
R0566	44	Residential	NCA02	43	49	43	49	41	46	41	46	41	49	41	49
R0567	44	Residential	NCA02	35	41	35	38	30	31	30	31	30	38	30	38
R0568	44	Residential	NCA02	47	47	47	47	48	48	48	48	48	56	48	56
R0569	44	Residential	NCA02	48	53	48	53	47	54	47	54	47	55	47	55
R0570	44	Residential	NCA02	35	41	35	39	32	35	32	35	32	40	32	40
R0571	44	Residential	NCA02	35	41	35	37	32	32	32	32	32	40	32	40
R0572	44	Residential	NCA02	51	54	51	54	51	52	52	52	52	60	52	60
R0573	44	Residential	NCA02	39	45	38	42	34	40	35	40	34	42	34	42
R0574	44	Residential	NCA02	43	49	43	49	40	47	40	47	41	48	41	48
R0575	44	Residential	NCA02	47	53	47	53	44	50	44	50	45	52	45	52
R0576	44	Residential	NCA02	48	54	48	54	49	54	49	54	49	57	49	57
R0577	44	Residential	NCA02	32	38	32	36	30	32	30	32	30	38	30	38
R0578	44	Residential	NCA02	47	50	47	50	48	51	48	51	48	56	48	56
R0579	44	Residential	NCA02	49	54	49	54	50	53	50	53	50	58	50	58
R0580	44	Residential	NCA02	35	41	34	38	31	34	31	34	31	39	31	39
R0581	44	Residential	NCA02	47	53	47	53	45	52	45	52	45	53	45	53
R0582	44	Residential	NCA02	38	44	38	41	36	40	37	39	33	40	33	40
R0583	44	Residential	NCA02	34	40	34	37	33	34	34	34	34	42	34	42
R0584	44	Residential	NCA02	35	39	35	36	33	33	33	33	32	40	32	40
R0585	44	Residential	NCA02	53	55	53	55	54	54	54	54	54	62	54	62
R0586	44	Residential	NCA02	48	54	48	54	49	53	49	53	49	57	49	57
R0587	44	Residential	NCA02	45	51	44	50	44	50	44	49	43	51	43	51
R0588	44	Residential	NCA02	47	53	47	53	45	51	45	51	45	53	45	53
R0589	44	Residential	NCA02	33	39	33	36	32	32	32	32	32	40	32	40
R0590	44	Residential	NCA02	34	40	34	39	35	35	36	36	31	37	31	37
R0591	44	Residential	NCA02	36	42	36	42	35	35	36	36	34	38	34	38
R0592	44	Residential	NCA02	48	54	48	54	47	54	47	54	47	55	47	55
R0593	44	Residential	NCA02	34	40	34	37	31	32	32	32	31	39	31	39
R0594	44	Residential	NCA02	40	46	40	46	41	42	41	42	39	47	39	47
R0595	44	Residential	NCA02	46	52	46	52	43	51	44	51	44	50	44	51
R0596	44	Residential	NCA02	33	39	33	35	31	31	31	31	31	39	31	39
R0597	44	Residential	NCA02	39	45	39	45	34	41	35	41	37	40	37	40
R0598	44	Residential	NCA02	40	46	40	46	39	42	39	42	38	46	38	46
R0599	44	Residential	NCA02	39	45	39	45	37	41	37	41	37	45	37	45
R0600	44	Residential	NCA02	37	43	37	40	35	39	35	39	32	37	32	37
R0601	44	Residential	NCA02	34	39	34	38	35	38	35	36	30	38	30	38
R0602	44	Residential	NCA02	50	55	50	55	51	55	51	55	51	59	51	59
R0603	44	Residential	NCA02	49	55	49	55	50	55	50	55	50	58	50	58
R0604	44	Residential	NCA02	33	39	33	36	32	33	32	33	32	40	32	40
R0605	44	Residential	NCA02	34	40	34	36	31	33	31	33	31	39	31	39
R0606	44	Residential	NCA02	31	37	31	37	32	33	32	33	32	40	32	40
R0607	44	Residential	NCA02	45	51	45	51	46	50	46	50	45	53	45	53
R0608	44	Residential	NCA02	34	40	34	37	30	33	30	33	30	38	30	38
R0609	44	Residential	NCA02	34	40	34	37	30	32	30	32	30	38	30	38
R0610	44	Residential	NCA02	34	40	34	37	31	32	32	32	32	40	32	40
R0611	44	Residential	NCA02	44	50	44	50	44	49	45	49	44	52	44	52
R0612	44	Residential	NCA02	50	55	50	55	51	55	51	55	51	59	51	59
R0613	44	Residential	NCA02	43	49	43	49	41	47	41	46	41	47	41	47
R0614	44	Residential	NCA02	30	36	30	36	30	32	30	32	30	38	30	38
R0615	44	Residential	NCA02	29	34	29	34	30	34	30	34	29	37	29	37
R0616	44	Residential	NCA02	33	39	33	39	30	36	30	36	31	38	31	38
R0617	44	Residential	NCA02	29	35	29	35	30	33	30	33	30	38	30	38
R0618	44	Residential	NCA02	43	49	43	49	40	48	41	48	41	49	41	49
R0619	44	Residential	NCA02	33	39	33	35	27	33	29	33	27	35	27	35
R0620	44	Residential	NCA02	33	39	33	35	30	32	30	32	30	38	30	38
R0621	44	Residential	NCA02	53	55	53	55	54	56	54	56	54	62	54	62
R0622	44	Residential	NCA02	33	39	33	39	31	35	31	35	31	39	31	39
R0623	44	Residential	NCA02	32	38	32	34	31	32	31	32	30	38	30	38
R0624	44	Residential	NCA02	30	36	30	36	29	32	29	32	29	37	29	37
R0625	44	Residential	NCA02	31	37	31	37	31	35	31	35	31	39	31	39
R0626	44	Residential	NCA02	32	38	32	38	31	37	31	37	31	39	31	39
R0627	44	Residential	NCA02	43	49	43	49	41	48	42	48	41	48	41	48
R0628	44	Residential	NCA02	48	54	48	54	49	54	49	54	48	56	48	56
R0629	44	Residential	NCA02	29	35	29	35	28	32	28	32	28	36	28	36
R0630	44	Residential	NCA02	36	37	36	37	36	37	37	37	30	38	30	38
R0631	44	Residential	NCA02	44	48	44	48	45	48	45	48	45	53	45	53
R0632	44	Residential	NCA02	48	54	48	54	47	52	47	52	47	55	47	55
R0633	44	Residential	NCA02	32	38	32	38	28	33	28	33	30	36	30	36
R0634	44	Residential	NCA02	42	47	42	47	43	47	43	47	39	45	39	46
R0635	44	Residential	NCA02	34	38	36	38	35	36	37	37	34	42	34	42
R0636	44	Residential	NCA02	31	37	31	37	29	35	30	35	29	37	29	37
R0637	44	Residential	NCA02	44	50	44	50	43	47	43	47	43	51	43	51
R0638	44	Residential	NCA02	30	36	30	36	29	35	29	35	29	37	29	37
R0639	44	Residential	NCA02	31	37	31	37	29	36	30	36	29	37	29	37
R0640	44	Residential	NCA02	30	36	30	34	30	33	30	33	30	38	30	38
R0641	44	Residential	NCA02	50	55	50	55	51	55	51	55	51	59	51	59
R0642	44	Residential	NCA02	41	46	41	46	42	45	42	45	38	42	38	42
R0643	44	Residential	NCA02	31	37	31	37	30	32	31	32	31	39	31	39
R0644	44	Residential	NCA02	35	41	35	41	30	34	30	34	33	38	33	38
R0645	44	Residential	NCA02	41	47	41	47	39	45	39	45	39	47	39	47
R0646	44	Residential	NCA02	32	38	32	38	29	33	29	33	30	37	30	37
R0647	44	Residential	NCA02	30	36	30	36	28	34	30	34	28	36	30	38
R0648	44	Residential	NCA02	39	45	39	44	37	41	37	41	36	42	36	42
R0649	44	Residential	NCA02	31	37	31	37	29	34	30	34	29	35	29	35
R0650	44	Residential	NCA02	50	55	50	55	51	55	51	55	50	58	50	58
R0651	44	Residential	NCA02	38	44	38	43	33	41	34	41	35	41	35	41
R0652	44	Residential	NCA02	29	33	29	33	30	31	30	31	29	37	29	37
R0653	44	Residential	NCA02	30	36	30	36	29	33	29	33	28	36	28	36
R0654	44	Residential	NCA02	30	36	30	35	31	35	31	35	31	39	31	39
R0655	44	Residential	NCA02	53	56	53	56	54	55	54	55	54	62	54	62
R0656	44	Residential	NCA02	45	51	45	51	44	51	45	51	44	52	45	53
R0657	44	Residential	NCA02	33	39	33	39	32	35	32	35	31	38	31	38
R0658	44	Residential	NCA02	42	48	42	48	42	43	42	43	40	43	40	43
R0659	44	Residential	NCA02	39	44	39	44	40	44	40	44	37	45	37	45
R0660	44	Residential	NCA02	30	36	30	36	29	33	29	33	28	36	28	36
R0661	44	Residential	NCA02	56	56	56	56	57	57	57	57	57	65	57	65
R0662	44	Residential	NCA02	32	38	32	38	28	34	28	34	30	36	30	36
R0663	44	Residential	NCA02	33	39	33	39	29	35	29	35	31	36	31	36
R0664	44	Residential	NCA02	48	52	48	52	49	52	49	52	49	57	49	57
R0665	44	Residential	NCA02	43	49	43	49	42	48	42	48	41	46	41	46
R0666	44	Residential	NCA02	38	44	38	45	35	40	35	40	37	40	37	40
R0667	44	Residential	NCA02	54	57	54	57	55	57	55	57	55	63	55	63
R0668	44	Residential	NCA02	35	41	35	41	32	39	32	39	33	40	33	40
R0669	44	Residential	NCA02	33	39	33	38	29	35	29	35	30	37	30	37
R0670	44	Residential	NCA02	52	55	52	55	53	56	53	56	53	61	53	61
R0671	44	Residential	NCA02	53	56	53	56	54	56	54	56	54	62	54	62
R0672	44	Residential	NCA02	41	47	41	47	39	43	39	43	39	47	39	47
R0673	44	Residential	NCA02	59	59	59	59	60	60	60	60	60	68	60	68
R0674	44	Residential	NCA02	59	59	59	59	60	60	60	60	60	68	60	68
R0675	44	Residential	NCA02	33	38	33	38	34	35	34	35	30	38	30	38
R0676	44	Residential	NCA02	47	53	47	53	47	50	47	50	47	55	47	55
R0677	44	Residential	NCA02	43	49	43	49	43	45	43	45	43	51	43	51
R0678	44	Residential	NCA02	36	41	36	41	37	37	37	37	33	38	33	38
R0679	44	Residential	NCA02	47	53	47	53	46	51	46	51	46	54	46	54
R0680	44	Residential	NCA02	59	59	59	59	60	60	60	60	60	68	60	68
R0681	44	Residential	NCA02	47	52	47	52	48	53	48	53	45	52	45	52
R0682	44	Residential	NCA02	47	52	46	52	48	51	47	51	48	56	47	55
R0683	44	Residential	NCA02	44	50	44	50	42	47	42	47	42	50	42	50
R0684	44	Residential	NCA02	58	58	58	58	59	59	59	59	59	67	59	67
R0685	44	Residential	NCA02	34	35	34	35	35	35	35	35	31	39	31	39
R0686	44	Residential	NCA02	36	42	36	42	36	38	37	39	34	41	34	41
R0687	44	Residential	NCA02	38	44	38	44	35	37	35	38	36	40	36	40
R0688	44	Residential	NCA02	51	57	51	57	51	54	51	54	51	59	51	59
R0689	44	Residential	NCA02	58	58	58	58	59	59	59	59	59	67	59	67
R0690	44	Residential	NCA02	43	49	43	49	39	47	40	47	41	47	41	48
R0691	44	Residential	NCA02	43	49	43	49	39	46	39	46	41	45	41	45
R0692	44	Residential	NCA02	40	46	40	46	38	43	38	43	38	41	38	41
R0693	44	Residential	NCA02	42	48	42	48	40	44	40	45	40	45	40	43
R0694	44	Residential	NCA02	60	60	60	60	61	61	61	61	61	69	61	69
R0695	44	Residential	NCA02	50	56	50	56	49	52	50	52	49	57	50	58
R0696	44	Residential	NCA02	61	61	61	61	62	62	62	62	62	70	62	70
R0697	44	Residential	NCA02	50	55	50	55	51	55	51	55	51	59	51	59
R0698	50	Medical facility	Medical facility	50	56	50	56	50	53	50	53	50	58	50	58
R0699	44	Residential	NCA02	62	62	62	62	63	63	63	63	63	71	63	71
R0700	44	Residential	NCA02	30	34	30	34	31	33	31	33	31	39	31	39

Predicted noise levels against PNTLs: Noise Policy for Industry

Receiver ID	Project Noise Trigger Level (NPI)	Receiver Type	NCA	CS1A	CS1B	CS1C	CS1D	CS2A	CS2B	CS2C	CS2D	CS3A	CS3B	CS3C	CS3D
			Exceeds Project Noise Trigger Level		Exceeds Project Noise Trigger Level + 10 dBA				Exceeds Project Noise Trigger Level + 20 dBA						
R0701	44	Residential	NCA02	48	54	48	54	47	49	46	49	47	55	46	54
R0702	44	Residential	NCA02	37	43	37	43	32	37	32	37	35	40	35	40
R0703	44	Residential	NCA02	46	52	46	52	44	50	43	50	44	52	44	51
R0704	44	Residential	NCA02	61	61	61	61	62	62	62	62	62	70	62	70
R0705	44	Residential	NCA02	62	62	62	62	63	63	63	63	63	71	63	71
R0706	44	Residential	NCA02	63	63	63	63	64	64	64	64	64	72	64	72
R0707	44	Residential	NCA02	57	57	57	57	58	58	58	58	58	66	58	66
R0708	44	Residential	NCA02	64	64	64	64	65	65	65	65	65	73	65	73
R0709	44	Residential	NCA02	55	55	55	55	56	56	56	56	56	64	56	64
R0710	44	Residential	NCA02	59	59	59	59	60	60	60	60	60	68	60	68
R0711	44	Residential	NCA02	60	60	60	60	61	61	61	61	61	69	61	69
R0712	44	Residential	NCA02	60	60	60	60	61	61	61	61	61	69	61	69
R0713	44	Residential	NCA02	60	60	60	60	61	61	61	61	61	69	61	69
R0714	50	Place of worship	Place of worship	56	56	56	56	57	57	57	57	57	65	57	65
R0715	50	Place of worship	Place of worship	61	61	61	61	62	62	62	62	62	70	62	70
R0716	44	Residential	NCA02	57	57	57	57	58	58	58	58	58	66	58	66
R0717	44	Residential	NCA02	55	58	55	58	56	56	56	56	56	64	56	64
R0718	44	Residential	NCA02	56	58	56	58	57	57	57	57	57	65	57	65
R0719	44	Residential	NCA02	56	56	56	56	57	57	57	57	57	65	57	65
R0720	44	Residential	NCA02	55	55	55	55	56	56	56	56	56	64	56	64
R0721	55	Educational institute	Educational institute	47	53	47	53	45	53	45	53	45	52	45	52
R0722	44	Residential	NCA02	53	57	53	57	54	54	54	54	54	62	54	62
R0723	44	Residential	NCA02	50	54	50	54	51	54	51	54	51	59	51	59
R0724	44	Residential	NCA02	47	50	47	50	48	50	48	50	48	56	48	56
R0725	44	Residential	NCA02	49	52	49	52	50	52	50	52	50	58	50	58
R0726	44	Residential	NCA02	44	49	44	49	45	50	45	50	45	53	45	53
R0727	44	Residential	NCA02	52	52	52	52	53	53	53	53	53	61	53	61
R0728	44	Residential	NCA02	40	43	40	43	41	42	41	42	41	49	41	49
R0729	44	Residential	NCA02	41	45	41	45	42	46	42	46	42	50	42	50
R0730	44	Residential	NCA02	40	46	40	46	38	43	38	44	38	44	38	44
R0731	44	Residential	NCA02	45	45	45	45	46	46	46	46	46	54	46	54
R0732	44	Residential	NCA02	37	43	37	41	37	41	37	41	34	42	33	41
R0733	44	Residential	NCA02	38	42	38	42	39	41	39	42	37	45	37	45
R0734	44	Residential	NCA02	40	40	40	40	41	41	41	41	41	49	41	49
R0735	44	Residential	NCA02	39	41	39	39	40	40	40	40	40	48	40	48
R0736	44	Residential	NCA02	37	38	36	36	38	39	37	38	39	47	37	45
R0737	44	Residential	NCA02	35	38	35	37	36	38	36	38	31	39	33	41
R0738	44	Residential	NCA02	36	36	36	36	36	39	36	39	36	44	36	44
R0739	44	Residential	NCA02	31	34	31	33	32	34	32	34	31	39	31	39
R0740	44	Residential	NCA02	40	40	40	40	41	41	41	41	41	49	41	49
R0741	44	Residential	NCA02	32	35	32	35	33	35	33	35	31	39	31	39
R0742	44	Residential	NCA02	34	34	33	34	35	35	35	35	35	43	35	43
R0743	44	Residential	NCA02	30	34	30	33	30	32	30	32	26	34	27	35
R0744	44	Residential	NCA02	32	32	32	32	33	33	33	33	33	41	33	41
R0745	44	Residential	NCA02	31	34	31	32	32	34	32	34	29	37	29	37
R0746	44	Residential	NCA02	31	34	31	32	31	33	31	33	29	37	29	37
R0747	44	Residential	NCA02	30	33	30	32	31	34	31	34	29	37	29	37
R0748	44	Residential	NCA02	32	32	32	32	33	33	33	33	33	41	33	41
R0749	44	Residential	NCA02	33	33	32	32	34	34	33	33	34	42	33	41
R0750	44	Residential	NCA02	32	32	32	30	31	32	31	32	29	37	29	37
R0751	44	Residential	NCA02	28	30	28	30	27	31	27	31	27	35	27	35
R0752	44	Residential	NCA02	27	29	27	29	28	31	28	31	28	36	28	36
R0753	44	Residential	NCA02	60	60	60	60	61	61	61	61	61	69	61	69
R0754	44	Residential	NCA02	60	60	60	60	61	61	61	61	61	69	61	69
R0755	44	Residential	NCA02	61	61	61	61	62	62	62	62	62	70	62	70
R0756	44	Residential	NCA02	61	61	61	61	62	62	62	62	62	70	62	70
R0757	44	Residential	NCA02	61	61	61	61	62	62	62	62	62	70	62	70
R0758	44	Residential	NCA02	61	61	61	61	62	62	62	62	62	70	62	70
R0759	44	Residential	NCA02	60	60	60	60	61	61	61	61	61	69	61	69
R0760	44	Residential	NCA02	51	56	51	56	52	56	52	56	52	60	52	60
R0761	44	Residential	NCA02	54	56	54	56	55	56	55	56	55	63	55	63
R0762	44	Residential	NCA02	53	56	53	56	54	57	54	57	54	62	54	62
R0763	44	Residential	NCA02	56	56	56	56	57	57	57	57	57	65	57	65
R0764	44	Residential	NCA02	56	57	56	57	57	58	57	58	57	65	57	65
R0765	44	Residential	NCA02	63	63	63	63	64	64	64	64	64	72	64	72
R0766	44	Residential	NCA02	38	44	38	44	37	43	37	44	36	42	36	42
R0767	44	Residential	NCA02	41	47	41	47	37	45	37	45	39	43	39	44
R0768	44	Residential	NCA02	42	48	42	48	39	43	39	43	40	44	40	44
R0769	44	Residential	NCA02	41	47	41	47	36	44	37	44	39	42	39	44
R0770	44	Residential	NCA02	35	41	35	41	34	36	34	36	33	41	33	41
R0771	44	Residential	NCA02	33	38	34	38	34	34	35	35	32	40	32	40
R0772	44	Residential	NCA02	36	41	36	41	37	38	37	38	33	40	33	40
R0773	44	Residential	NCA02	32	38	32	38	33	35	33	35	30	38	30	38
R0774	44	Residential	NCA02	33	39	33	39	33	35	33	35	31	37	31	37
R0775	44	Residential	NCA02	32	38	32	38	31	37	31	37	31	39	31	39
R0776	44	Residential	NCA02	33	39	33	39	33	38	33	38	33	41	33	41
R0777	44	Residential	NCA02	30	34	30	34	31	33	31	33	31	39	31	39
R0778	44	Residential	NCA02	33	39	33	39	31	37	33	37	31	39	31	39
R0779	44	Residential	NCA02	34	38	34	38	35	35	35	35	31	39	31	39
R0780	44	Residential	NCA02	33	39	33	35	29	32	30	32	28	36	28	36
R0781	44	Residential	NCA02	41	47	41	45	37	43	37	43	37	45	37	45
R0782	44	Residential	NCA02	38	44	38	41	34	34	34	34	34	42	34	42
R0783	44	Residential	NCA02	39	45	39	41	32	40	32	40	33	39	33	39
R0784	44	Residential	NCA02	38	44	38	41	35	35	35	35	35	43	35	43
R0785	44	Residential	NCA02	38	44	38	42	32	33	32	33	34	40	34	40
R0786	44	Residential	NCA02	38	42	38	38	35	35	35	35	35	43	35	43
R0787	44	Residential	NCA02	48	49	48	49	49	49	49	49	49	57	49	57
R0788	44	Residential	NCA02	45	50	45	50	47	50	46	50	46	54	46	54
R0789	44	Residential	NCA02	47	51	47	51	48	51	48	51	48	56	48	56
R0790	44	Residential	NCA02	45	51	45	51	45	50	45	50	45	53	45	53
R0791	44	Residential	NCA02	52	52	52	52	53	53	53	53	53	61	53	61
R0792	44	Residential	NCA02	49	50	49	50	50	50	50	50	50	58	50	58
R0793	44	Residential	NCA02	48	53	48	53	49	52	49	52	49	57	49	57
R0794	44	Residential	NCA02	53	55	53	55	54	56	54	56	54	62	54	62
R0795	44	Residential	NCA02	52	55	52	55	53	56	53	56	53	61	53	61
R0796	44	Residential	NCA02	46	50	46	50	47	50	47	50	47	55	47	55
R0797	44	Residential	NCA02	39	45	39	42	40	40	40	40	40	48	40	48
R0798	44	Residential	NCA02	47	51	47	51	48	52	48	52	44	49	44	49
R0799	44	Residential	NCA02	34	40	34	40	33	34	33	34	33	41	33	41
R0800	44	Residential	NCA02	37	43	37	41	30	39	31	39	33	36	33	36
R0801	44	Residential	NCA02	34	40	34	40	28	34	27	34	32	35	32	35
R0802	44	Residential	NCA02	33	39	33	38	26	33	26	33	30	34	30	34
R0803	44	Residential	NCA02	25	31	25	29	24	28	24	28	24	32	24	32
R0804	44	Residential	NCA02	27	33	27	32	25	32	25	32	25	33	25	33
R0805	44	Residential	NCA02	29	35	29	34	27	32	29	32	29	37	29	37
R0806	44	Residential	NCA02	31	37	31	35	32	32	32	32	32	40	32	40
R0807	44	Residential	NCA02	31	36	31	33	31	31	31	31	31	39	31	39
R0808	44	Residential	NCA02	31	37	31	36	29	32	29	32	29	37	29	37
R0809	44	Residential	NCA02	31	32	31	31	32	32	32	32	32	40	32	40
R0810	44	Residential	NCA02	37	43	37	40	32	36	32	36	32	40	32	40
R0811	44	Residential	NCA02	36	42	36	39	32	32	32	32	32	40	32	40
R0812	44	Residential	NCA02	31	37	31	33	30	30	30	30	30	38	30	38
R0813	44	Residential	NCA02	37	43	37	40	32	36	32	36	32	39	32	39
R0814	44	Residential	NCA02	40	46	40	42	37	38	37	38	34	42	34	42
R0815	44	Residential	NCA02	36	42	36	38	27	35	28	35	30	36	30	36
R0816	42	Residential	NCA03	33	33	33	30	31	31	31	31	31	39	31	39
R0817	42	Residential	NCA03	39	45	39	42	32	34	32	34	34	40	34	40
R0818	42	Residential	NCA03	45	49	45	49	46	49	46	49	46	54	46	54
R0819	42	Residential	NCA03	61	67	61	67	50	56	50	56	59	59	59	59
R0820	42	Residential	NCA03	59	65	59	65	55	56	55	57	57	63	57	63
R0821	42	Residential	NCA03	55	55	55	55	56	56	56	56	56	64	56	64
R0822	42	Residential	NCA03	56	57	56	58	57	57	57	57	57	65	57	65
R0823	42	Residential	NCA03	58	58	58	58	59	59	59	59	59	67	59	67
R0824	42	Residential	NCA03	56	56	56	56	57	57	57	57	57	65	57	65
R0825	42	Residential	NCA03	55	55	55	55	56	56	56	56	56	64	56	64
R0826	42	Residential	NCA03	57	57	57	57	58	59	58	59	58	66	58	66
R0827	42	Residential	NCA03	60	66	60	66	51	59	51	59	58	58	58	58
R0828	42	Residential	NCA03	59	65	59	65	49	55	49	55	57	57	57	57
R0829	42	Residential	NCA03	55	55	55	55	56	56	56	56	56	64	56	64
R0830	42	Residential	NCA03	58	58	58	58	59	59	59	59	59	67	59	67
R0831	42	Residential	NCA03	57	57	57	57	58	58	58	58	58	66	58	66
R0832	42	Residential	NCA03	58	58	58	58	59	59	59	59	59	67	59	67
R0833	42	Residential	NCA03	56	56	56	56	57	58	57	58	57	65	57	65
R0834	42	Residential	NCA03	59	59	59	59	60	60	60	60	60	68	60	68
R0835	42	Residential	NCA03	57	57	57	57	58	58	58	58	58	66	58	66
R0836	42	Residential	NCA03	58	58	58	58	59	59	59	59	59	67	59	67
R0837	42	Residential	NCA03	58	64	58	64	48	53	48	53	56	56	56	56
R0838	42	Residential	NCA03	57	57	57	57	58	58	58	58	58	66	58	66
R0839	42	Residential	NCA03	57	57	57	57	58	58	58	58	58	66	58	66
R0840	42	Residential	NCA03	57	57	57	57	58	58	58	58	58	66	58	66

Predicted noise levels against PNTLs: Noise Policy for Industry

Receiver ID	Project Noise Trigger Level (NPI)	Receiver Type	NCA	CS1A	CS1B	CS1C	CS1D	CS2A	CS2B	CS2C	CS2D	CS3A	CS3B	CS3C	CS3D
			Exceeds Project Noise Trigger Level		Exceeds Project Noise Trigger Level + 10 dBA				Exceeds Project Noise Trigger Level + 20 dBA						
R0841	42	Residential	NCA03	58	58	58	58	59	59	59	59	59	67	59	67
R0842	42	Residential	NCA03	58	64	58	64	49	56	49	55	56	56	56	56
R0843	42	Residential	NCA03	58	64	58	64	50	58	50	58	56	56	56	56
R0844	42	Residential	NCA03	58	58	58	58	59	59	59	59	59	67	59	67
R0845	42	Residential	NCA03	57	57	57	57	58	58	58	58	58	66	58	66
R0846	42	Residential	NCA03	57	63	57	63	49	57	48	56	55	55	55	55
R0847	42	Residential	NCA03	53	53	53	53	54	54	54	54	54	62	54	62
R0848	42	Residential	NCA03	54	54	54	54	55	56	55	56	55	63	55	63
R0849	42	Residential	NCA03	52	52	52	52	53	53	53	53	53	61	53	61
R0850	42	Residential	NCA03	54	54	54	54	55	55	55	55	55	63	55	63
R0851	42	Residential	NCA03	51	51	51	51	52	52	52	52	52	60	52	60
R0852	42	Residential	NCA03	47	50	47	50	48	53	48	53	48	56	48	56
R0853	42	Residential	NCA03	52	58	52	58	47	47	47	47	50	50	50	50
R0854	42	Residential	NCA03	54	54	54	54	55	55	55	55	55	63	55	63
R0855	42	Residential	NCA03	57	63	57	63	49	57	49	57	55	55	55	55
R0856	42	Residential	NCA03	42	42	42	42	43	43	43	43	43	51	43	51
R0857	42	Residential	NCA03	55	55	55	55	56	56	56	56	56	64	56	64
R0858	42	Residential	NCA03	50	56	50	56	47	51	47	51	48	54	48	54
R0859	42	Residential	NCA03	54	54	54	54	55	56	55	56	55	63	55	63
R0860	42	Residential	NCA03	56	56	56	56	57	57	57	57	57	65	57	65
R0861	42	Residential	NCA03	48	54	49	55	45	51	45	51	46	47	47	47
R0862	42	Residential	NCA03	51	57	51	57	45	50	44	50	49	50	49	50
R0863	42	Residential	NCA03	41	41	41	41	42	42	42	42	42	50	42	50
R0864	42	Residential	NCA03	53	53	53	53	54	54	54	55	54	62	54	62
R0865	42	Residential	NCA03	54	54	54	54	55	55	55	55	55	63	55	63
R0866	42	Residential	NCA03	54	54	54	54	55	55	55	55	55	63	55	63
R0867	42	Residential	NCA03	52	52	52	52	53	54	53	54	53	61	53	61
R0868	42	Residential	NCA03	41	43	41	43	42	45	42	45	40	48	39	47
R0869	42	Residential	NCA03	50	56	50	56	44	51	44	51	48	48	48	48
R0870	42	Residential	NCA03	53	53	53	53	54	54	54	54	54	62	54	62
R0871	42	Residential	NCA03	43	43	43	43	44	44	44	44	44	52	44	52
R0872	42	Residential	NCA03	48	48	48	48	49	51	49	51	49	57	49	57
R0873	42	Residential	NCA03	42	46	42	46	43	45	43	45	38	44	38	44
R0874	42	Residential	NCA03	37	37	38	38	38	38	39	39	34	42	34	42
R0875	42	Residential	NCA03	55	55	55	55	56	56	56	56	56	64	56	64
R0876	42	Residential	NCA03	51	51	51	51	52	52	52	52	52	60	52	60
R0877	42	Residential	NCA03	48	48	48	48	49	49	49	49	49	57	49	57
R0878	42	Residential	NCA03	48	48	48	48	49	49	49	49	49	57	49	57
R0879	42	Residential	NCA03	50	56	50	56	43	51	43	50	48	48	48	48
R0880	42	Residential	NCA03	44	45	44	45	45	48	45	48	45	53	45	53
R0881	42	Residential	NCA03	43	43	43	43	44	44	44	44	44	52	44	52
R0882	42	Residential	NCA03	55	55	55	55	56	56	56	56	56	64	56	64
R0883	42	Residential	NCA03	42	44	42	44	43	47	43	47	43	51	43	51
R0884	42	Residential	NCA03	47	53	47	53	43	49	43	49	45	45	45	45
R0885	42	Residential	NCA03	47	47	47	47	48	48	48	48	48	56	48	56
R0886	42	Residential	NCA03	45	45	45	45	46	46	46	46	46	54	46	54
R0887	42	Residential	NCA03	46	46	46	46	47	47	47	47	47	55	47	55
R0888	42	Residential	NCA03	41	47	41	47	42	44	42	44	41	49	41	49
R0889	42	Residential	NCA03	45	45	45	45	46	46	46	46	46	54	46	54
R0890	42	Residential	NCA03	41	41	41	41	42	42	42	44	42	50	42	50
R0891	42	Residential	NCA03	45	51	45	51	44	50	45	50	43	49	43	49
R0892	42	Residential	NCA03	43	43	43	43	44	44	44	44	44	52	44	52
R0893	42	Residential	NCA03	42	48	42	48	39	40	39	40	40	47	40	46
R0894	42	Residential	NCA03	46	46	46	46	47	47	47	48	47	55	47	55
R0895	42	Residential	NCA03	50	50	50	50	51	51	51	51	51	59	51	59
R0896	42	Residential	NCA03	42	48	42	48	43	46	43	46	40	46	40	46
R0897	42	Residential	NCA03	46	46	46	46	47	48	47	48	47	55	47	55
R0898	42	Residential	NCA03	47	47	47	47	48	48	48	48	48	56	48	56
R0899	42	Residential	NCA03	40	42	40	42	41	45	41	45	41	49	41	49
R0900	42	Residential	NCA03	44	46	44	46	45	49	45	49	45	53	45	53
R0901	42	Residential	NCA03	46	52	46	52	41	47	41	47	44	45	44	45
R0902	42	Residential	NCA03	44	45	44	45	45	48	45	48	45	53	45	53
R0903	42	Residential	NCA03	40	43	40	43	41	42	41	42	35	41	35	41
R0904	42	Residential	NCA03	40	40	40	40	41	41	41	41	41	49	41	49
R0905	42	Residential	NCA03	40	41	40	41	41	41	41	41	35	43	35	43
R0906	42	Residential	NCA03	39	40	39	40	40	40	40	40	33	41	33	41
R0907	42	Residential	NCA03	38	38	38	38	39	39	39	39	39	47	39	47
R0908	42	Residential	NCA03	40	40	40	40	41	41	41	41	33	41	33	41
R0909	42	Residential	NCA03	36	36	36	36	37	37	37	37	37	45	37	45
R0910	42	Residential	NCA03	39	45	39	45	38	45	40	45	37	41	37	41
R0911	42	Residential	NCA03	39	44	39	44	40	40	40	41	36	38	36	38
R0912	42	Residential	NCA03	32	36	32	36	33	33	33	33	33	41	33	41
R0913	42	Residential	NCA03	33	39	33	39	34	35	34	34	34	42	34	42
R0914	42	Residential	NCA03	42	48	44	50	41	46	41	46	40	45	42	45
R0915	42	Residential	NCA03	36	36	36	36	37	37	37	37	36	44	36	44
R0916	42	Residential	NCA03	40	42	40	42	41	43	41	43	37	45	37	45
R0917	42	Residential	NCA03	37	37	37	37	38	38	38	38	38	46	38	46
R0918	42	Residential	NCA03	37	37	37	37	38	38	38	38	38	46	38	46
R0919	42	Residential	NCA03	40	40	40	40	41	41	41	41	41	49	41	49
R0920	42	Residential	NCA03	39	39	39	39	40	41	40	42	40	48	40	48
R0921	42	Residential	NCA03	32	35	32	35	33	36	33	36	32	40	32	40
R0922	42	Residential	NCA03	38	38	38	38	39	39	39	39	39	47	39	47
R0923	42	Residential	NCA03	36	36	36	36	37	37	37	37	37	45	37	45
R0924	42	Residential	NCA03	41	41	39	39	42	42	40	40	42	50	40	48
R0925	42	Residential	NCA03	38	44	41	47	38	39	39	39	37	45	39	45
R0926	42	Residential	NCA03	36	42	36	42	35	37	35	37	34	39	34	39
R0927	42	Residential	NCA03	42	42	41	41	43	43	42	42	43	51	42	50
R0928	42	Residential	NCA03	35	38	35	38	36	36	36	36	36	44	36	44
R0929	42	Residential	NCA03	37	37	37	37	38	38	38	38	38	46	38	46
R0930	42	Residential	NCA03	41	41	41	41	42	42	42	43	42	50	42	50
R0931	42	Residential	NCA03	40	41	40	41	41	44	41	44	41	49	41	49
R0932	42	Residential	NCA03	31	35	31	35	32	34	32	34	32	40	32	40
R0933	42	Residential	NCA03	38	39	38	39	39	42	39	42	39	47	39	47
R0934	42	Residential	NCA03	39	39	39	39	40	40	40	40	40	48	40	48
R0935	42	Residential	NCA03	43	49	45	51	39	45	39	45	41	41	43	43
R0936	42	Residential	NCA03	39	39	39	39	40	40	40	40	40	48	40	48
R0937	42	Residential	NCA03	46	52	46	52	43	50	43	50	44	44	44	44
R0938	42	Residential	NCA03	39	44	39	44	39	44	40	43	36	42	36	42
R0939	42	Residential	NCA03	42	42	42	42	43	43	43	43	43	51	43	51
R0940	42	Residential	NCA03	33	33	33	33	35	34	34	34	34	42	34	42
R0941	42	Residential	NCA03	39	39	39	39	40	40	40	40	40	48	40	48
R0942	42	Residential	NCA03	36	37	36	37	37	37	37	37	37	45	37	45
R0943	42	Residential	NCA03	34	34	34	34	35	36	35	36	32	40	32	40
R0944	42	Residential	NCA03	39	42	39	44	39	45	39	45	37	37	37	37
R0945	42	Residential	NCA03	29	35	29	35	30	33	30	33	30	38	30	38
R0946	42	Residential	NCA03	31	35	31	35	32	32	32	32	32	40	32	40
R0947	42	Residential	NCA03	34	35	34	35	35	35	35	35	35	43	35	43
R0948	42	Residential	NCA03	33	34	33	34	34	35	34	35	34	42	34	42
R0949	42	Residential	NCA03	33	36	35	36	34	36	36	36	32	40	32	40
R0950	42	Residential	NCA03	36	36	36	36	37	37	37	37	34	42	34	42
R0951	42	Residential	NCA03	35	35	35	35	36	36	36	36	32	40	32	40
R0952	42	Residential	NCA03	38	38	38	38	38	39	39	39	39	47	39	47
R0953	42	Residential	NCA03	38	42	37	42	39	39	38	39	34	37	34	37
R0954	42	Residential	NCA03	35	35	35	35	36	36	36	36	36	44	36	44
R0955	42	Residential	NCA03	37	37	37	37	38	38	38	38	38	46	38	46
R0956	42	Residential	NCA03	35	35	35	35	36	36	36	36	36	44	36	44
R0957	42	Residential	NCA03	35	37	35	37	36	36	36	36	32	40	31	39
R0958	42	Residential	NCA03	34	34	34	34	35	35	35	35	35	43	35	43
R0959	42	Residential	NCA03	36	36	36	36	37	37	37	37	37	45	37	45
R0960	42	Residential	NCA03	37	38	37	38	38	38	38	38	35	43	35	43
R0961	42	Residential	NCA03	49	55	49	55	42	50	42	50	47	47	47	47
R0962	42	Residential	NCA03	33	33	33	33	34	35	34	35	34	42	34	42
R0963	42	Residential	NCA03	30	35	30	35	31	31	31	31	31	39	31	39
R0964	42	Residential	NCA03	36	36	36	36	37	37	37	37	37	45	37	45
R0965	42	Residential	NCA03	47	53	47	53	41	47	41	47	45	45	45	45
R0966	42	Residential	NCA03	34	37	34	37	35	35	35	35	35	43	35	43
R0967	42	Residential	NCA03	37	43	38	44	32	37	32	37	35	35	36	36
R0968	42	Residential	NCA03	33	37	33	37	34	34	34	34	34	42	34	42
R0969	42	Residential	NCA03	36	36	36	36	37	37	37	37	36	44	36	44
R0970	42	Residential	NCA03	31	35	31	35	31	35	31	35	31	39	31	39
R0971	42	Residential	NCA03	38	42	38	42	39	42	39	41	34	41	34	41
R0972	42	Residential	NCA03	37	40	37	40	37	40	37	40	32	40	32	40
R0973	42	Residential	NCA03	45	51	46	52	43	49	43	49	43	43	44	44
R0974	42	Residential	NCA03	35	35	35	35	36	36	36	36	36	44	36	44
R0975	42	Residential	NCA03	44	50	45	51	42	47	42	47	42	42	43	43
R0976	42	Residential	NCA03	37	37	34	34	38	38	35	35	38	46	35	43
R0977	42	Residential	NCA03	29	35	29	35	30	30	30	30	30	38	30	38
R0978	42	Residential	NCA03	31	35	31	35	32	32	32	32	32	40	32	40
R0979	42	Residential	NCA03	30	36	30	36	31	32	31	32	31	39	31	39
R0980	42	Residential	NCA03	45	51	44	50	39	44	39	44	43	43	42	42

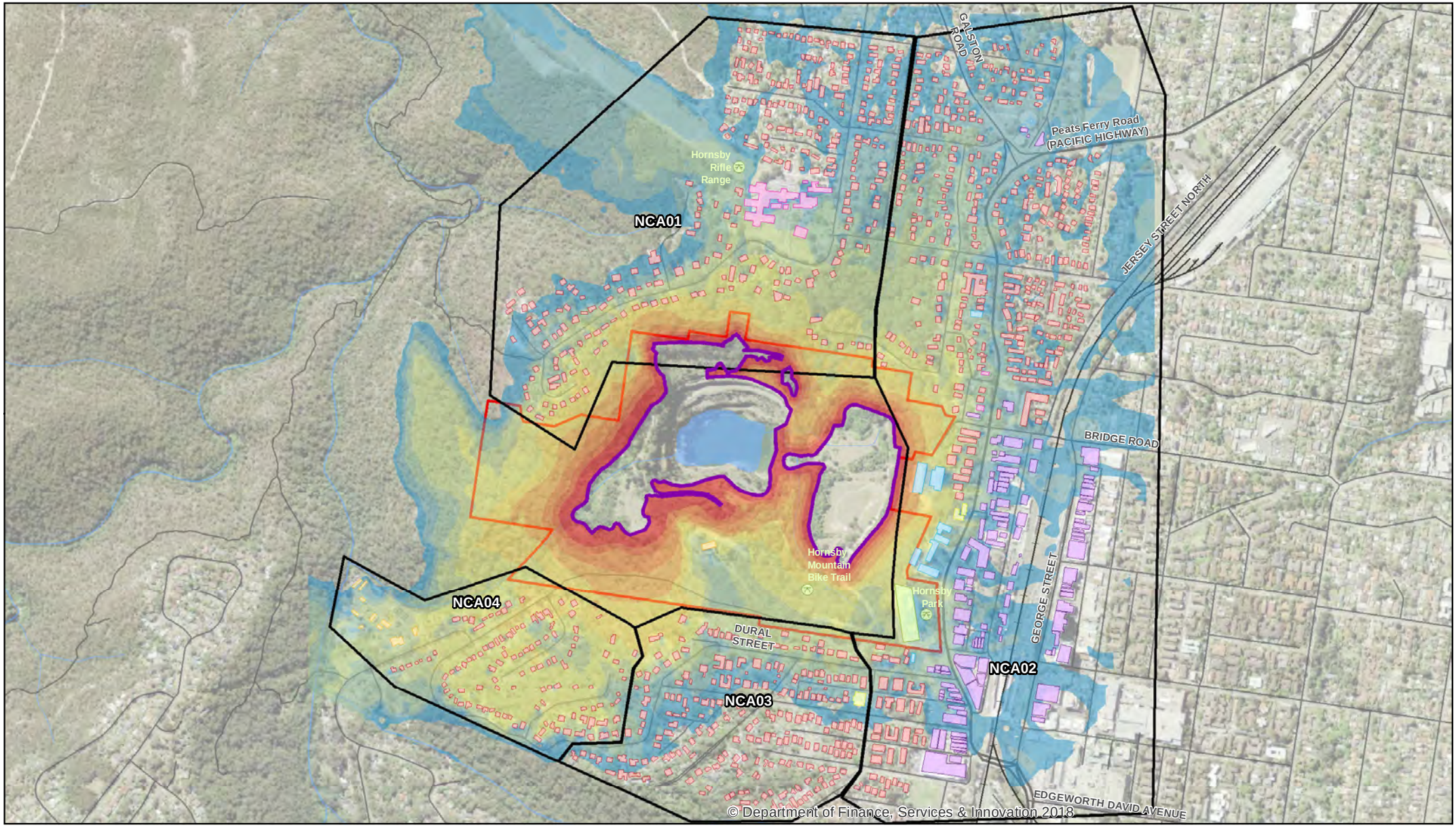
Predicted noise levels against PNTLs: Noise Policy for Industry

Receiver ID	Project Noise Trigger Level (NPI)	Receiver Type	NCA	CS1A	CS1B	CS1C	CS1D	CS2A	CS2B	CS2C	CS2D	CS3A	CS3B	CS3C	CS3D
			Exceeds Project Noise Trigger Level		Exceeds Project Noise Trigger Level + 10 dBA				Exceeds Project Noise Trigger Level + 20 dBA						
R0981	42	Residential	NCA03	42	48	43	49	40	46	40	46	40	43	41	43
R0982	42	Residential	NCA03	40	43	40	43	41	44	41	44	36	36	36	36
R0983	42	Residential	NCA03	29	35	29	35	29	31	29	31	29	37	29	37
R0984	42	Residential	NCA03	32	34	31	34	30	33	30	33	30	38	30	38
R0985	42	Residential	NCA03	36	36	36	36	37	37	37	37	37	45	37	45
R0986	42	Residential	NCA03	29	35	29	35	28	31	28	31	28	36	28	36
R0987	42	Residential	NCA03	29	34	29	34	30	31	30	31	30	38	30	38
R0988	42	Residential	NCA03	30	33	33	33	31	33	31	33	31	39	31	39
R0989	42	Residential	NCA03	30	36	30	36	29	30	29	30	29	37	29	37
R0990	42	Residential	NCA03	34	34	34	34	35	35	35	35	35	43	35	43
R0991	42	Residential	NCA03	30	34	30	34	31	31	31	31	31	39	31	39
R0992	42	Residential	NCA03	30	32	31	32	31	31	32	32	31	39	32	40
R0993	42	Residential	NCA03	32	32	32	32	33	33	33	33	33	41	33	41
R0994	42	Residential	NCA03	37	43	37	43	38	39	38	39	35	35	35	35
R0995	42	Residential	NCA03	32	32	32	32	33	33	33	33	33	41	33	41
R0996	42	Residential	NCA03	28	34	28	34	27	31	27	31	27	35	27	35
R0997	42	Residential	NCA03	29	34	29	34	30	30	30	30	30	38	30	38
R0998	42	Residential	NCA03	37	38	37	39	35	38	34	38	30	36	31	36
R0999	42	Residential	NCA03	30	31	30	31	31	31	31	31	31	39	31	39
R1000	42	Residential	NCA03	29	35	28	34	27	30	27	30	27	35	27	35
R1001	42	Residential	NCA03	36	42	37	41	35	42	35	42	34	35	34	35
R1002	42	Residential	NCA03	27	33	27	33	26	30	26	30	26	34	26	34
R1003	42	Residential	NCA03	33	33	33	33	34	34	34	34	34	42	34	42
R1004	42	Residential	NCA03	31	35	31	35	31	31	31	31	31	39	31	39
R1005	42	Residential	NCA03	28	32	28	32	29	29	29	29	29	37	29	37
R1006	42	Residential	NCA03	28	34	28	34	29	29	29	29	29	37	29	37
R1007	42	Residential	NCA03	25	31	25	31	26	30	26	30	26	34	26	34
R1008	42	Residential	NCA03	26	32	26	32	26	29	26	29	26	34	26	34
R1009	42	Residential	NCA03	25	30	25	30	26	29	26	29	26	34	26	34
R1010	42	Residential	NCA03	25	29	25	29	26	29	26	29	26	34	26	34
R1011	42	Residential	NCA03	27	33	27	33	28	29	28	29	28	36	28	36
R1012	42	Residential	NCA03	26	32	26	32	27	31	26	31	27	35	26	34
R1013	42	Residential	NCA03	26	32	26	32	25	30	25	30	25	33	25	33
R1014	42	Residential	NCA03	27	33	27	33	25	28	26	28	26	34	26	34
R1015	42	Residential	NCA03	26	32	26	32	26	29	26	29	26	34	26	34
R1016	42	Residential	NCA03	25	31	25	31	26	29	26	29	26	34	26	34
R1017	42	Residential	NCA03	26	32	26	32	26	31	26	31	26	34	26	34
R1018	42	Residential	NCA03	26	32	26	32	27	29	27	29	27	35	27	35
R1019	42	Residential	NCA03	27	33	27	33	28	29	28	29	28	36	28	36
R1020	42	Residential	NCA03	25	31	25	31	26	29	26	29	26	34	26	34
R1021	42	Residential	NCA03	27	33	27	33	25	29	26	29	26	34	26	34
R1022	42	Residential	NCA03	26	32	26	32	26	29	26	29	26	34	26	34
R1023	42	Residential	NCA03	26	32	26	32	25	29	25	29	25	33	25	33
R1024	42	Residential	NCA03	24	30	25	31	25	29	25	29	25	33	25	33
R1025	42	Residential	NCA03	27	33	27	33	26	30	26	30	26	34	26	34
R1026	42	Residential	NCA03	26	32	26	32	27	31	27	31	27	35	27	35
R1027	42	Residential	NCA03	26	32	26	32	26	29	26	29	26	34	26	34
R1028	42	Residential	NCA03	25	31	25	31	26	29	26	29	26	34	26	34
R1029	42	Residential	NCA03	26	32	26	32	25	29	25	29	25	33	25	33
R1030	42	Residential	NCA03	26	32	26	32	27	30	27	30	27	35	27	35
R1031	40	Residential	NCA04	25	31	26	31	26	29	25	29	25	33	25	33
R1032	40	Residential	NCA04	26	32	26	32	26	29	26	29	26	34	26	34
R1033	40	Residential	NCA04	31	31	31	31	32	32	32	32	32	40	32	40
R1034	40	Residential	NCA04	59	65	59	65	48	51	49	57	57	57	57	57
R1035	40	Residential	NCA04	62	68	62	68	49	50	51	57	60	60	60	60
R1036	40	Residential	NCA04	62	68	62	68	48	48	50	52	60	60	60	60
R1037	40	Residential	NCA04	57	63	57	64	48	53	48	55	56	56	56	56
R1038	40	Residential	NCA04	55	61	55	61	48	55	48	56	53	53	53	53
R1039	40	Residential	NCA04	57	63	57	63	48	54	48	56	55	55	55	55
R1040	40	Residential	NCA04	60	66	60	66	48	50	49	57	58	58	58	58
R1041	40	Residential	NCA04	62	68	62	68	48	49	49	52	60	60	60	60
R1042	40	Residential	NCA04	61	67	61	67	49	51	50	58	59	59	59	59
R1043	40	Residential	NCA04	55	61	55	61	47	55	47	55	53	53	53	53
R1044	40	Residential	NCA04	55	61	55	61	47	52	47	52	53	53	53	53
R1045	40	Residential	NCA04	53	59	53	59	48	53	47	55	51	51	51	51
R1046	40	Residential	NCA04	56	62	56	62	47	55	47	55	54	54	54	54
R1047	40	Residential	NCA04	57	63	57	63	48	49	48	53	55	55	55	55
R1048	40	Residential	NCA04	56	62	56	62	47	55	47	55	54	54	54	54
R1049	40	Residential	NCA04	58	64	58	64	48	52	48	56	56	56	56	56
R1050	40	Residential	NCA04	58	64	58	64	48	51	48	56	56	56	56	56
R1051	40	Residential	NCA04	59	65	59	65	48	48	48	55	57	57	57	57
R1052	40	Residential	NCA04	55	61	55	62	49	53	49	57	54	54	54	54
R1053	40	Residential	NCA04	57	63	57	63	47	50	47	52	55	55	55	55
R1054	40	Residential	NCA04	58	64	58	64	46	47	47	52	56	56	56	56
R1055	40	Residential	NCA04	58	64	58	64	47	53	48	56	56	56	56	56
R1056	40	Residential	NCA04	55	61	55	61	44	44	44	49	53	53	53	53
R1057	40	Residential	NCA04	57	63	57	63	47	52	48	56	55	55	55	55
R1058	40	Residential	NCA04	54	60	54	60	44	49	44	47	52	52	52	52
R1059	40	Residential	NCA04	60	66	60	66	50	58	51	59	58	58	58	58
R1060	40	Residential	NCA04	57	63	57	63	47	52	47	55	55	55	55	55
R1061	40	Residential	NCA04	57	63	57	63	47	50	47	53	55	55	55	55
R1062	40	Residential	NCA04	55	61	55	61	47	53	47	55	53	53	53	53
R1063	40	Residential	NCA04	41	47	44	50	34	36	34	37	39	39	42	42
R1064	40	Residential	NCA04	56	62	56	62	44	47	44	50	54	54	54	54
R1065	40	Residential	NCA04	56	62	56	62	47	54	47	55	54	54	54	54
R1066	40	Residential	NCA04	58	64	58	64	46	52	46	53	56	56	56	56
R1067	40	Residential	NCA04	58	64	58	64	47	52	47	54	56	56	56	56
R1068	40	Residential	NCA04	55	61	55	61	47	55	47	55	53	53	53	53
R1069	40	Residential	NCA04	59	65	59	65	50	58	49	57	57	57	57	57
R1070	40	Residential	NCA04	57	63	57	63	47	53	48	56	55	55	55	55
R1071	40	Residential	NCA04	59	65	59	65	49	54	49	57	57	57	57	57
R1072	40	Residential	NCA04	59	65	59	65	48	56	48	56	57	57	57	57
R1073	40	Residential	NCA04	42	48	47	53	41	41	41	41	40	40	45	45
R1074	40	Residential	NCA04	53	59	53	59	46	54	46	54	51	51	51	51
R1075	40	Residential	NCA04	55	61	55	61	46	54	47	55	53	53	53	53
R1076	40	Residential	NCA04	56	62	56	62	48	53	49	57	54	54	54	54
R1077	40	Residential	NCA04	55	61	55	61	46	54	47	55	53	53	53	53
R1078	40	Residential	NCA04	51	57	51	57	45	53	45	53	49	49	49	49
R1079	40	Residential	NCA04	50	56	50	56	45	53	45	53	48	48	48	48
R1080	40	Residential	NCA04	57	63	57	63	47	49	47	50	55	55	55	55
R1081	40	Residential	NCA04	52	58	52	58	45	52	45	53	50	50	50	50
R1082	40	Residential	NCA04	56	62	56	62	46	52	47	55	54	54	54	54
R1083	40	Residential	NCA04	56	62	56	62	47	50	47	52	54	54	54	54
R1084	40	Residential	NCA04	56	62	56	62	48	54	48	54	54	54	54	54
R1085	40	Residential	NCA04	50	56	50	56	45	52	45	52	48	48	48	48
R1086	40	Residential	NCA04	55	61	55	61	48	51	47	51	53	53	53	53
R1087	40	Residential	NCA04	54	60	54	60	47	55	47	55	52	52	52	52
R1088	40	Residential	NCA04	57	63	57	63	46	50	47	53	55	55	55	55
R1089	40	Residential	NCA04	55	61	55	61	47	52	47	55	53	53	53	53
R1090	40	Residential	NCA04	57	63	57	63	46	51	47	55	55	55	55	55
R1091	40	Residential	NCA04	52	58	52	59	46	54	46	54	51	51	51	51
R1092	40	Residential	NCA04	56	62	56	62	47	51	47	55	54	54	54	54
R1093	40	Residential	NCA04	49	55	49	55	45	51	45	51	47	47	47	47
R1094	40	Residential	NCA04	55	61	55	61	45	53	46	54	53	53	53	53
R1095	40	Residential	NCA04	53	59	53	59	46	54	46	54	51	51	51	51
R1096	40	Residential	NCA04	54	60	54	60	46	54	46	54	52	52	52	52
R1097	40	Residential	NCA04	55	61	55	61	46	51	47	55	53	53	53	53
R1098	40	Residential	NCA04	55	61	55	61	46	52	47	55	53	53	53	53
R1099	40	Residential	NCA04	57	63	57	63	47	51	47	55	55	55	55	55
R1100	40	Residential	NCA04	56	62	56	62	47	51	47	54	54	54	54	54
R1101	40	Residential	NCA04	57	63	57	63	47	51	47	55	55	55	55	55
R1102	40	Residential	NCA04	54	60	54	60	47	54	47	54	52	52	52	52
R1103	40	Residential	NCA04	54	60	54	60	46	54	47	55	52	52	52	52
R1104	40	Residential	NCA04	53	59	53	59	45	49	45	51	51	51	51	51
R1105	40	Residential	NCA04	56	62	56	62	47	51	47	55	54	54	54	54
R1106	40	Residential	NCA04	47	53	49	55	41	44	41	44	45	45	47	47
R1107	40	Residential	NCA04	53	59	53	59	45	53	45	53	51	51	51	51
R1108	40	Residential	NCA04	54	60	54	60	45	53	46	54	52	52	52	52
R1109	40	Residential	NCA04	41	47	44	50	39	39	39	39	39	39	42	42
R1110	40	Residential	NCA04	53	59	53	59	45	53	46	54	51	51	51	51
R1111	40	Residential	NCA04	55	61	55	61	46	54	47	55	53	53	53	53
R1112	40	Residential	NCA04	48	54	48	54	42	47	42	47	46	46	46	46
R1113	40	Residential	NCA04	55	61	55	61	47	55	48	56	53	53	53	53
R1114	40	Residential	NCA04	53	59	53	59	43	51	43	50	51	51	51	51
R1115	40	Residential	NCA04	54	60	54	60	45	53	47	55	52	52	52	52
R1116	40	Residential	NCA04	55	61	55	61	47	55	47	55	53	53	53	53
R1117	40	Residential	NCA04	53	59	52	58	44	51	44	52	51	51	50	50
R1118	40	Residential	NCA04	54	60	54	60	46	51	46	51	52	52	52	52
R1119	40	Residential	NCA04	54	60	54	60	45	53	46	54	52	52	52	52
R1120	40	Residential	NCA04	54	60	54	60	46	50	46	54	52	52	52	52

Predicted noise levels against PNTLs: Noise Policy for Industry

Receiver ID	Project Noise Trigger Level (NPI)	Receiver Type	NCA	CS1A	CS1B	CS1C	CS1D	CS2A	CS2B	CS2C	CS2D	CS3A	CS3B	CS3C	CS3D
Exceeds Project Noise Trigger Level					Exceeds Project Noise Trigger Level + 10 dBA				Exceeds Project Noise Trigger Level + 20 dBA						
R1121	40	Residential	NCA04	54	60	54	60	45	52	46	54	52	52	52	52
R1122	40	Residential	NCA04	54	60	54	60	46	51	46	54	52	52	52	52
R1123	40	Residential	NCA04	54	60	54	60	46	51	47	55	52	52	52	52
R1124	40	Residential	NCA04	54	60	54	60	46	54	47	55	52	52	52	52
R1125	40	Residential	NCA04	54	60	54	60	46	54	46	54	52	52	52	52
R1126	40	Residential	NCA04	52	58	52	58	45	50	45	50	50	50	50	50
R1127	40	Residential	NCA04	54	60	54	60	46	54	47	55	52	52	52	52
R1128	40	Residential	NCA04	54	60	54	60	46	54	46	54	52	52	52	52
R1129	40	Residential	NCA04	54	60	54	60	45	51	46	54	52	52	52	52
R1130	40	Residential	NCA04	56	62	56	62	47	55	47	55	54	54	54	54
R1131	40	Residential	NCA04	54	60	54	60	46	54	46	54	52	52	52	52
R1132	40	Residential	NCA04	55	61	55	61	46	51	46	51	53	53	53	53
R1133	40	Residential	NCA04	51	57	51	57	43	50	43	50	49	49	49	49
R1134	40	Residential	NCA04	54	60	54	60	45	52	45	52	52	52	52	52
R1135	40	Residential	NCA04	54	60	54	60	46	54	46	54	52	52	52	52
R1136	40	Residential	NCA04	54	60	54	60	45	52	45	52	52	52	52	52
R1137	40	Residential	NCA04	52	58	52	58	44	50	43	50	50	50	50	50
R1138	40	Residential	NCA04	49	55	49	55	46	51	45	51	47	47	47	47
R1139	40	Residential	NCA04	53	59	53	59	45	52	45	53	51	51	51	51
R1140	40	Residential	NCA04	52	58	52	58	45	51	45	51	50	50	50	50
R1141	40	Residential	NCA04	53	59	53	59	46	52	46	52	51	51	51	51
R1142	40	Residential	NCA04	51	57	51	57	43	49	43	51	49	49	49	49
R1143	40	Residential	NCA04	52	58	52	59	43	51	44	52	51	51	51	51
R1144	40	Residential	NCA04	62	68	62	68	49	54	50	58	60	60	60	60
R1145	40	Residential	NCA04	53	59	53	59	47	53	47	53	51	51	51	51
R1146	40	Residential	NCA04	54	60	54	60	48	55	48	55	52	52	52	52
R1147	40	Residential	NCA04	58	64	58	64	48	53	49	55	56	56	56	56
R1148	40	Residential	NCA04	54	60	54	60	46	54	46	54	52	52	52	52
R1149	55	Active Recreation	Active Recreation	50	56	50	56	50	52	50	52	50	58	50	58
R1150	55	Active Recreation	Active Recreation	41	47	41	47	37	45	37	45	39	45	39	45
R1151	55	Active Recreation	Active Recreation	76	76	76	76	77	77	77	77	77	85	77	85

Appendix F – Construction noise contours for CS1B, CS2D and CS3D



Paper Size A4

0 100 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Project Site
- Extent of Works
- Noise Catchment Areas
- Active Recreation Areas

Sensitive Receiver Buildings

- Active Recreation
- Commercial
- Educational Institute
- Industrial
- Medical Facility
- Residential
- Place of Worship

$L_{Aeq(15min)}$ noise contours - CS1B (dB)

- 35
- 40
- 45
- 50
- 55
- 60
- 65
- 70
- 75
- 80

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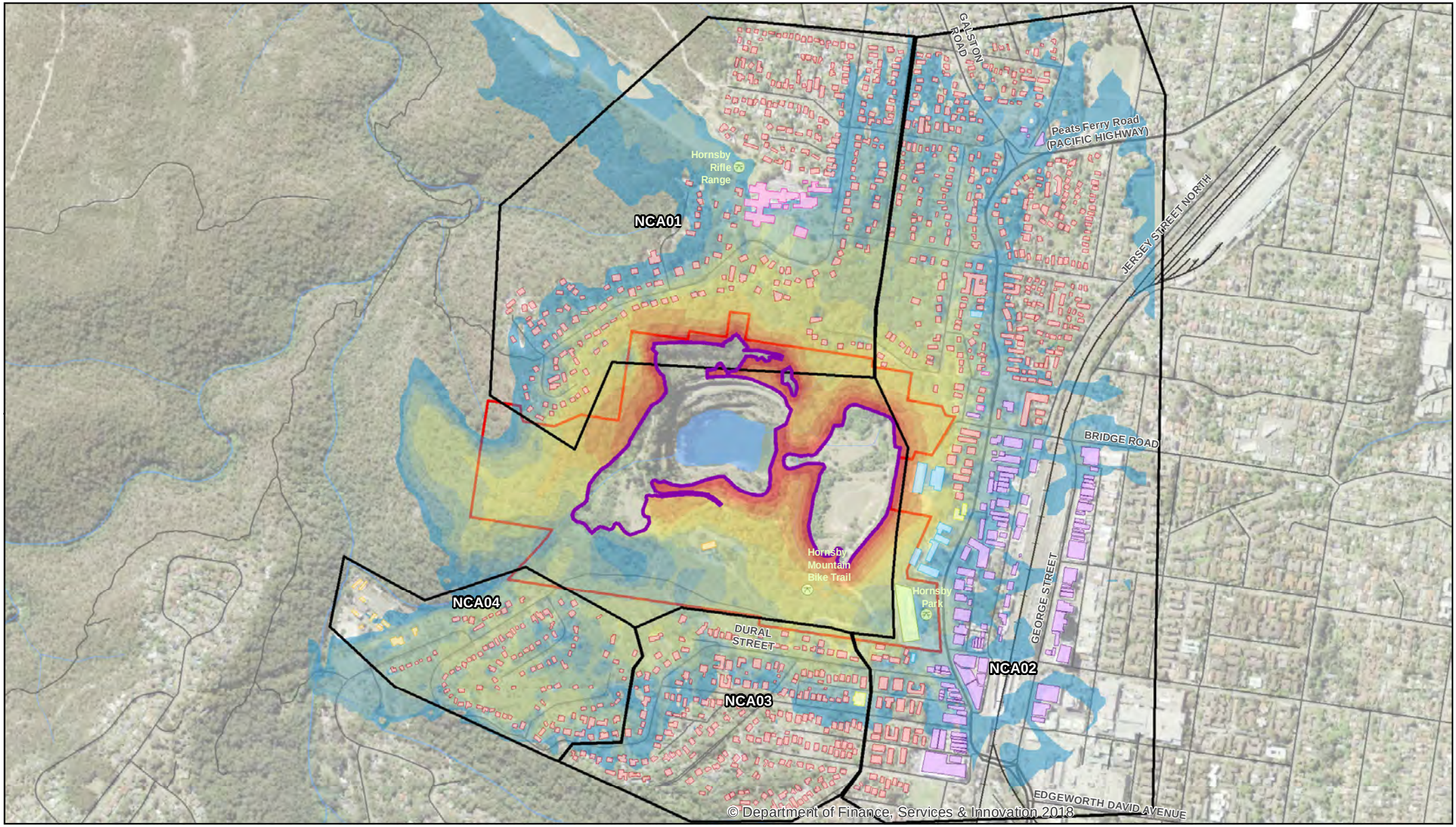
Construction noise contours for CS1B

Appendix F-1

\\ghdnet\ghd\AU\Sydney\Projects\21\26457\GIS\Maps\Deliverables\21_26457_Z009_NOISE_Appendix_SMA.mxd (SMA record: 1)

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: NSW LPI (DTDB), Topographic base data, 2012; NSW LPI (DCDB), Topographic base data, 2015. Created by:afoddy



Paper Size A4

0 100 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Project Site
- Extent of Works
- Noise Catchment Areas
- Active Recreation Areas

Sensitive Receiver Buildings

- Active Recreation
- Commercial
- Educational Institute
- Industrial
- Medical Facility
- Residential
- Place of Worship

$L_{Aeq(15min)}$ noise contours - CS2D (dB)

- 35
- 40
- 45
- 50
- 55
- 60
- 65
- 70
- 75
- 80

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Date 15 Nov 2018

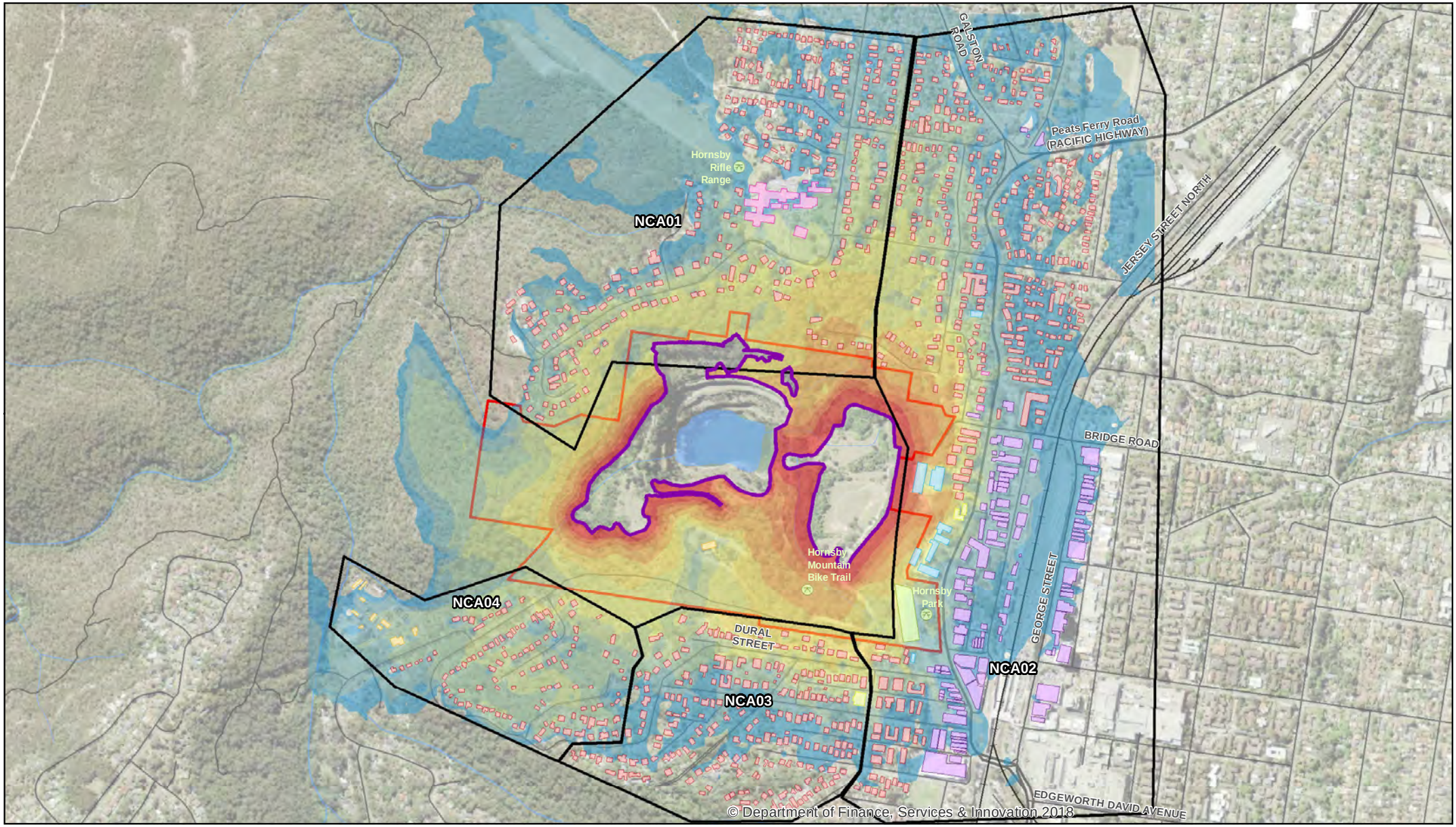
Construction noise contours for CS2D

Appendix F-2

\\ghdnet\ghd\AU\Sydney\Projects\21\26457\GIS\Maps\Deliverables\21_26457_Z009_NOISE_Appendix_SMA.mxd (SMA record: 2)

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: NSW LPI (DTDB), Topographic base data, 2012; NSW LPI (DCDB), Topographic base data, 2015. Created by:afoddy



Paper Size A4

0 100 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Project Site
- Extent of Works
- Noise Catchment Areas
- Active Recreation Areas

Sensitive Receiver Buildings

- Active Recreation
- Commercial
- Educational Institute
- Industrial
- Medical Facility
- Residential
- Place of Worship

$L_{Aeq(15min)}$ noise contours - CS3D (dB)

35 40 45 50 55 60 65 70 75 80

GHD

Hornsby Shire Council
Hornsby Quarry Rehabilitation

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Date 15 Nov 2018

Construction noise contours for CS3D

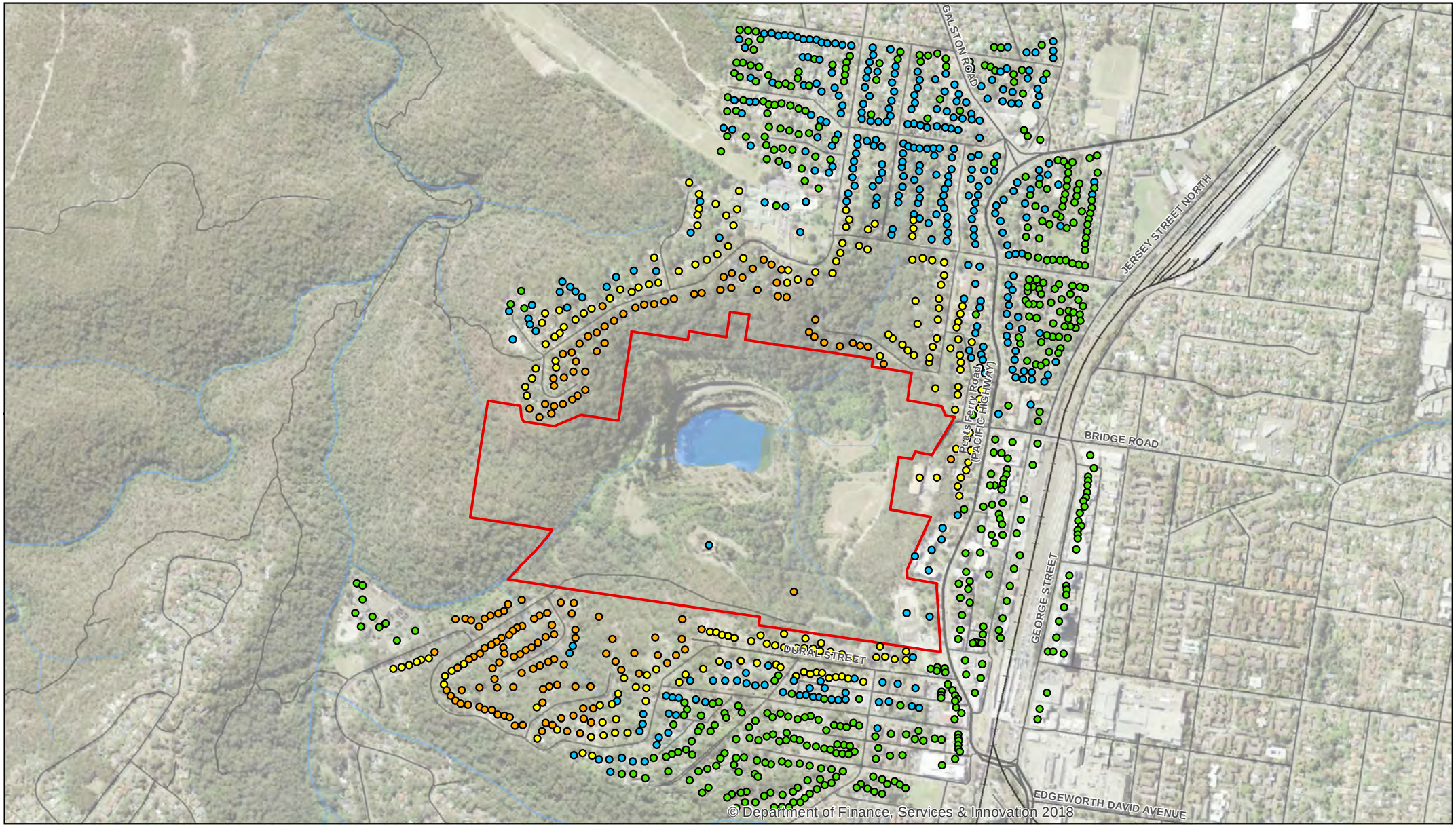
Appendix F-3

\\ghdnet\ghd\AU\Sydney\Projects\21\26457\GIS\Maps\Deliverables\21_26457_Z009_NOISE_Appendix_SMA.mxd (SMA record: 3)

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: NSW LPI (DTDB), Topographic base data, 2012; NSW LPI (DCDB), Topographic base data, 2015. Created by:afoddy

Appendix G – Exceedances above PNTLs for CS1B, CS2D and CS3D at sensitive receivers



Paper Size A4

0 100 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Project Site

Receiver Results CS1B

- >20 dB Exceedance
- >10 dB Exceedance
- Exceedance
- No Exceedance

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Exceedanaces above PNTLs for CS1B

Appendix G-1

\\ghdnet\ghd\AU\Sydney\Projects\21\26457\GIS\Maps\Deliverables\21_26457_Z009_NOISE_Appendix_SMA.mxd (SMA record: 4)

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: NSW LPI (DTDB), Topographic base data, 2012; NSW LPI (DCDB), Topographic base data, 2015. Created by:afoddy

Paper Size A4

0 100 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Project Site

Receiver Results CS2D

- >20 dB Exceedance
- >10 dB Exceedance
- Exceedance
- No Exceedance

Hornsby Shire Council
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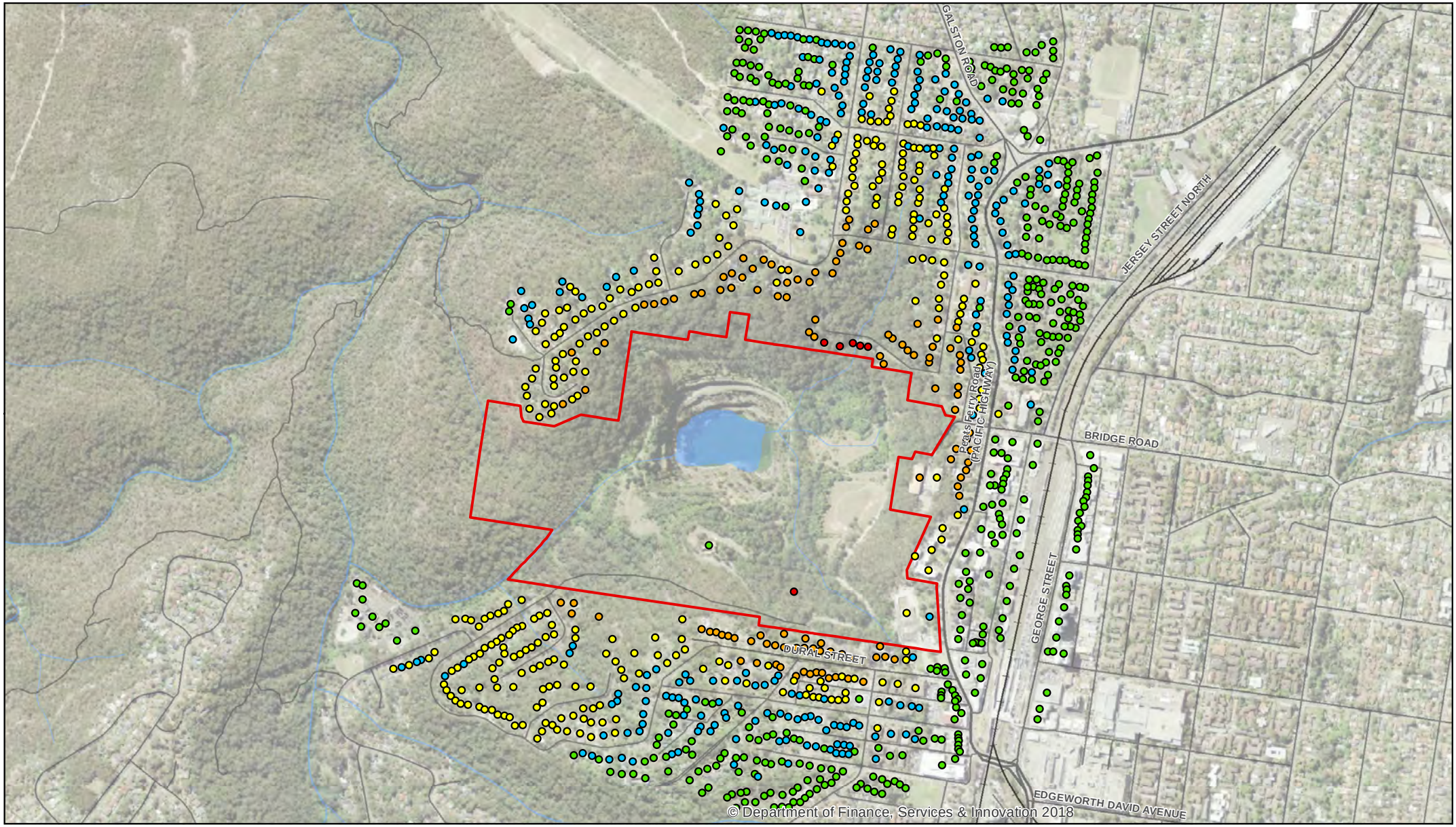
Exceedanaces above PNTLs for CS2D

Appendix G-1

\\ghdnet\ghd\AU\Sydney\Projects\21\26457\GIS\Maps\Deliverables\21_26457_Z009_NOISE_Appendix_SMA.mxd (SMA record: 5)

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: NSW LPI (DTDB), Topographic base data, 2012; NSW LPI (DCDB), Topographic base data, 2015. Created by:afoddy



Paper Size A4

0 100 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Project Site
- No Exceedance

Receiver Results CS3D

- >30 dB Exceedance
- >20 dB Exceedance
- >10 dB Exceedance
- Exceedance

Hornsby Shire Council
Hornsby Quarry Rehabilitation

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Date 15 Nov 2018

Exceedanaces above PNTLs for CS3D

Appendix G-1

\\ghdnet\ghd\AU\Sydney\Projects\21\26457\GIS\Maps\Deliverables\21_26457_Z009_NOISE_Appendix_SMA.mxd (SMA record: 6)

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: NSW LPI (DTDB), Topographic base data, 2012; NSW LPI (DCDB), Topographic base data, 2015. Created by:afoddy

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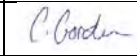
2126457-59890/https://projects.ghd.com/oc/Sydney/hornsbyquarryrehabil/Delivery/Documents/2126457-REP_EIS Noise Impact Assessment - Hornsby Quarry Rehabilitation.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	M.Velasco	C.Gordon		D.Gamble		21/11/2018

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Appendix D – Air quality assessment

Hornsby Shire Council

Hornsby Quarry Rehabilitation EIS

Air Quality Impact Assessment

November 2018

Executive summary

Hornsby Shire Council proposes to rehabilitate the Hornsby Quarry void to create a landform suitable for future development as community parkland, which will require filling and stabilisation. The landform would include a lake directly below the exposed eastern face of the quarry. This air quality impact assessment has been prepared in accordance with the Secretary's Environmental Assessment Requirements to assess dust dispersion from the rehabilitation and reshaping works expected to be undertaken throughout the project.

Three scenarios containing worst case location of plant and equipment with expected throughput rates have been modelled to account for likely particulate matter dispersion impacts. Predicted particulate matter concentrations were assessed against criteria provided in the Approved Methods.

No particulate matter criteria exceedances were predicted. Based on assumptions as outlined in the assessment, the predicted particulate matter emission from the reshaping and rehabilitation of the quarry are expected to comply with the relevant criteria wen assessed in accordance with the Approved Methods. The application of standard dust mitigation measures outlined in this report will assist to minimise potential particulate matter impacts.

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1. Introduction

1.1 Overview

Hornsby Quarry is a former breccia hard rock quarry that was operated by private business from the early 1900s and ceased in the late 1990s. The quarry is considered a safety risk and has therefore been closed to the public since that time.

Hornsby Shire Council (Council) acquired the site in 2002 and has since undertaken a number of investigations and studies with regard to the future use of the site and the environmental and technical constraints that the site poses. Through these studies, Council identified the need to:

- stabilise the quarry
- manage the site in a safe and environmentally sustainable manner, and
- actively seek opportunities to fill the quarry void with spoil arising from major infrastructure projects in the region

Council also resolved to ultimately develop the site into a community parkland.

In 2016 approval was granted to Roads and Maritime Services, to beneficially reuse up to 1.5 million cubic metres of excavated rock and soil (spoil) from the construction of the NorthConnex tunnel to partially fill the Hornsby Quarry (the '2016 Planning Approval'). Filling has been undertaken at the site under this approval.

Following completion of filling by NorthConnex, Council is proposing to rehabilitate and reshape the site in a suitable way to ensure public safety and allow future development into a parkland for community use (the project).

1.2 Purpose of this report

GHD Pty Ltd (GHD) has been engaged by Council to prepare documentation to support a development application for approval of the project under Part 4 of the New South Wales (NSW) *Environmental Planning and Assessment Act 1979* (the EP&A Act). The Environmental Impact Statement (EIS) is being prepared in accordance with the provisions of the EP&A Act.

This report has been prepared by GHD to provide an assessment of potential air quality impacts as an input to the EIS. This report addresses the Secretary of the NSW Department of Planning and Environment's Environmental Assessment Requirements (EAR 1167) dated 6 September 2017.

1.3 Project location

The project is located in the Hornsby local government area (LGA), approximately 21 kilometres (km) to the north west of the Sydney central business district. The site is accessible via Quarry Road (off Dural Street and other local roads) from the south east and from Bridge Road (off the Peats Ferry Road from the north east.

Figure 1.1 shows the location of the site.

1.4 Project overview

Key features of the project include:

- Rehabilitation, stabilisation and geotechnical safety management works around various parts of the site

- Earthworks and placement of material won from within the site to create a final landform similar to Option 1 in the Clouston Associates (2014) 'Recreation Potential Study for Hornsby Quarry and Old Mans Valley Lands' (p.88).

Approximately 500,000 m^3 of spoil is expected to be generated from stabilisation of the northern face as well as obtained from nearby onsite earthworks. Much of this material would be placed on the NorthConnex spoil to create a landform that generally slopes from the proposed lake up to the top of the western quarry face and would allow for the creation of a new parkland to be constructed within the quarry void. The landform would include a lake directly below the exposed eastern face of the quarry. There would also be cut and fill works on Old Mans Valley to create a landform suitable for future development into playing fields and other recreational activities.

It is expected that a combination of ripping, rock breaking and rock sawing will be required to shift the material. Rock fragments would be crushed onsite using a mobile crusher or rock breaker prior to placement as fill.

No additional spoil is proposed to be imported to the site for filling purposes nor would the excavated material be transported off the site.

The project is expected to take approximately two years to complete.

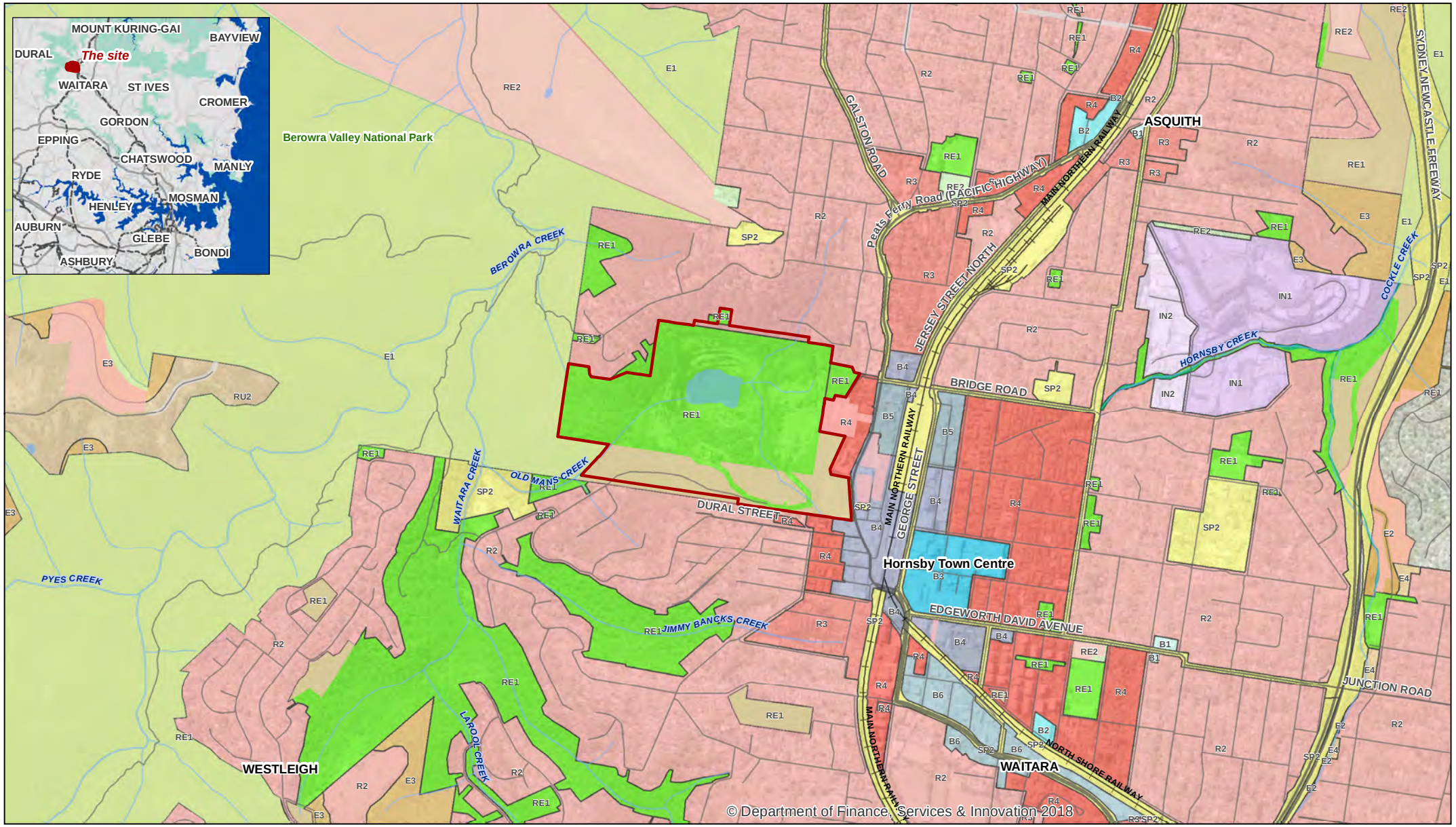
The proposed extent of works is shown in Figure 1.2

1.5 Definitions

The following terms are used within this report:

- The 'site' refers to the entirety of:
  - Lots A, B, C, D and E in Deposited Plan (DP) 318676
  - Lot 1 DP 926103
  - Lot 1 DP 926449
  - Lot 1 DP 114323
  - Lots 1 and 2 in DP 169188
  - Lot 7306 DP 1157797
  - Lot 1 DP 859646
  - Lot 1 DP 926449
  - Lot 13 DP 734459
  - Lot 114 DP 749606
  - Lot 213 DP 713249
  - Summers Avenue, Hornsby partly formed
  - Old Mans Valley Trail

  The boundary of the site is shown on Figure 1.1
- The 'extent of works' refers to both the quarry pit filling extent and the earthworks design extent plus an additional 2 to 5 m outside these areas to allow for construction fencing, etc. The boundary of the extent of works is shown on Figure 1.2.



Paper Size A4

0 200 400 800

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Legend

- The site
- Watercourses
- Parks and reserves
- Crown parcel
- Crown road
- Crown waterway

Hornsby Shire Council
Hornsby Quarry Rehabilitation

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Date 09 Nov 2018

Site location, surrounding land uses and zoning

Figure 1.1

N:\AU\Sydney\Projects\21\26457\GIS\Maps\Deliverables\21_26457_Z001_SMA.mxd (SMA record: 1)

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: NSW LPI (DTDB), Topographic base data, 2012; NSW LPI (DCDB), Topographic base data, 2015. Created by:jwatson2

LEGEND

- CADASTRE
- ASSUMED EXISTING SURFACE
- PIT FILLING EXTENT
- EARTHWORKS DESIGN EXTENT
- EXTENT OF WORKS

VEGETATION COMMUNITY

- SYDNEY BLUE GUM - BLACKBUTT SMOOTH-BARKED APPLE MOIST SHRUBBY OPEN FOREST (CEEC TSC A□□) (MODERATE/GOOD - POOR)
- BLACKBUTT GULLY FOREST (POOR)
- BLACKBUTT GULLY FOREST (MODERATE/GOOD - HIGH)
- BLACKBUTT GULLY FOREST (MODERATE/GOOD - POOR)

0 30 60 90m

SCALE 1:3000 AT ORIGINAL SIZE

N

HORNSBY SHIRE COUNCIL
HORNSBY QUARRY REHABILITATION
EXTENT OF WORKS

Job Number 21-26457
Revision A
Date SEP 2018

Figure 1.2

Level 15, 133 Castlereagh Street, Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Plot Date: 25 September 2018 - 3:53 PM Plotted by: Celine El-Khouri Cad File No: G:\21\26457\CADD\Drawings\21-26457-SK206.dwg

1.6 Secretary's Environmental Assessment Requirements (SEAR) 1167

The specific SEARs and agency requirements addressed in this report are summarised in Table 1-1.

Table 1-1 Secretary's Environmental Assessment Requirements and agency requirements (extract)

Assessment requirements	Section(s) of this report where addressed
Legislation	
Relevant legislation • *Protection of the Environment Operations (POEO) Act 1997* • *Protection of the Environment Operations (Clean Air) Regulation 2002* • Secretary's Environmental Assessment Requirements 1167	 Section 3 Section 3 Section 6
Relevant policies and guidelines • Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (NSW EPA, 2016)	Section 3
Air quality	
• Assess the likely air quality impacts of the development in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW. • Assess the potential dust impacts on any nearby private receptors due to construction activities	Section 6 Section 6

1.7 Scope and structure of the report

1.7.1 Scope of report

GHD conducted an air quality impact assessment to assess the potential impacts of the Project. The assessment involved the following tasks:

- Undertaking a desktop review of site plans, aerial photographs and topographic maps to gain an understanding of the existing environment in terms of local terrain, existing/proposed operations and sensitive receptors within the study area.
- Reviewing available ambient air quality monitoring data, to gain an understanding of existing air quality in the vicinity of the site. Ambient dust levels were sourced from data recorded from the Office of Environment and Heritage (OEH) ambient monitoring station located in Lindfield.
- Outlining the applicable air quality criteria with consideration to the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (EPA, 2016) (the Approved Methods').
- Undertaking meteorological modelling to gain an understanding of the local wind climate and use as input for conducting atmospheric dispersion modelling.
- Preparing an emission inventory for the quarry rehabilitation and reshaping activities to identify significant sources of dust emission and estimate the emissions rates. Emission rates were estimated using emission factors published in the *National Pollutant Inventory (NPI) Emission Estimation Technique Manual (EETM) for Mining V 3.1 (2012)* and the *National Pollutant Inventory Emission Estimation Technique Manual for Mining and*

Processing of Non-Metallic Minerals Version 2.1 (2014). This air quality impact assessment focused on the potential impact from particulate (dust) emissions, in particular; total suspended particulates (TSP), fine particulates less than 10 micrometres in equivalent aerodynamic diameter (PM_{10}) and dust deposition.

- Undertaking dust modelling using the regulatory atmospheric dispersion model CALPUFF for use in areas with complex terrain based on proposed rehabilitation scenarios.
- Recommending in principle mitigation and management measures to reduce potential dust impacts.

1.7.2 Structure of report

This report is structured as follows:

- **Chapter 1 – Introduction:** introduces the project and describes the site
- **Chapter 2 – Existing environment:** summarises the existing environmental air quality conditions
- **Chapter 3 – Air quality criteria:** outlines the relevant Commonwealth and State legislation and any guidelines and assessment criteria relevant to air quality during the rehabilitation of the quarry.
- **Chapter 4 – Emissions from the project:** outlines the estimated emissions to air from the project
- **Chapter 5 – Assessment methodology:** details the assessment methodology and process followed to synthesize meteorology for the project site
- **Chapter 6 – Predicted impacts**: presents a summary of the dust impact assessment results
- **Chapter 7 – Mitigation measures:** Provides an overview of the proposed air quality mitigation measures undertaken during the project
- **Chapter 8 – Conclusion:** presents a summary of the air quality findings and sets out the principal conclusions for the assessment.

1.8 Limitations

This report: has been prepared by GHD for Hornsby Shire Council and may only be used and relied on by Hornsby Shire Council for the purpose agreed between GHD and the Hornsby Shire Council as set out in this report.

GHD otherwise disclaims responsibility to any person other than Hornsby Shire Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

2. Existing environment

2.1 Sensitive receptors

The location of the nearest identified sensitive receptors to the site are presented in Table 2-1 with the address and receptor type. *The Approved Methods* (EPA, 2016) defines sensitive receptors as locations where people are likely to work or reside and may include a dwelling, school, hospital, office or recreation area. A figure showing the location of the site and surrounding receptors is supplied in Figure 2.1. Nearest receptors to the project site in each general direction are included in the assessment.

Table 2-1 Sensitive receptor location

ID	X Coordinate (m)	Y Coordinate (m)	Address	Description
R01	322765	6269885	98 Manor Rd	Residential
R02	322962	6270094	43 Manor Rd	Residential
R03	323305	6270043	17 Fern Tree Cl	Residential
R04	323473	6269945	1A Fern Tree Cl	Residential
R05	323646	6269831	1 Bridge Rd	Residential
R06	323651	6269577	207 Peats Ferry Rd	St Peters Anglican Church Hornsby
R07	323514	6269385	203 Peats Ferry Rd	Hornsby Aquatic and Leisure centre
R08	323295	6269291	24A Quarry Rd	Residential
R09	323041	6269331	52 Dural St	Residential
R10	322728	6269374	3 Lockinvar Pl	Residential

Paper Size A4

0 100 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

The Site

Sensitive Receptors

Hornsby Shire Council
Hornsby Quarry Rehabilitation

Job Number 21-26457
Revision A
Date 13 Nov 2018

Site and receptor location

Figure 2.1

G:\21\26457\GIS\Maps\Deliverables\21_26457_Z010_AIR_SMA.mxd (SMA record: 7)

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: NSW LPI (DTDB), Topographic base data, 2012; NSW LPI (DCDB), Topographic base data, 2015. Created by:jrbacani

2.2 Relevant pollutants

Air quality may be impacted by a number of pollutants, each of which has different emission sources and effects on human health and the environment.

Dust and particular matter was identified as the pollutant most likely to impact nearby sensitive receptors. The assessment of dust and particulate matter includes:

- Total suspended particulates (TSP)
- Particulate matter smaller than 10 microns (PM_{10})
- Particulate matter smaller than 2.5 microns ($PM_{2.5}$) and
- Dust deposition

Fine particle emissions associated with exhausts from mobile plant and stationary engines used during construction activities are accounted for in the emission factors for earthmoving and handling used in the air quality assessment. Engine emission sources during operation are expected to be discontinuous, transient and mobile.

2.3 Ambient air quality

The NSW Office of Environment and Heritage (OEH) operates ambient air quality monitoring stations in selected areas around NSW. The nearest station to the site with sufficient data is the Lindfield station, which is approximately 11 km southeast of the site. The Macquarie park station is located closer at approximately 10 km southeast of the site, but does not contain data from the representative modelling year.

Background PM_{10} measurements for the modelled year (2013, selection of modelled year is discussed in section 5.1) were taken from the Lindfield OEH monitoring site. Historical air quality data is limited, so daily background TSP and $PM_{2.5}$ data has been scaled off PM_{10} measurements. A TSP to PM_{10} ratio of 2:1 was assumed. Review of recent particulate measurements from the Macquarie monitoring station (10/8/2017 – 7/10/2018) resulted in a $PM_{10}/PM_{2.5}$ ratio of 2.66. This ratio has been used to scale $PM_{2.5}$ for the modelled year.

The adopted annual background TSP, PM_{10} and $PM_{2.5}$ concentrations are presented in Table 2-2. A summary of the 24 hour PM_{10} and $PM_{2.5}$ data set is shown in Figure 2.2 with the associated assessment criteria. Any 24 hour periods that contain background concentrations that exceed impact criteria have been excluded from this assessment

Table 2-2 Background ambient levels for TSP, PM_{10} and $PM_{2.5}$

Pollutant	Assumed ambient concentration ($\mu g/m^3$)
$PM_{2.5}$ (Annual average)	5.4
PM_{10} (Annual average)	14.4
TSP (Annual average)	28.8

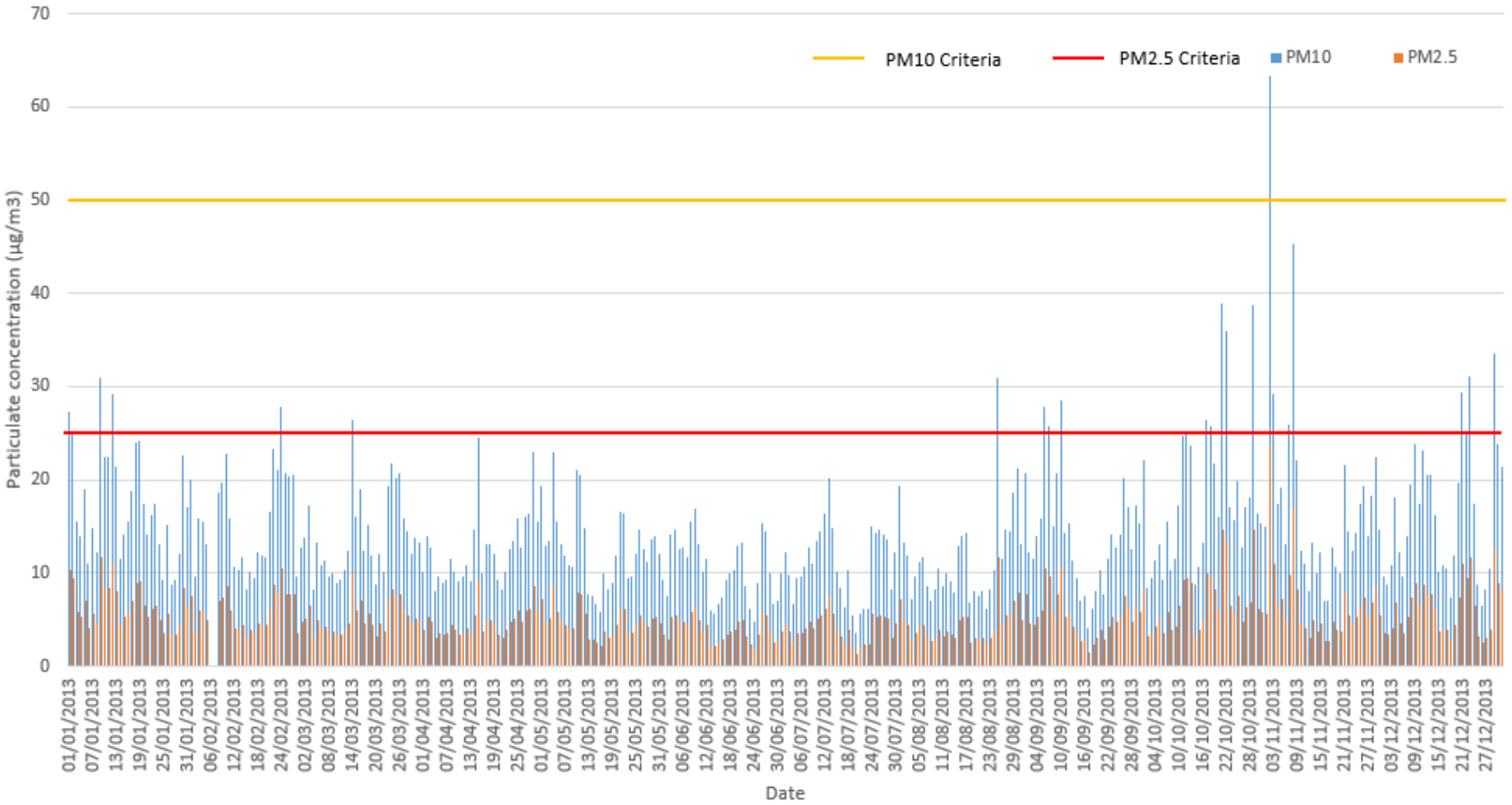


Figure 2.2 24 hour average PM_{10} and $PM_{2.5}$ data monitored at Lindfield (2013)

3. Air quality criteria

3.1 Legislative and policy context to the assessment

The *Protection of the Environment Operations (POEO) Act 1997* provides the statutory framework for managing pollution in NSW, including the procedures for issuing licences for environmental protection on aspects such as waste, air, water and noise pollution control. Companies and property owners are legally bound to control emissions (including particulates and deposited dust) from construction sites under the POEO Act. Activities undertaken onsite must not contribute to environmental degradation, and pollution and air emissions must not exceed the standards. Where an environment protection licence applies, air quality requirements (including criteria) may be specified by the licence.

The *Protection of the Environment Operations (Clean Air) Regulation 2010* (the Clean Air Regulation) provides regulatory measures to control emissions from motor vehicles, fuels, and industry. The project would be operated to ensure it complies with the Clean Air Regulation.

The National Environment Protection Council of Environmental Ministers, now the National Environment Protection Council (NEPC), set uniform national standards for ambient air quality in February 2016. These are known as the *National Environment Protection (Ambient Air Quality) Measure* ('the Air NEPM'). The Air NEPM sets non-binding standards and ten-year goals (for 2026). The Air NEPM contains goals for the identified relevant pollutants inclusive of particulates such as PM_{10} and $PM_{2.5}$ and toxic pollutants including CO, NO_2, and SO_2. The Air NEPM contains concentration limits, averaging periods and number of allowed exceedances for each of the identified pollutants.

The Air NEPM standards apply to regional air quality as it affects the general population. The standards do not apply in areas impacted by localised air emissions, such as industrial sources, construction activity, and heavily trafficked streets and roads.

The Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (EPA, 2016) (the Approved Methods) lists the statutory methods for modelling and assessing emissions of air pollutants from stationary sources in NSW. It considers the above mentioned legislation and acts to construct pollutant assessment criteria. The Approved Methods assess the cumulative (background plus incremental site emissions) pollutant impact at the site boundary or the nearest existing or likely future off-site sensitive receptor depending on pollutant. Background concentrations of air pollutants are ideally obtained from ambient monitoring data collected at a proposal site in accordance with the Approved Methods.

The Approved Methods recognises that this data is rare, and that data is typically obtained from monitoring sites as close as possible to a proposal site, where sources of air pollution resemble the existing sources at the project site.

3.2 Project impact assessment criteria

Assessment criteria has been taken from the Approved Methods to set the impact assessment criteria for the project. These criteria should be met at existing or future off-site sensitive receptors. The assessment criteria is provided as cumulative impacts, where the predicted impact of the project is added to the background levels in order to assess the pollutants impacts. To ensure that environmental outcomes are achieved, emissions from the project must be assessed against the assessment criteria shown in Table 3-1.

Table 3-1 Impact assessment criteria

Pollutant	Averaging period	Concentration ($\mu g/m^3$)
Total suspended particulates (TSP)	Annual	90
PM_{10}	24 hours	50
	Annual	25
$PM_{2.5}$	24 hours	25
	Annual	8
Dust deposition	Annual	2 g/m^2/month*

** Maximum Increment. Maximum cumulative impact of 4 g/m^2/month.*

4. Emissions from the project

4.1 Emissions overview

The air quality assessment focuses on dust and particulate matter, as they are the primary emissions to air from the rehabilitation and reshaping of the quarry, with potential for off-site impacts. This section details the estimated air emissions from the project and the scenarios modelled.

The fractions of interest assessed in this report are airborne concentrations of TSP and fine particulate matter as well as total deposited dust. Weather conditions that cause maximum dust impact are generally consistent winds in the direction of the nearest sensitive receivers throughout the daytime period outside of rain events.

The rehabilitation processes that may generate significant amounts of particulate matter (dust) are identified to be:

- Stabilisation works
- Earthworks across other parts of the site in order to rehabilitate the site
- Placement of material from stabilisation and earthworks in the quarry void to create a final landform suitable for future development into a community parkland.

Emissions factors were taken from the *National Pollutant Inventory Emission Estimation Technique Manual for Mining and Processing of Non-Metallic Minerals Version 2.1 (2014)* and the *National Pollutant Inventory Emission estimation Technique Manual for Mining Version 3.1 (2012).* The techniques used to estimate emissions from operations are based primarily on activity rate (e.g. tonnes per hour).

Expected plant and equipment throughputs have been calculated based on the expected total amount of material moved during the entire project and the predicted duration each piece of plant and equipment will be active on site. Estimated throughput calculations are provided in Appendix A.

Other air emissions such as combustion products (e.g. vehicle exhaust) will also be present within the quarry site, however due to the small number of vehicles, the potential for impact from these emissions is considered to be negligible. Fine particle emissions associated with exhausts from mobile plant and stationary engines used during construction activities are accounted for in the emission factors for earthmoving and handling used in the air quality assessment. Therefore, vehicle exhaust emissions have not been considered further in this assessment.

4.2 Project activities and emissions

It is understood that the project will involve the handling and transfer of compacted and loose fill, weathered sandstone and hard rock. This material will be moved by various plant and equipment to fill in the quarry. Quarry rehabilitation and reshaping activities that generate dust and their associated plant and equipment are presented in Table 4-1.

Table 4-1 Dust generating activities and plant

Activity	Plant/equipment involved	Plant/equipment quantity
Excavation	Excavator	7
Ripping		
Rock breaking		
Crushing	Rock crusher	1

Screening	Screening plant	1
Filling	Dozer, Roller/compactor	2 2
Moving spoil	Articulated dumper	6

4.3 Assessed scenarios

The quarry rehabilitation and reshaping works have been represented in three scenarios which represent potential worst case situations. Plant and equipment throughputs and location are different for each scenario. The three modelled scenarios are:

Scenario 1

- – West: Excavation, rock breaking/ripping/crushing works and rock sawing
- – Quarry: Rock ripping, filling works, screening and excavation.

Scenario 2

- – North: Excavation works
- – Quarry: Excavation, Rock breaking/sawing/crushing, filling and screening
- – East: Excavation and filling

Scenario 3

- – West: Excavation and rock sawing
- – Quarry: Filling
- – East: Rock ripping/sawing/crushing, filling, excavation and screening

General operations in each scenario are shown in in Figure 4.1 to Figure 4.3.

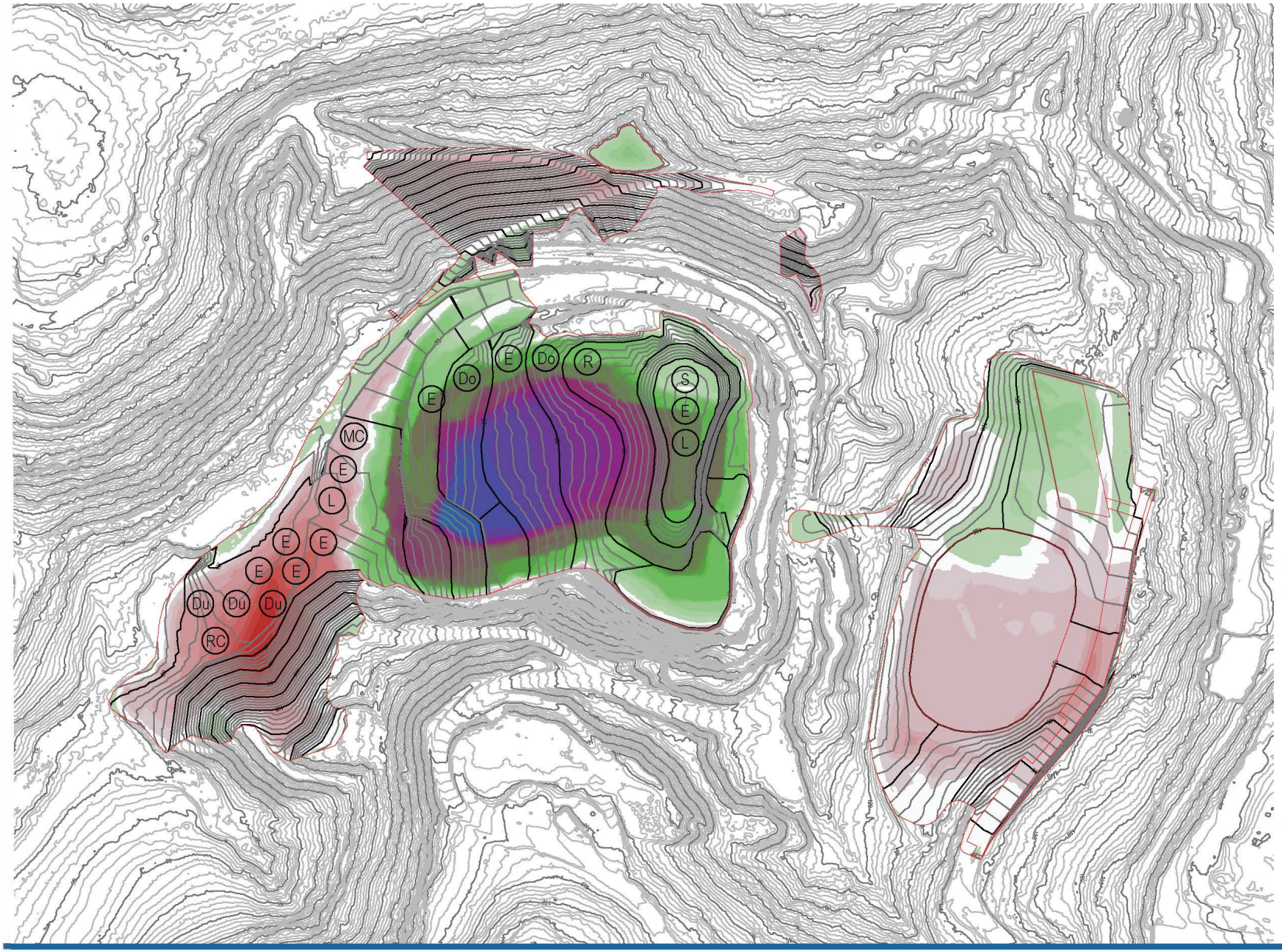
A complete emissions inventory that details all emissions sources is presented in Table 4-2, Table 4-3 and Table 4-4 for scenarios 1, 2 and 3 respectively. Estimated daily total throughputs presented in Table 4-2, Table 4-3 and Table 4-4 for use of the excavator, screener and crusher have been calculated using estimates provided in Appendix A. Dumped material is equal to excavated material.

Rock sawing has the potential to produce dust in a localised area around the activity. It has been assumed that all rock saws are equipped with wet control systems to aid in dust suppression and heat management. Wet control systems such as built in water sprays significantly reduce dust dispersion. It has been assumed that wet control systems are active while rock sawing resulting in minimal dust generation. Due to its expected minimal impacts with wet controls, rock sawing has not been included in the emissions inventory and modelling.

The following assumptions were made in calculating the dust emission rates for quarry activities:

- Proposed activities have been modelled to occur at a consistent production rate
- Sources in the model have been split up to represent scenarios in the figures below
- Adequate water supplies will be available to undertake dust suppression watering
- The use of a water truck, compactor and roller have been assumed not to generate dust emissions, as its use will act to suppress emissions. Therefore, the water truck, compactor and roller are not included in the emissions inventory.

- Rehabilitation works occur during standard construction works, 07:00 – 18:00 Monday – Friday and 08:00 – 13:00 on Saturday.
- Wet control systems are active during rock sawing resulting in minimal dust generation.



CUT FILL DEPTH RANGE

25m CUT
22.5m
20m
17.5m
15m
12.5m
10m
7.5m
5m
2.5m
0
2.5m
5m
7.5m
10m
12.5m
15m
17.5m FILL

17.5m FILL
20m
22.5m
25m
27.5m
30m
32.5m
35m
37.5m
40m
42.5
45m
47.5m
50m
52.5m
55m
57.5m
60m FILL

LEGEND

ASSUMED EXISTING SURFACE

PIT AREA DESIGN SURFACE

(E) EXCAVATOR

(Du) DUMPER

(Do) DOZER

(RC) ROCK SAW

(MC) MOBILE CRUSHER

(L) LOADER

(R) ROLLER

(S) SCREENER

0 30 60 90m

SCALE 1:3000 AT ORIGINAL SIZE

N

GHD

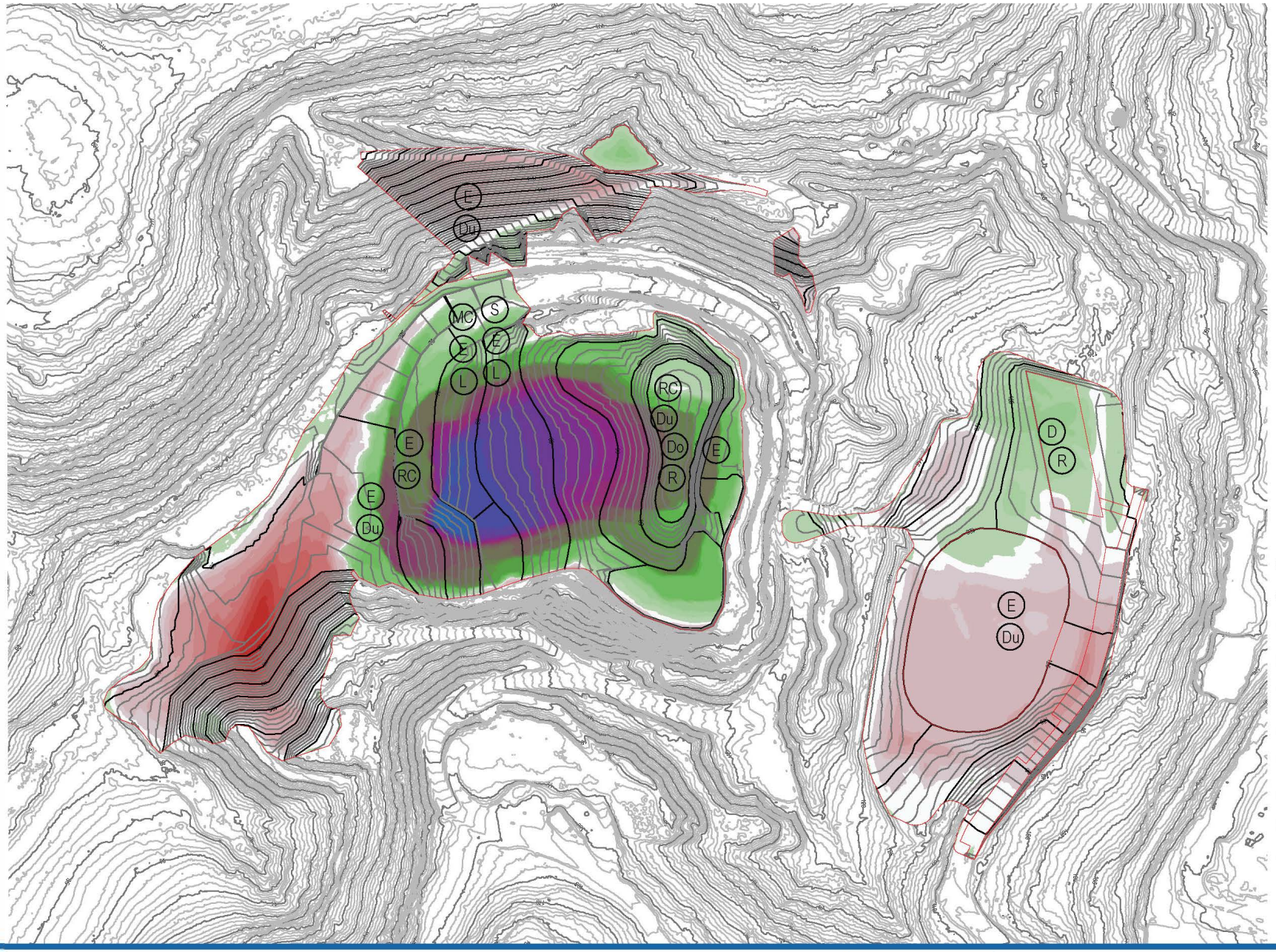
HORNSBY SHIRE COUNCIL
HORNSBY QUARRY REHABILITATION
PROJECT FINAL LANDFORM
SCENARIO 1

Job Number 21-26457
Revision A
Date SEP 2018

Figure 4.1

Level 15, 133 Castlereagh Street, Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Plot Date: 12 October 2018 - 10:42 AM Plotted by: Rashmith Grewal Cad File No: G:\21\26457\CADD\Drawings\21-26457-FIG4.1.dwg



CUT FILL DEPTH RANGE

25m CUT	17.5m FILL
22.5m	20m
20m	22.5m
17.5m	25m
15m	27.5m
12.5m	30m
10m	32.5m
7.5m	35m
5m	37.5m
2.5m	40m
0	42.5
2.5m	45m
5m	47.5m
7.5m	50m
10m	52.5m
12.5m	55m
15m	57.5m
17.5m FILL	60m FILL

LEGEND

- ASSUMED EXISTING SURFACE
- PIT AREA DESIGN SURFACE
- (E) EXCAVATOR
- (Du) DUMPER
- (Do) DOZER
- (RC) ROCK SAW
- (MC) MOBILE CRUSHER
- (L) LOADER
- (R) ROLLER
- (S) SCREENER

0 30 60 90m

SCALE 1:3000 AT ORIGINAL SIZE

N

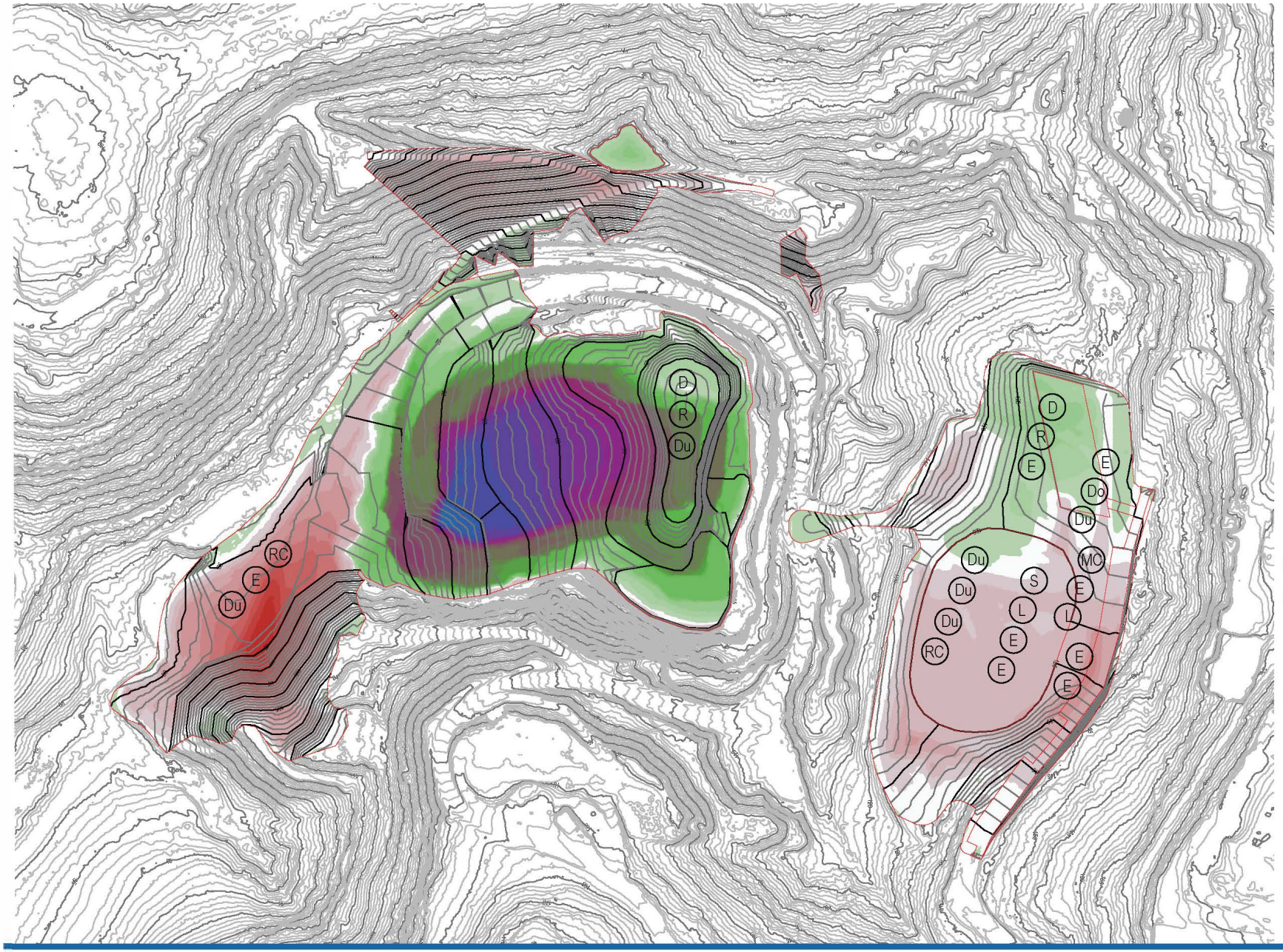
HORNSBY SHIRE COUNCIL
HORNSBY QUARRY REHABILITATION
PROJECT FINAL LANDFORM
SCENARIO 2

Job Number	21-26457
Revision	A
Date	SEP 2018

Figure 4.2

Level 15, 133 Castlereagh Street, Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Plot Date: 12 October 2018 - 10:50 AM Plotted by: Reshnith Grewal Cad File No: G:\21\26457\CAD\Drawings\21-26457-FIG4.1.dwg



CUT FILL DEPTH RANGE

- 25m CUT
- 22.5m
- 20m
- 17.5m
- 15m
- 12.5m
- 10m
- 7.5m
- 5m
- 2.5m
- 0
- 2.5m
- 5m
- 7.5m
- 10m
- 12.5m
- 15m
- 17.5m FILL

- 17.5m FILL
- 20m
- 22.5m
- 25m
- 27.5m
- 30m
- 32.5m
- 35m
- 37.5m
- 40m
- 42.5
- 45m
- 47.5m
- 50m
- 52.5m
- 55m
- 57.5m
- 60m FILL

LEGEND

- ASSUMED EXISTING SURFACE
- PIT AREA DESIGN SURFACE
- (E) EXCAVATOR
- (Du) DUMPER
- (Do) DOZER
- (RC) ROCK SAW
- (MC) MOBILE CRUSHER
- (L) LOADER
- (R) ROLLER
- (S) SCREENER

0 30 60 90m

SCALE 1:3000 AT ORIGINAL SIZE

N

HORNSBY SHIRE COUNCIL
HORNSBY QUARRY REHABILITATION
PROJECT FINAL LANDFORM
SCENARIO 3

Job Number	21-26457
Revision	A
Date	SEP 2018

Figure 4.3

Level 15, 133 Castlereagh Street, Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Plot Date: 12 October 2018 - 10:57 AM Plotted by: Reshnith Grewal Cad File No: G:\21\26457\CADD\Drawings\21-26457-FIG4.1.dwg

Table 4-2 Scenario 1 emissions inventory

Equipment	Source type	TSP emission rate (g/s)	PM_{10} emission rate (g/s)	$PM_{2.5}$ emission rate (g/s)	Assumptions
Excavator	area	0.031	0.015	0.0022	Level 2 watering applied to areas of use achieving a 50% control efficiency to be used on days with high dust potential. Assumed throughput of 22,312 t/day (estimated total daily excavation throughputs).
Rocksaw	Area	0	0	0	Wet control systems are active during operation. No dust generation is expected.
Dozer	line volume	0.71	0.16	0.023	Level 2 watering applied to areas of use achieving a 50% control efficiency to be used on days with high dust potential. Dozers operate for 10 hours per day. A maximum of 2 dozers are operational at any time.
Screener	volume	0.065	0.022	0.0033	Wet suppression system in place. Assumed 2,121 t (total screened material) of material screened each day.
Crusher	volume	0.039	0.017	0.0026	Wet suppression system in place. Assumed 2,314 t (total crushed material) of material crushed each day.
Truck movements	line volume	1.13	0.35	0.035	Based on a round trip of 200 m and a total of 416 trips per day (7 trips per vehicle per hour). Total of 83 vehicle kilometres travelled per day. Level 2 watering applied to high trafficked areas achieving a 50% control efficiency. Any long term haul roads that display high dust potential can use a combination of level 2 water or chemical dust suppression to achieve a 90% control efficiency.
Dumping material (miscellaneous transfer points)	area	0.037	0.018	0.0027	Water sprays at dumping location achieve a 70% reduction of dust dispersion. Assumed 22,312 t/day of material is transferred.

Table 4-3 Scenario 2 emissions inventory

Equipment	Source type	TSP emission rate (g/s)	PM_{10} emission rate (g/s)	$PM_{2.5}$ emission rate (g/s)	Assumptions
Excavator	area	0.026	0.012	0.0018	Level 2 watering applied to areas of use achieving a 50% control efficiency to be used on days with high dust potential. Assumed throughput of 18,266 t/day (estimated total daily excavation throughputs).
Rocksaw	Area	0	0	0	Wet control systems are active during operation. No dust generation is expected.
Dozer	line volume	0.71	0.16	0.023	Level 2 watering applied to areas of use achieving a 50% control efficiency to be used on days with high dust potential. Dozers operate for 10 hours per day. A maximum of 2 dozers are operational at any time.
Screener	volume	0.069	0.023	0.0035	Wet suppression system in place. Assumed 2,243 t (total screened material) of material screened each day.
Crusher	volume	0.037	0.017	0.0025	Wet suppression system in place. Assumed 2,243 t (total crushed material) of material crushed each day.
Truck movements	line volume	0.82	0.25	0.025	Based on a round trip of 200 m and a total of 302 trips per day (5 trips per vehicle per hour). Total of 60 vehicle kilometres travelled per day. Level 2 watering applied to high trafficked areas achieving a 50% control efficiency. Any long term haul roads that display high dust potential can use a combination of level 2 water or chemical dust suppression to achieve a 90% control efficiency.
Dumping material (miscellaneous transfer points)	area	0.031	0.015	0.0022	Water sprays at dumping location achieve a 70% reduction of dust dispersion. Assumed 18,266 t/day of material is transferred.

Table 4-4 Scenario 3 emissions inventory

Equipment	Source type	TSP emission rate (g/s)	PM_{10} emission rate (g/s)	$PM_{2.5}$ emission rate (g/s)	Assumptions
Excavator	area	0.029	0.014	0.0021	Level 2 watering applied to areas of use achieving a 50% control efficiency to be used on days with high dust potential. Assumed throughput of 20,892 t/day (estimated total daily excavation throughputs).
Rocksaw	Area	0	0	0	Wet control systems are active during operation. No dust generation is expected.
Dozer	line volume	0.71	0.16	0.023	Level 2 watering applied to areas of use achieving a 50% control efficiency to be used on days with high dust potential. Dozers operate for 10 hours per day. A maximum of 2 dozers are operational at any time.
Screener	volume	0.015	0.0049	0.00074	Wet suppression system in place. Assumed 481 t (total screened material) of material screened each day.
Crusher	volume	0.032	0.014	0.0022	Wet suppression system in place. Assumed 1922 t (total crushed material) of material crushed each day.
Truck movements	line volume	1.11	0.34	0.034	Based on a round trip of 200 m and a total of 409 trips per day (7 trips per vehicle per hour). Total of 60 vehicle kilometres travelled per day. Level 2 watering applied to high trafficked areas achieving a 50% control efficiency. Any long term haul roads that display high dust potential can use a combination of level 2 water or chemical dust suppression to achieve a 90% control efficiency.
Dumping material (miscellaneous transfer points)	area	0.035	0.017	0.0025	Water sprays at dumping location achieve a 70% reduction of dust dispersion. Assumed 20,892 t/day of material is transferred.

5. Assessment methodology

5.1 Selection of a representative year of meteorology

An analysis of meteorology from the years from 2013 to 2017 was conducted to select a period considered to be most representative of 'normal' conditions.

A comprehensive analysis of the meteorological data has been undertaken that covers five years from the BoM site at Sydney Olympic park, ID 66212. The analysis included five consecutive years of meteorological data as per guidance in the Approved Methods (EPA, 2016).

The analysis shows that the year 2013 is the most representative year based on a review of temperature, humidity, wind speed and wind direction. 2013 was also identified as not being excessively wet or dry.

Probability density function graphs of the wind speed and direction over the five years are provided in Appendix B.

5.2 Meteorological modelling

The TAPM prognostic model was run to obtain a coarse meteorological 3D gridded dataset for the site for the selected year. This dataset is based on synoptic observations, local terrain and land use information with a resolution of 1000 m. The TAPM model parameters are summarised in Table 5-1.

Table 5-1 Selected TAPM model settings

Parameter	Value
Modelled Year	Dec 2012 – Jan 2014
Domain centre	Latitude = S -33.7 Longitude = E 151.1
Site location	322367 m E; 6269457 m S Zone 56
Number of vertical levels	25
Number of Easting Grid Points	25
Number of Northing Grid Points	25
Outer Grid Spacing Number of Grids (nests)	30,000 m x 30,000 m 4
Grid Resolution	Level 1 – 30,000 m Level 2 – 10,000 m Level 3 – 3,000 m Level 4 – 1,000 m

GHD has found from previous studies that TAPM does not predict light wind conditions as well as CALMET. It is these meteorological conditions which give rise to the upper percentile impacts, (i.e. top 0.1 per cent) when poor dispersion can occur.

Upon completion of the broad scale TAPM modelling runs, a CALMET simulation was set up to run for the modelled year, combining the three dimensional gridded data output from the TAPM model and using the CALTAPM conversion utility available with CALMET. This approach is consistent with NSW OEH (2011) guidance documentation.

5.2.1 CALMET diagnostic meteorological pre-processor

The US EPA approved version of CALMET (Version 5.8) was used to resolve the wind field around the project area to a 200 m spatial resolution. The application of CALMET is an approved modelling approach in Approved Methods, with model guidance documentation provided (OEH, 2011).

All model settings were selected based on the OEH (2012) guidance and as per the CALPUFF modelling guidelines (OEH, 2011, p. 5). CALMET was run using the no observation (NOOBS) mode with the TAPM data provided as an initial guess field.

All CALMET settings were selected as per the CALPUFF guidance document OEH (2011).

The terrain of the site is shown in Figure 5.1 and the land usage of the site is shown in Figure 5.2. Lakes Calpuff View was used to generate the geo file containing topography and land use data to the resolution required for the CALMET run. This file was modified manually to produce the results with the site location in the centre. The meteorology of the region is influenced by the local terrain and vegetation meaning that the resulting winds in the local area are different to those experienced at the Olympic park BOM site approximately 18 km away.

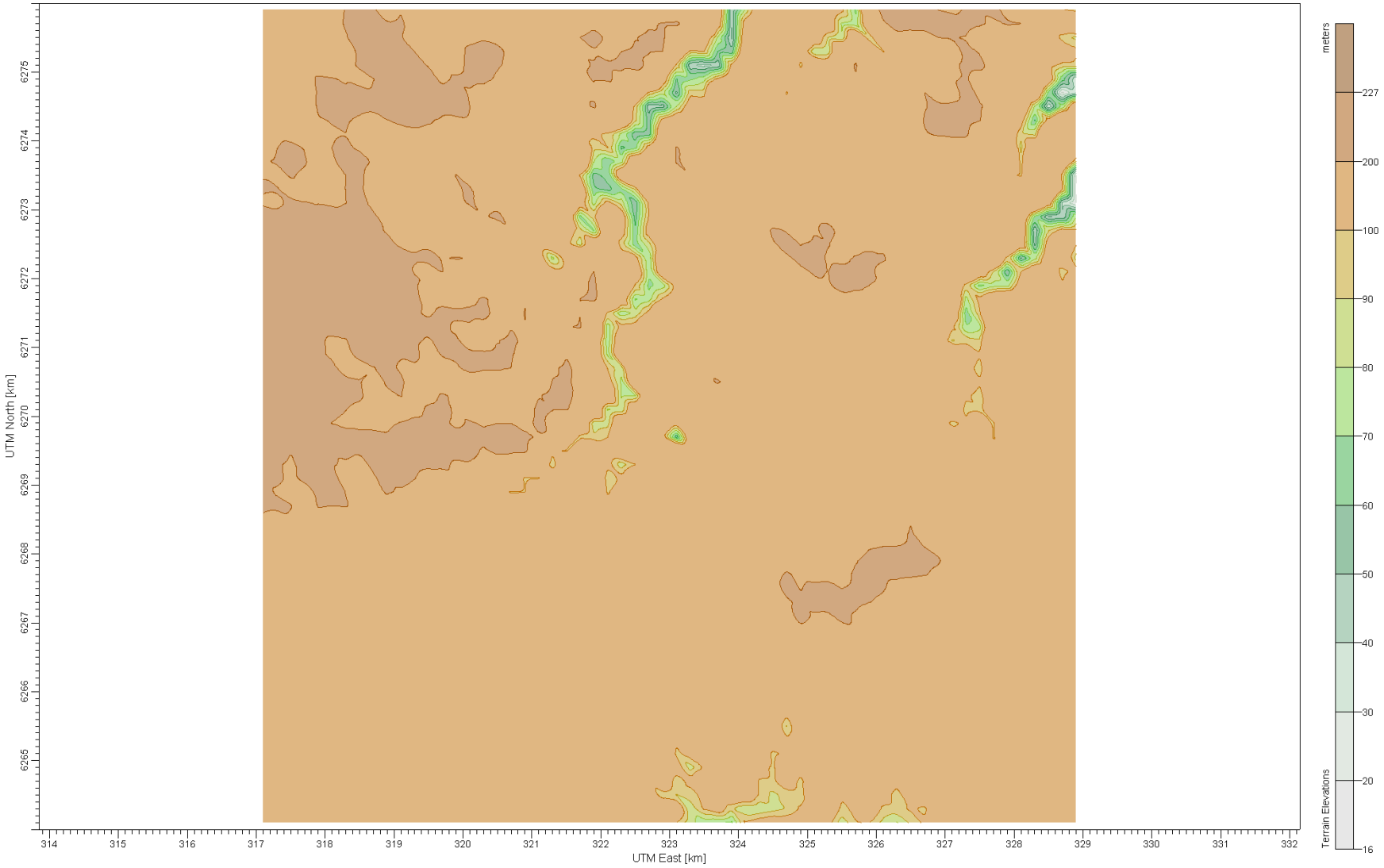


Figure 5.1 CALMET terrain data

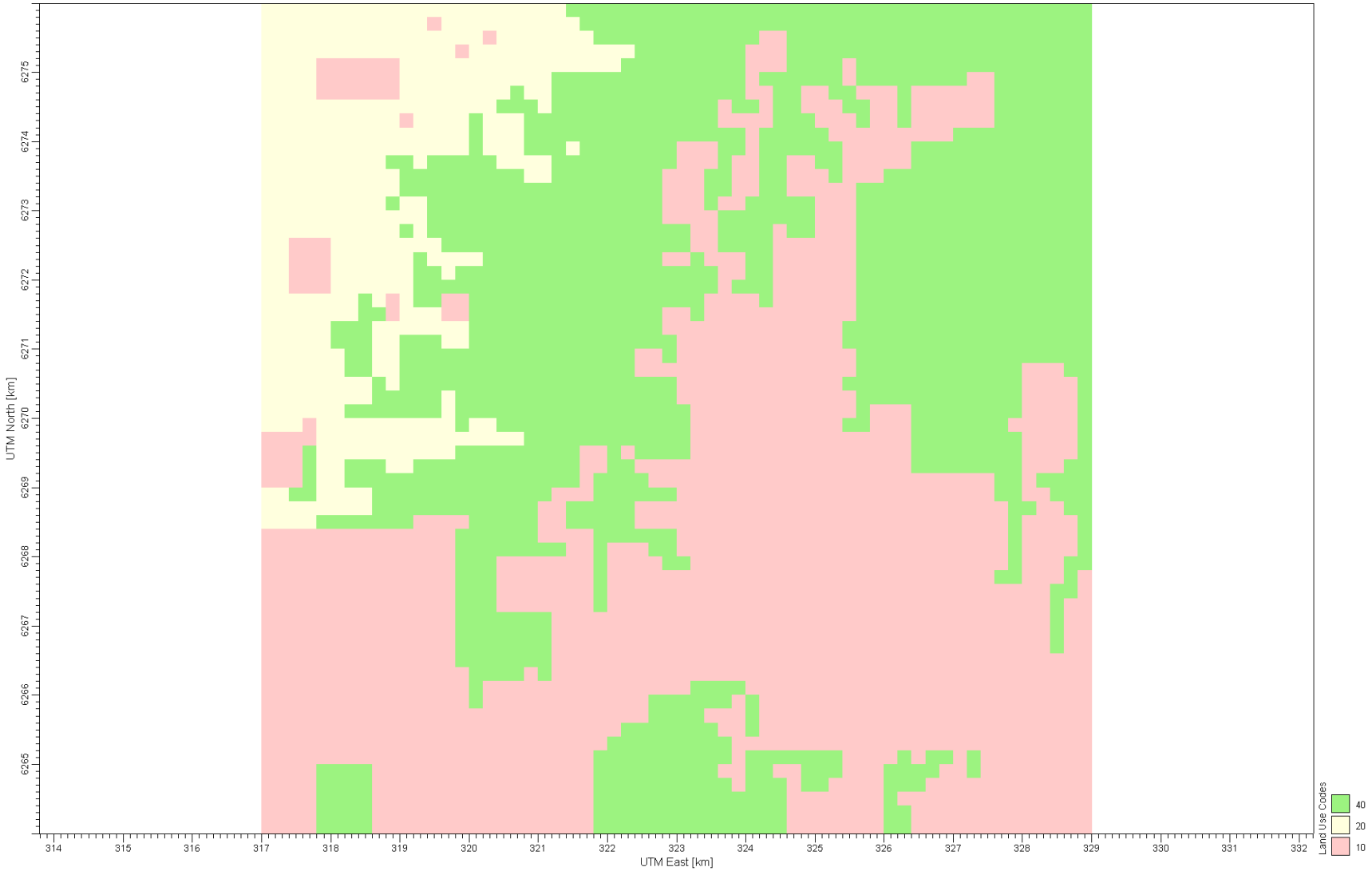


Figure 5.2 CALMET Land usage data

The TERRAD variable was set to a value of 5 km based on an inspection of the terrain elevations in the immediate vicinity of the site, based on OEH (2011) guidance. The CALMET model parameters are summarised in Table 5-2.

Table 5-2 Selected CALMET model settings

Parameter	Value
Mode	NOOBS mode
UTM Zone	52
Domain Origin (SW corner)	Easting: 317.000 km Northing: 6264.000 km
Grid Resolution	60 x 60 at 0.2 km resolution (12 km x 12 km)
Number of Vertical Levels	11
Vertical Levels (m)	20,40,60,90,120,180,250,500, 750, 1000, 2000, 3000
CALMET Settings for No-Obs mode (OEH, 2011)	TERRAD = 5 km

5.3 Site specific meteorology

5.3.1 Wind

The local meteorology largely determines the pattern of off-site air quality impact on receptors. The effect of wind on dispersion patterns can be examined using the wind and stability class distributions at the site. The winds at a site are most readily displayed by means of wind rose and stability distribution plots.

The features of particular interest in this assessment are: (i) the dominant wind directions and (ii) the relative incidence of stable light wind conditions that yield minimal mixing.

Annual wind patterns

Figure 5.3 shows the annual average wind rose for the site for the period 1 January 2013 to 31 December 2013, and the following features can be seen:

- Annual average wind speed of 1.86 m/s
- Winds are most prevalent from the northeast and southwest sectors.
- Winds are least prevalent for the northwest and southeast sectors
- Light winds (< 2 m/s) are more prevalent from the northeast and southwest sector.
- The observed wind speed distribution indicates that the largest proportion of high wind speeds (> 4 m/s) are from the west.

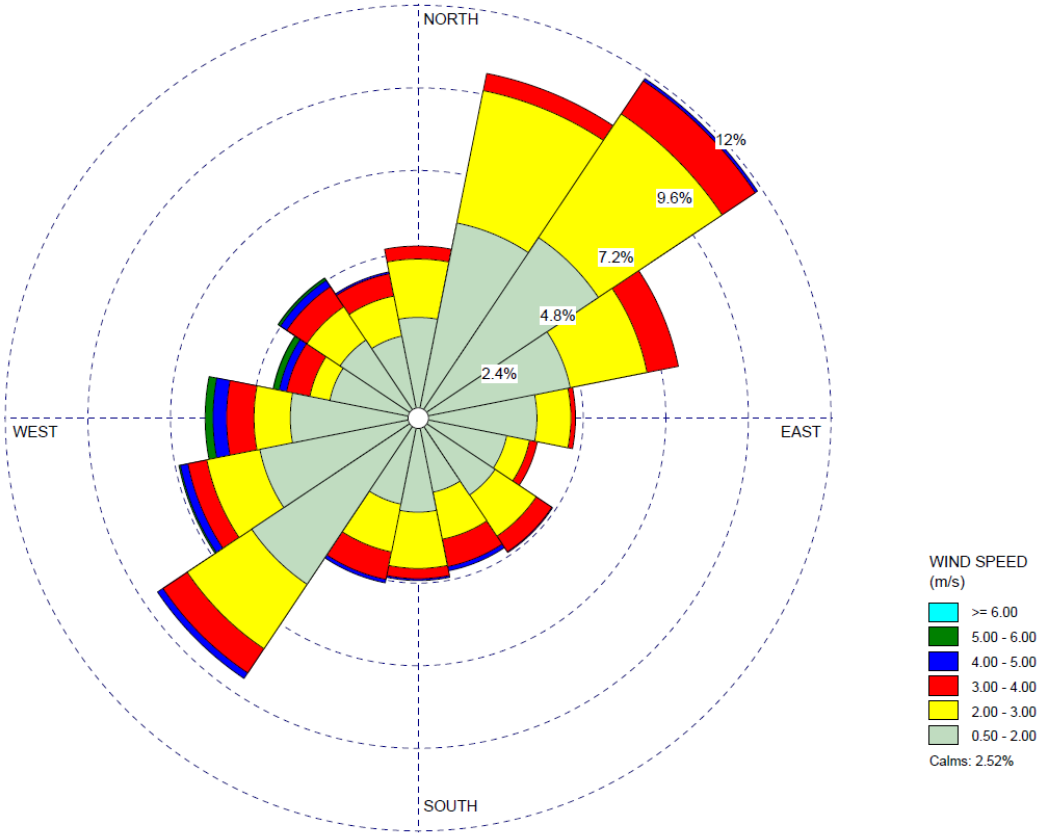


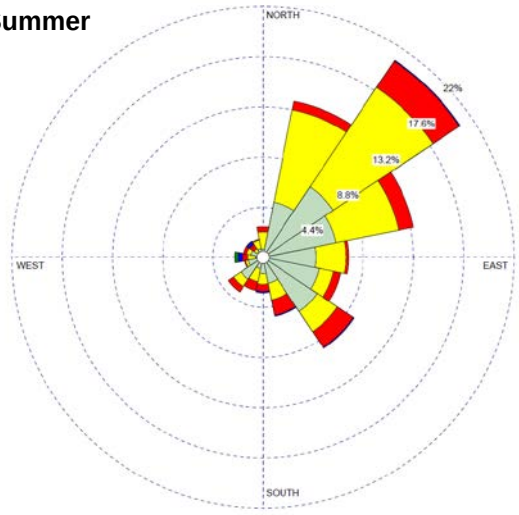
Figure 5.3 CALMET annual wind rose at project site (average wind speed = 1.86 m/s)

Seasonal variation in wind patterns

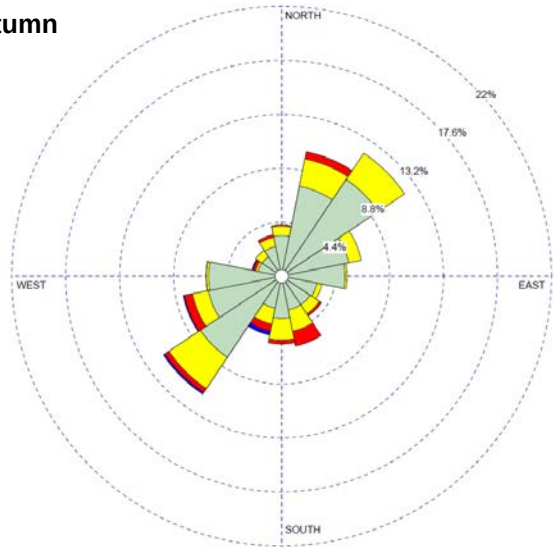
The seasonal wind roses for 2013 are presented in Figure 5.4 and show that:

- During summer the predominant wind direction is from the north east.
- During winter the predominant wind direction is form the west and south west.
- Autumn and spring are transitional periods. During these seasons both summer and winter patterns are observed.
- The greatest proportion of light (< 2 m/s) winds occur during Autumn.
- The greatest proportion of high (> 4 m/s) winds occur during spring

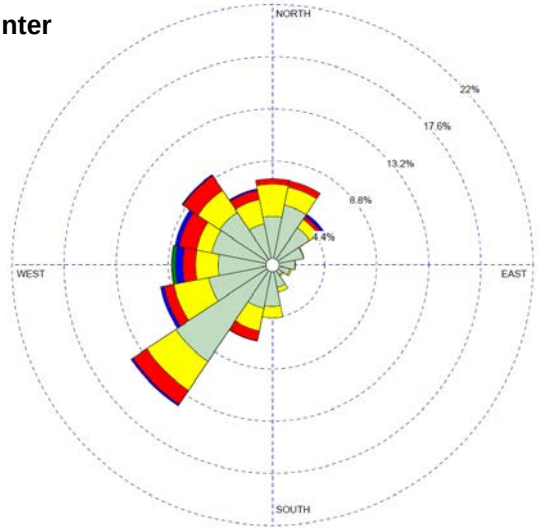
Summer



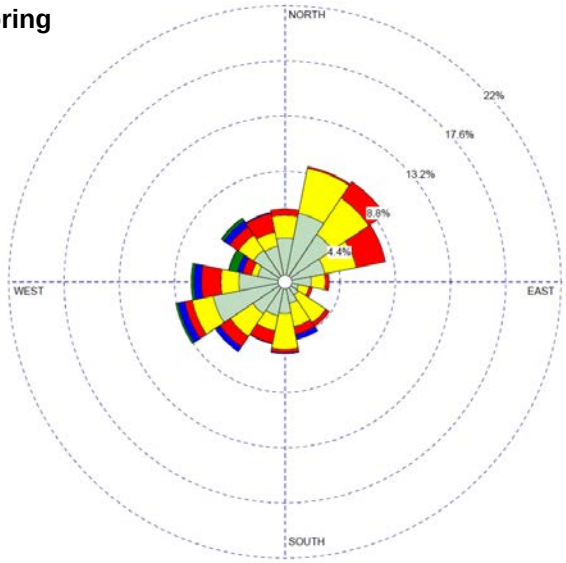
Autumn



Winter



Spring



Season	%Complete Record	Average WS (m/s)	Calms Frequency (%)
Summer	99.95	2.07	0.93
Autumn	100	1.54	3.76
Winter	100	1.76	2.99
Spring	100	2.07	2.38

Figure 5.4 Seasonal wind roses for 2013

5.3.2 Atmospheric stability

Atmospheric stability substantially affects the capacity of a pollutant such as gas, particulate matter or odour to disperse into the surrounding atmosphere upon discharge and is a measure of the amount of turbulent energy in the atmosphere.

There are six Pasquill–Gifford classes (A-F) used to describe atmospheric stability, and these classes are grouped into three stability categories; stable (classes E-F), neutral (class D), and unstable (classes A-C). The climate parameters of wind speed, cloud cover and insolation are used to define the stability category as shown in Table 5-3, and as these parameters vary diurnally, there is a corresponding variation in the occurrence of each stability category. Stability is most readily displayed by means of stability rose plots, giving the frequency of winds from different directions for various stability classes A to F.

Table 5-3 Stability category relationship to wind speed, and stability characteristics

Stability category	Wind speed range (m/s) [a]	Stability characteristics
A	0 – 2.8	Extremely unstable atmospheric conditions, occurring near the middle of day, with very light winds, no significant cloud
B	2.9 – 4.8	Moderately unstable atmospheric conditions occurring during mid-morning/mid-afternoon with light winds or very light winds with significant cloud
C	4.9 – 5.9	Slightly unstable atmospheric conditions occurring during early morning/late afternoon with moderate winds or lighter winds with significant cloud
D	≥6	Neutral atmospheric conditions. Occur during the day or night with stronger winds or during periods of total cloud cover, or during the twilight period
E	3.4 – 5.4 [b]	Slightly stable atmospheric conditions occurring during the night-time with significant cloud and/or moderate winds
F	0 – 3.3 [b]	Moderately stable atmospheric conditions occurring during the night-time with no significant cloud and light winds

a. Data sourced from the Turner's Key to the P-G stability Categories, assuming a Net Radiation Index of +4 for daytime conditions (between 10:00 am and 6:00 pm) and –2 for night-time conditions (between 6:00 pm and 10:00 am)

b. Assumed to only occur at night, during Net Radiation Index categories of –2.

The incidence of stable conditions can be viewed by means of a stability distribution plot. Figure 5.5 shows the frequency distribution of stability classes for the entire data period (one year). The figure shows that stable atmospheres (E and F) occur for 50% of the total time period. Unstable atmospheres (A, B and C) occur 43% of the total time period while neutral conditions (D) occur 7% of the total time period. The dominant state of the atmosphere is stable (E and F).

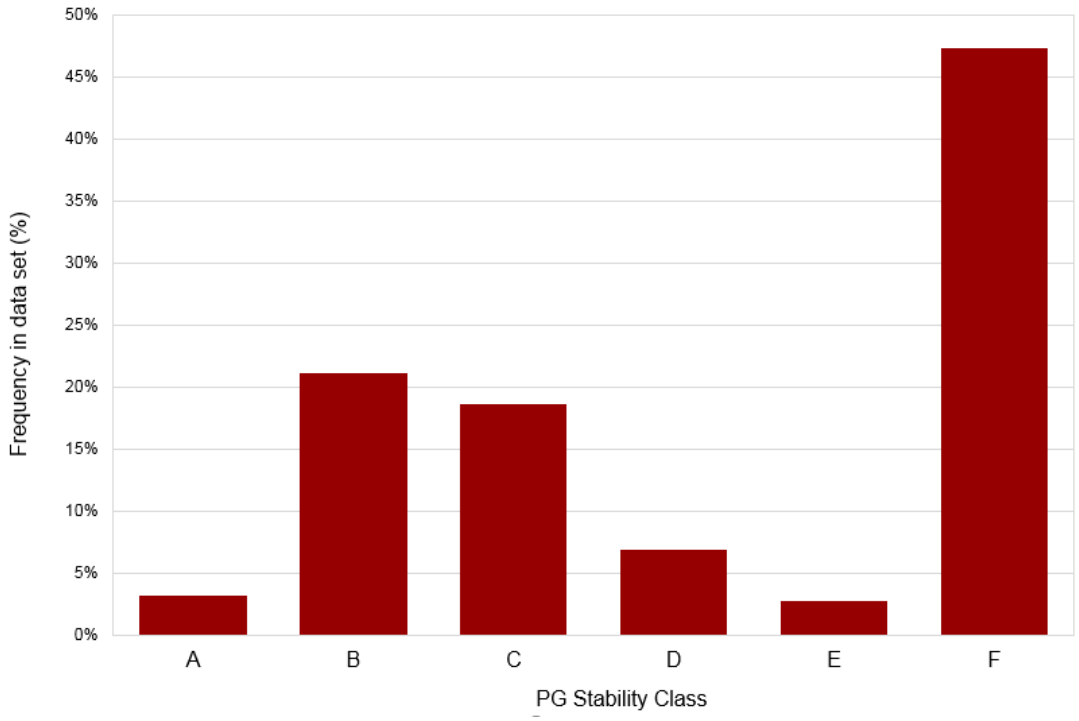


Figure 5.5 CALMET atmospheric stability class distribution at site

5.4 Dispersion modelling

Atmospheric dispersion modelling was carried out using the CALPUFF dispersion model. CALPUFF is a non-steady-state, Lagrangian puff dispersion model. It is accepted for use by the OEH and NSW EPA for application in environments where wind patterns and plume dispersion is strongly influenced by complex terrain, the land-sea interface or where there is a high frequency of stable calm night-time conditions.

The local terrain surrounding the site is relatively complex, and surrounding receivers are all at a higher elevation than the project site. This makes CALPUFF the most appropriate dispersion model for this assessment.

For this assessment, the CALPUFF dispersion model was used to predict ground-level concentrations of modelled pollutants downwind of the project. The grid size used in the CALPUFF model was equivalent to the CALMET domain. A grid resolution of 200 m was used in CALPUFF.

The following assumptions have been applied in the assessment:

- Emission sources are active for a total of 10 hours per day, from 07:00 to 18:00 with a one hour break from 12:00 to 13:00
- Line volume sources were used model dozer and vehicle movements.
- Area source were used to model excavator and dumping material activities.
- Volume sources were used to model the screening and crushing plants
- Particulate deposition was assumed

6. Predicted impacts

The TSP, PM_{10} and $PM_{2.5}$ impacts were assessed at nearby sensitive receptors for each scenario (scenario 1, scenario 2 and scenario 3). A summary of the predicted particulate concentrations are presented in this section. No exceedances of criteria are predicted.

6.1 Predicted TSP impacts

TSP concentrations are assessed against an annually averaged criterion of 90 µg/m^3. Given the lack of measured background TSP data, background TSP concentrations have been calculated using the PM_{10} data as discussed in Section 2.3. This resulted in a background annual TSP concentration of 28.7 µg/m^3. Table 6-1 presents the incremental and cumulative annual TSP concentrations (bolded) for each receptor. There are no predicted exceedances of the criteria.

Table 6-1 Incremental and cumulative annual TSP concentrations (µg/m^3)

	Scenario 1		Scenario 2		Scenario 3	
Receptor	Incremental	Cumulative	Incremental	Cumulative	Incremental	Cumulative
R01	6.4	**35.1**	4.4	**33.1**	1.3	**30.0**
R02	3.3	**32.0**	4.3	**33.0**	1.6	**30.3**
R03	1.5	**30.2**	2.0	**30.7**	1.9	**30.6**
R04	1.0	**29.7**	1.1	**29.8**	2.7	**31.4**
R05	0.4	**29.1**	0.4	**29.1**	1.4	**30.1**
R06	0.3	**29.0**	0.3	**29.0**	1.2	**29.9**
R07	0.4	**29.1**	0.4	**29.1**	1.1	**29.8**
R08	0.6	**29.3**	0.4	**29.1**	0.7	**29.4**
R09	1.4	**30.1**	1.0	**29.7**	1.2	**29.9**
R10	3.3	**32.0**	1.6	**30.3**	1.3	**30.0**

6.2 Predicted PM_{10} impacts

PM_{10} concentrations are assessed against a 24 hour averaged criterion of 50 µg/m^3 and an annual averaged criterion of 25 µg/m^3. The maximum daily incremental 24 hour PM_{10} concentrations predicted from each scenario are presented in Table 6-2. It can be seen from this table that there were no exceedances of the 24 hour averaged criterion of 50 µg/m^3 at any of the receptors, for any of the scenarios.

Table 6-2 Maximum predicted incremental 24 hour PM_{10} concentration for each scenario, µg/m^3

Receptor	Scenario 1	Scenario 2	Scenario 3
R01	25.7	23.6	15.3
R02	14.2	21.6	9.9
R03	8.5	7.5	5.6
R04	4.3	4.2	8.2
R05	2.3	1.9	5.9
R06	1.5	1.5	4.4
R07	2.2	1.8	4.5
R08	2.6	2.1	2.3
R09	5.2	3.6	2.6
R10	9.9	6.0	5.0

A contour plot presenting the 24 hour PM_{10} concentrations for the worst case scenario (Scenario 1) for the modelled year is shown in Figure 6.1.

The most affected receptor from all three scenarios was identified to be receptor R01, which is located to the north west of the project site.

A contemporaneous assessment during the worst case scenario (scenario 1) for receptor R01 is presented in Table 6-3. A contemporaneous assessment adds historical background concentrations to the predicted incremental concentrations to quantify the expected cumulative impacts.

All days that contained background concentrations that already exceeded the criteria were discarded and are not considered further in this assessment. The contemporaneous assessment shows that no criteria exceedances are predicted even with historically high background PM_{10} concentrations at Receptor R01.

Table 6-3 PM_{10} 24 hour contemporaneous assessment for the worst case affected receptor R01 during the worst case Scenario 1 (µg/m^3)

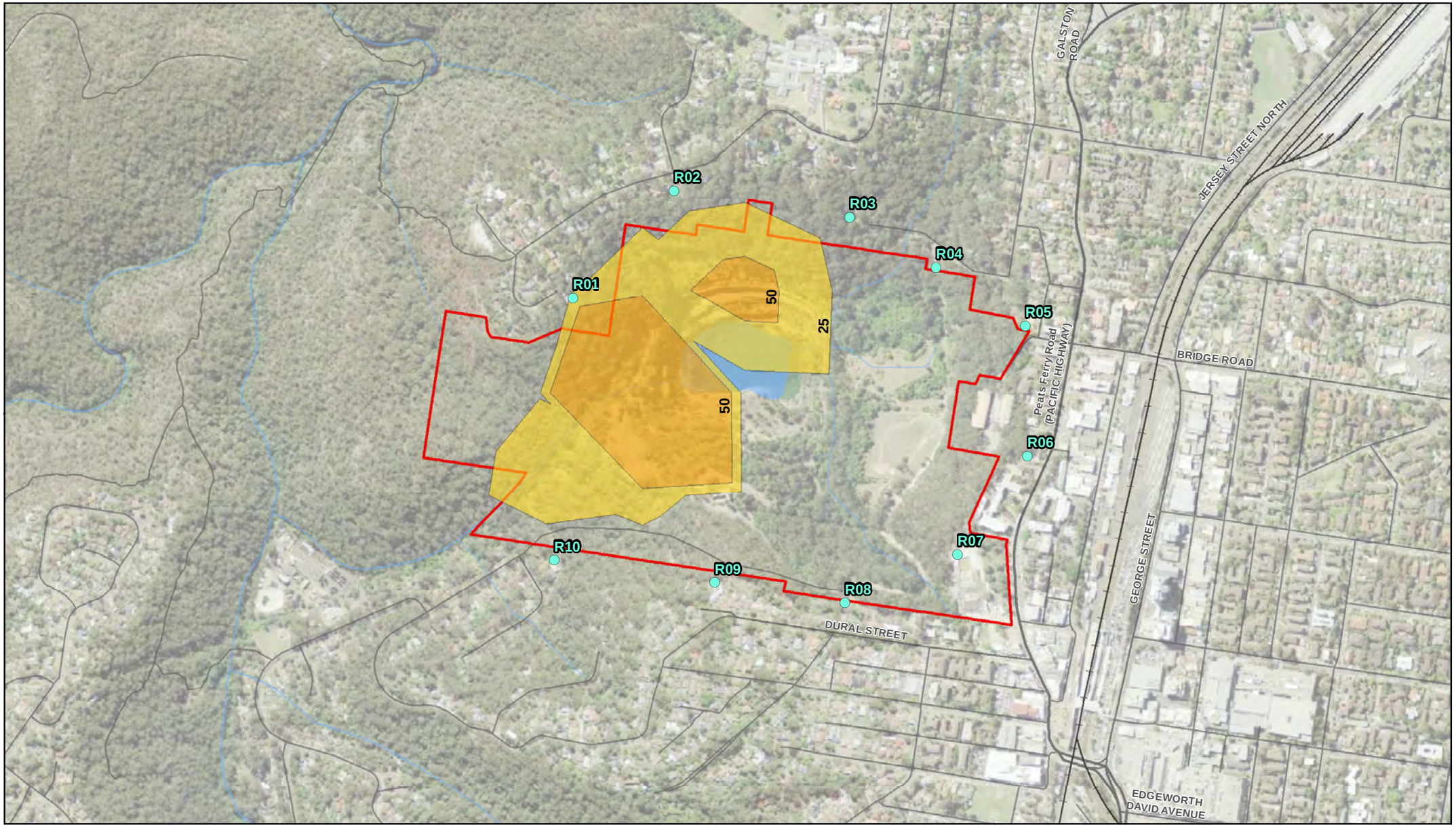
Date	PM_{10} Background	Date	PM_{10} Incremental	Date	PM_{10} Cumulative
08/11/2013	45.3	27/06/2013	25.7	08/11/2013	45.3
21/10/2013	38.9	08/06/2013	25.6	08/06/2013	41.2
29/10/2013	38.8	28/06/2013	21.9	27/06/2013	40.1
22/10/2013	36.0	07/05/2013	19.6	29/10/2013	39.6
29/12/2013	33.5	22/05/2013	16.7	21/10/2013	38.9
23/12/2013	31.1	17/04/2013	16.2	22/10/2013	36.2
09/01/2013	31.0	10/05/2013	14.9	10/05/2013	36.0
25/08/2013	31.0	12/02/2013	14.2	14/03/2013	36.0
21/12/2013	29.3	03/03/2013	13.9	29/12/2013	35.2

The measured annual background for 2013 was 14.4 µg/m^3. The incremental and cumulative annual PM_{10} concentration (bolded) are shown in Table 6-4. No criteria exceedances are

predicted and the incremental concentrations are significantly lower than the assessment criteria of 25 µg/m^3.

Table 6-4 Predicted incremental and cumulative annual PM_{10} concentrations (µg/m^3)

Receptor	Scenario 1		Scenario 2		Scenario 3	
	Incremental	Cumulative	Incremental	Cumulative	Incremental	Cumulative
R01	1.9	**16.2**	1.3	**15.6**	0.4	**14.7**
R02	0.9	**15.3**	1.2	**15.6**	0.5	**14.8**
R03	0.4	**14.8**	0.6	**14.9**	0.6	**14.9**
R04	0.3	**14.6**	0.3	**14.7**	0.8	**15.1**
R05	0.1	**14.5**	0.1	**14.5**	0.4	**14.8**
R06	0.1	**14.4**	0.1	**14.4**	0.3	**14.7**
R07	0.1	**14.5**	0.1	**14.5**	0.3	**14.6**
R08	0.2	**14.5**	0.1	**14.5**	0.2	**14.5**
R09	0.4	**14.8**	0.3	**14.6**	0.3	**14.7**
R10	0.9	**15.3**	0.4	**14.8**	0.4	**14.7**



Paper Size A4

0 100 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- The Site
- Sensitive Receptors
- PM10 Contour Plot - 50 µg/m³
- PM10 Contour Plot - 25 µg/m³

Hornsby Shire Council
Hornsby Quarry Rehabilitation

Job Number 21-26457
Revision A
Date 13 Nov 2018

24 hour incremental PM10 concentration plot for worst case scenario (Scenario 1, µg/m³)

Figure 6.1

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: NSW LPI (DTDB), Topographic base data, 2012; NSW LPI (DCDB), Topographic base data, 2015. Created by:jrbacani

6.3 Predicted $PM_{2.5}$ impacts

$PM_{2.5}$ concentrations are assessed against a daily averaged criterion of 25 µg/m^3 and an annually average criterion of 8 µg/m^3.

Background $PM_{2.5}$ concentrations were unavailable from the Lindfield OEH site for the assessment period. Adopted background $PM_{2.5}$ levels have been calculated based on PM_{10} levels as discussed in section 2.3.

The maximum daily incremental 24 hour $PM_{2.5}$ concentrations predicted from each scenario are presented in Table 6-5. No incremental criteria exceedances are predicted.

Table 6-5 Maximum predicted incremental 24 hour $PM_{2.5}$ concentrations for each scenario (µg/m^3)

Receptor	Scenario 1	Scenario 2	Scenario 3
R01	4.2	4.3	2.3
R02	2.5	4.3	1.6
R03	1.5	1.4	1.3
R04	1.0	1.2	2.3
R05	0.6	0.7	1.9
R06	0.4	0.5	1.2
R07	0.6	0.5	1.1
R08	0.6	0.4	0.6
R09	0.9	0.6	0.6
R10	1.6	1.0	0.8

The most affected receptor from all three scenarios was identified to be receptor R01 located to the north west of the project site. A contemporaneous assessment during the worst case scenario (scenario 1) for receptor R01 is presented in Table 6-6.

Table 6-6 $PM_{2.5}$ 24 hour contemporaneous assessment for the worst case affected receptor during the worst case Scenario 1 (µg/m^3)

Date	$PM_{2.5}$ Background	Date	$PM_{2.5}$ Incremental	Date	$PM_{2.5}$ Cumulative
02/11/2013	23.8	08/06/2013	4.2	02/11/2013	23.8
08/11/2013	17.0	27/06/2013	3.8	08/11/2013	17.0
21/10/2013	14.6	28/06/2013	3.4	29/10/2013	14.8
29/10/2013	14.6	07/05/2013	3.3	21/10/2013	14.6
22/10/2013	13.5	22/05/2013	2.8	22/10/2013	13.5
29/12/2013	12.6	17/04/2013	2.5	29/12/2013	12.9
23/12/2013	11.7	12/02/2013	2.4	09/01/2013	12.1
09/01/2013	11.6	03/03/2013	2.4	25/08/2013	12.0
25/08/2013	11.6	10/05/2013	2.2	14/03/2013	11.7

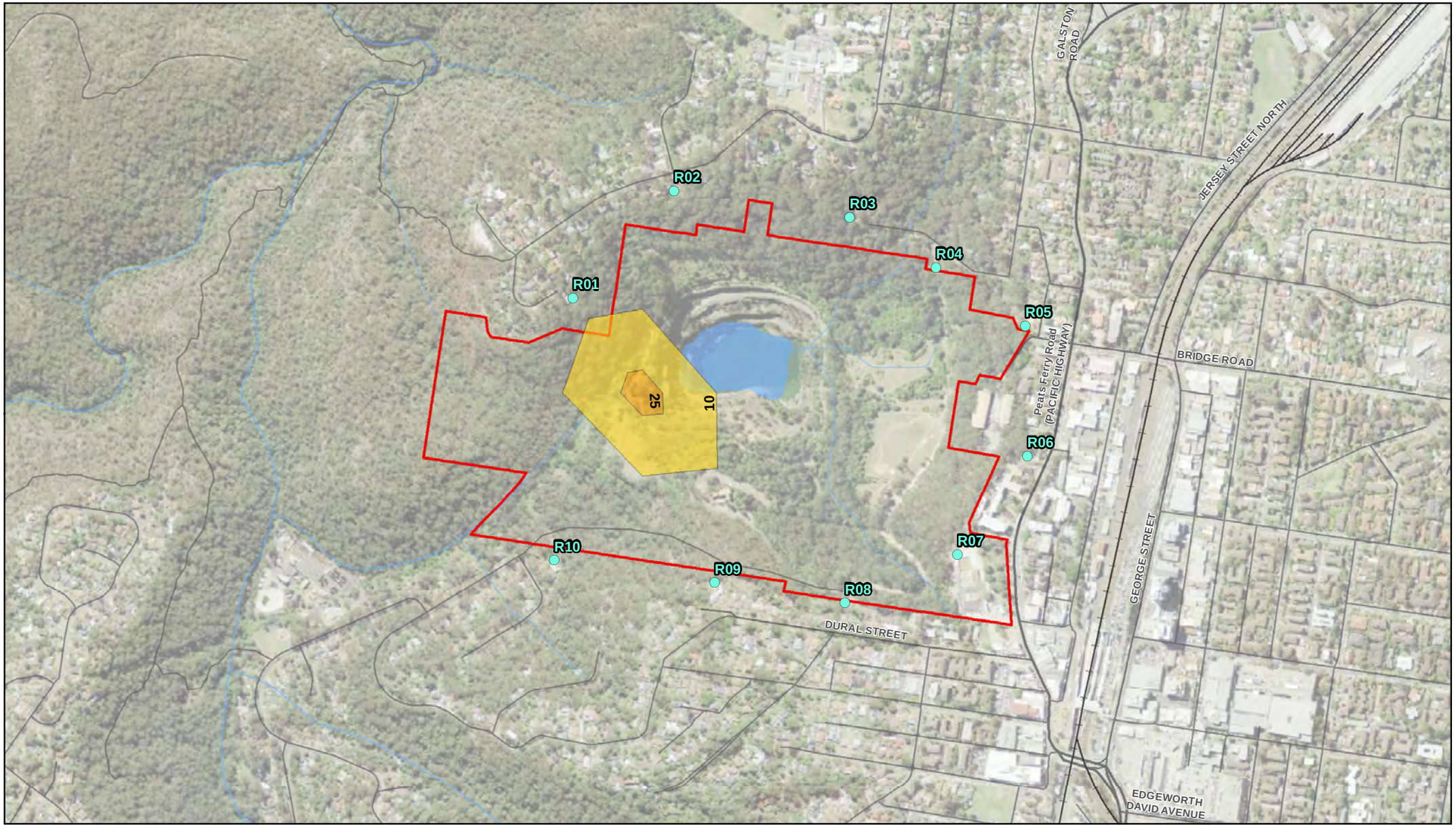
The adopted annual $PM_{2.5}$ background for 2013 was 5.4 µg/m^3. The incremental and cumulative annual (bolded) $PM_{2.5}$ concentration are shown in Table 6-7. No criteria exceedances are

predicted and the incremental concentrations are significantly lower than the assessment criteria of 8 µg/m^3.

Table 6-7 Predicted incremental and cumulative annual $PM_{2.5}$ concentrations (µg/m^3)

Receptor	Scenario 1		Scenario 2		Scenario 3	
	Incremental	Cumulative	Incremental	Cumulative	Incremental	Cumulative
R01	0.3	**5.7**	0.2	**5.6**	0.1	**5.4**
R02	0.2	**5.5**	0.2	**5.6**	0.1	**5.4**
R03	0.1	**5.4**	0.1	**5.5**	0.1	**5.5**
R04	0.1	**5.4**	0.1	**5.4**	0.1	**5.5**
R05	0.0	**5.4**	0.0	**5.4**	0.1	**5.4**
R06	0.0	**5.4**	0.0	**5.4**	0.1	**5.4**
R07	0.0	**5.4**	0.0	**5.4**	0.1	**5.4**
R08	0.0	**5.4**	0.0	**5.4**	0.0	**5.4**
R09	0.1	**5.4**	0.1	**5.4**	0.1	**5.4**
R10	0.2	**5.5**	0.1	**5.4**	0.1	**5.4**

A contour plot presenting the 24 hour $PM_{2.5}$ concentrations for the worst case scenario (scenario 1) for the modelled year is shown in Figure 6.2.



Paper Size A4

0 100 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- The Site
- Sensitive Receptors
- PM2.5 Contour Plot - 25 µg/m^3
- PM2.5 Contour Plot - 10 µg/m^3

Hornsby Shire Council
Hornsby Quarry Rehabilitation

Job Number 21-26457
Revision A
Date 13 Nov 2018

24 hour incremental PM2.5 concentration plot for worst case scenario (Scenario 1, µg/m^3)

Figure 6.2

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: NSW LPI (DTDB), Topographic base data, 2012; NSW LPI (DCDB), Topographic base data, 2015. Created by:jrbacani

7. Mitigation measures

While the project is not expected to exceed air quality goals at nearby private receptors, the following mitigation measures are recommended:

- Water material prior to it being loaded for on-site haulage, where appropriate
- Aim to minimise the size of storage piles where possible
- Limit cleared areas of land and clear only when necessary to reduce fugitive dust emissions
- Control on-site traffic by designating specific routes for haulage and access and limiting vehicle speeds to below 25 km/h
- Cover all trucks hauling material on the way to the site and maintain a reasonable amount of vertical space between the top of the load and top of the trailer
- Suspend operations conducted in areas of low moisture content material during high wind speed events or use water sprays
- Rock saws are equipped with in built wet control systems that reduce dust generation to negligible levels. These wet control systems should be used during all rock sawing activities.

These measures will assist in reducing impacts on all areas off-site.

8. Conclusions

GHD has been engaged by Council to provide an assessment of potential air quality impacts of the proposed rehabilitation of the Hornsby Quarry. The air quality assessment was undertaken to assess potential impacts of the project on surrounding sensitive receivers.

Particulate emissions ($PM_{2.5}$, PM_{10} and TSP) were estimated based on the project description and expected equipment to be used during construction. The assessment included consideration of three different construction scenarios and is considered worst-case in terms of potential dust impacts on receivers.

Weather conditions that cause maximum dust impact are generally consistent winds in the direction of the nearest sensitive receivers throughout the daytime period outside of rain events

Based on assumptions as outlined in the assessment, the predicted $PM_{2.5}$, PM_{10} and TSP emissions from the project are expected to comply with the relevant criteria when assessed in accordance with the Approved Methods. The application of standard dust mitigation measures will also assist to minimise potential impacts from general site operations.

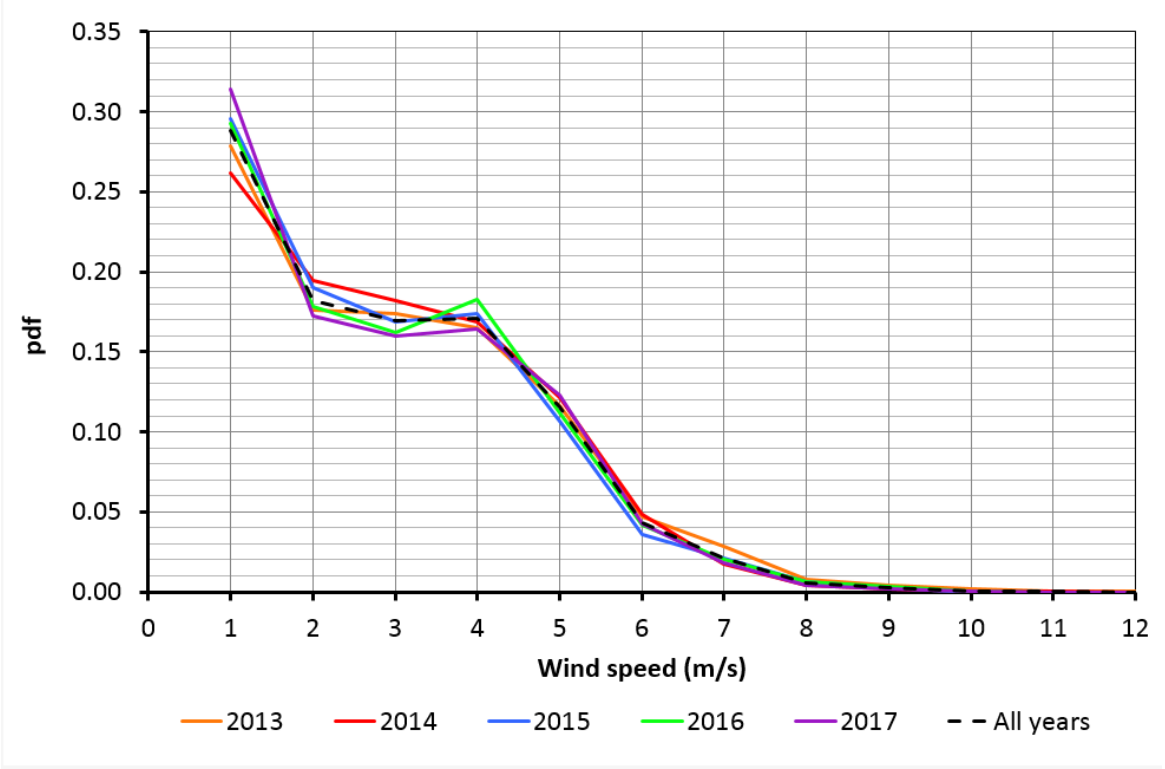
The project should be acceptable from an air quality perspective provided that the relevant mitigation measures are implemented.

Appendices

Appendix A – Estimated throughput calculations

						Assumed densities					
						Compacted/Loose fill		1.8	t/m3		
						Weathered sandstone		2.323	t/m3		
HORNSBY QUARRY REHABILITATION						Hardrock		2.67	t/m3		
WORK/ACTIVITY DURATION ESTIMATE						dump truck capacity		30	t		
Scenario 1											
Material Type	Compacted/ Loose Fill	Weathered Sandstone	Hard Rock			Compacted/ Loose Fill		Weathered Sandstone	Hard Rock		
Quantity	205570	63560	47670			205570		63560	47670		
											Daily Totals (t/day)
Work/Activity	Duration (Weeks)			Subtotal	Total	Rate (m3/day)					
Excavation	16	5	13	34	34	2570		2542	733		12489
Ripping		5	13	18				2542	733		7864
Rock Breaking			13	13					733		1958
Crushing			11	11					867		2314
Screening			12	12					795		2121
Filling	17			17		2418					4353
truck movements											
Scenario 2											
Material Type	Compacted/ Loose Fill	Weathered Sandstone	Hard Rock			Compacted/ Loose Fill		Weathered Sandstone	Hard Rock		
Quantity	25200	25200	12600	63000		25200		25200	12600		
Work/Activity	Duration (Weeks)				Total	Rate (m3/day)					
Excavation	6	2	4	12	12	840		2520	630		9048
Ripping		2	4	6				2520	630		7536
Rock Breaking			4	4					630		1682
Crushing			3	3					840		2243
Screening				0					840		2243
Filling	2			2		2520					4536
Scenario 3											
Material Type	Compacted/ Loose Fill	Weathered Sandstone	Hard Rock			Compacted/ Loose Fill		Weathered Sandstone	Hard Rock		
Quantity	141400	14400	3600	159400		141400		14400	3600		
Work/Activity	Duration (Weeks)				Total	Rate (m3/day)					
Excavation	11	1	2	14	14	2571		2880	360		12279
Ripping		1	2	3				2880	360		7651
Rock Breaking			2	2					360		961
Crushing			1	1					720		1922
Screening			4	4					180		481
Filling	2			2		14140					25452

Appendix B – Selection of representative year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Wind speed (m/s)
2013
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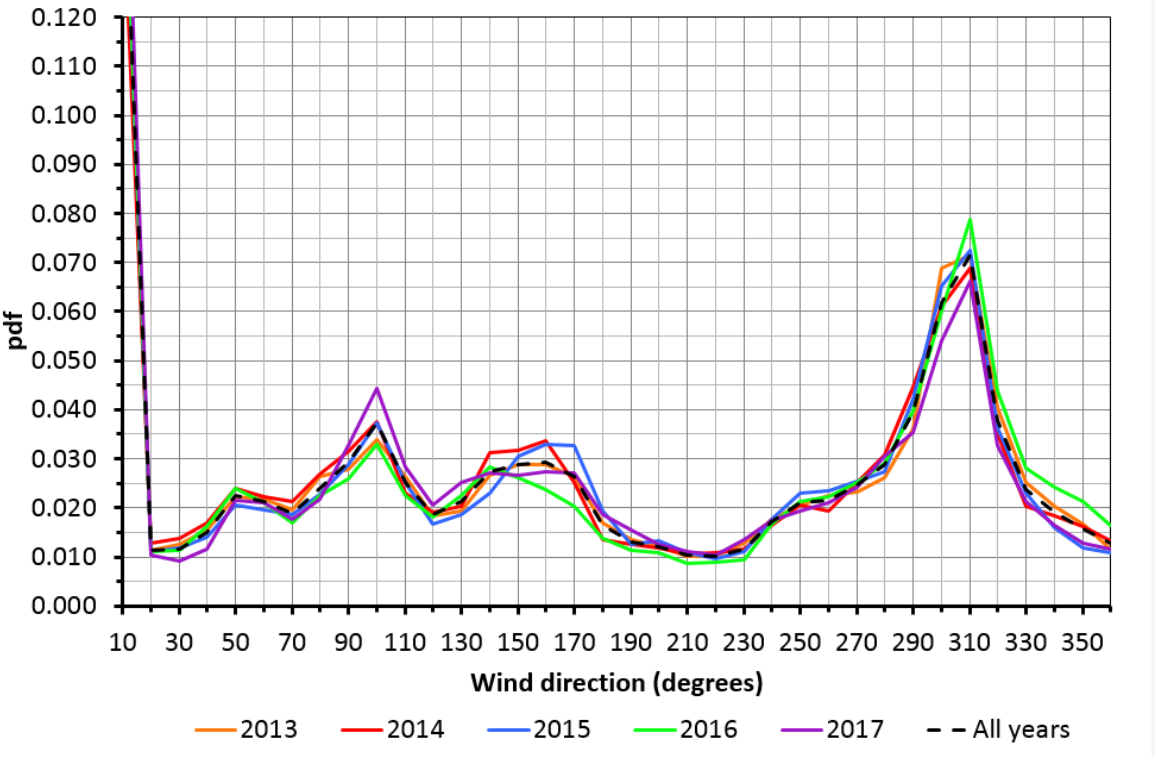
2016
2017
All years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170
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330
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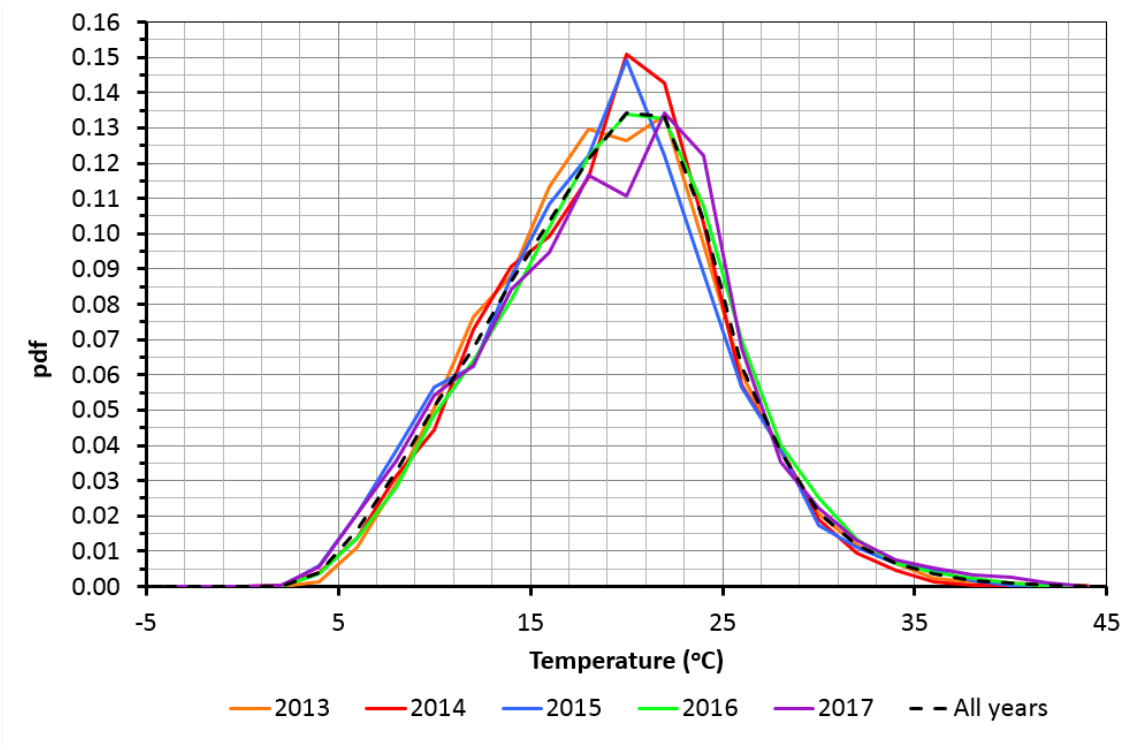
Wind direction (degrees)
2013
2014
2015
2016
2017
All years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Temperature (°C)
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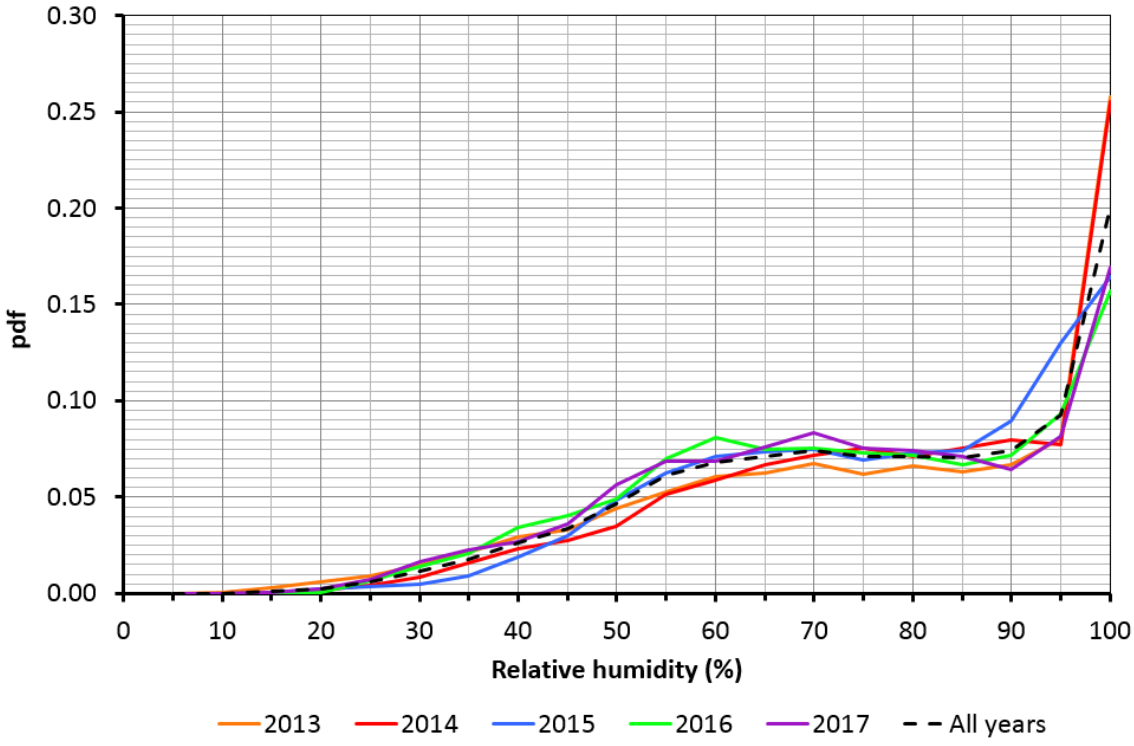
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60
70
80
90
100
Relative humidity (%)
2013
2014
2015
2016
2017
All years

GHD

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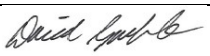
2126457-40284/https://projects.ghd.com/oc/Sydney/hornsbyquarryrehabil/Delivery/Documents/2126457_REP_Air Quality Assessment.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	N Spurrett	E Smith		D Gamble		22/11/18

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Appendix E – Water assessment

Hornsby Shire Council

Hornsby Quarry Rehabilitation EIS

Water Specialist Report

November 2018

Executive summary

Hornsby Shire Council proposes to rehabilitate the Hornsby Quarry void to create a landform suitable for future development as community parkland, which will require filling and stabilisation. The landform would include a lake directly below the exposed eastern face of the quarry. This water specialist report has been prepared in accordance with the Secretary's Environmental Assessment Requirements to provide an assessment of the potential impacts of the project in relation to water.

In 2016 approval was granted to Roads and Maritime Services, to beneficially reuse up to 1.5 million cubic metres of excavated rock and soil (spoil) from the construction of the NorthConnex tunnel to partially fill the Hornsby Quarry (the '2016 Planning Approval'). Following completion of filling by NorthConnex, Council is proposing to rehabilitate and reshape the site in a suitable way to ensure public safety and allow future development into a parkland for community use. This report has been prepared by GHD to provide an assessment of any water related impacts associated with these proposed Council works, and forms an input into the EIS prepared for Council's development application for the works.

The quarry is located in Old Mans Valley. This valley collects runoff from the east including urban areas within the suburb of Hornsby as well as vegetated areas surrounding the quarry site. Upstream flows through the valley have been diverted around the quarry via constructed channels and culverts, resulting in the quarry only receiving surface runoff from the immediate vicinity. Water flows into the quarry void due to the elevated surrounding groundwater levels compared to the levels within the pit. Historically this groundwater inflow resulted in filling of the base of the void with water, which was subsequently pumped out. Council possesses a corresponding dewatering licence under the *Water Management Act 2000*, with an allocation of 370 ML/year.

Based on comparison of monitoring data for historical dewatering from the quarry to Regional Environmental Health Values developed for the area, the historic quality of water in the void is generally similar to an unimpacted or slightly disturbed catchment. This water is considered to be generally representative of groundwater inflows into the quarry.

The proposed works under the project will allow for the "filling up" of the voids of emplaced material, followed by the filling up of an above ground lake. The level of this lake would be maintained at 55 m AHD through dewatering pumping when the lake rises above this level.

A risk assessment was undertaken to assess the water related risks of the project such that a subsequent impact assessment could be undertaken. The primary risks identified were with relation to impacts on groundwater levels and availability, non-compliance with water licencing requirements, impact on the quality of external groundwater and impact on the quality or quantity of water in downstream surface water systems due to dewatering activities.

Impact assessment was undertaken finding that the water related impacts of the project are not anticipated to be significant. This is on the basis of:

- A water balance and groundwater flow assessment identifying that groundwater take is significantly less than current licence entitlements, with the take predicted to be less than under historic dewatering activities.
- The water quality of water discharged from the void is anticipated to be generally similar to that of the receiving environment. This is supported by existing void water quality monitoring data, assessment of the impacts of emplacing material undertaken for the

NorthConnex project, and water balance results showing no increasing accumulation of concentrations of water quality constituents.

- The flow direction of groundwater being inwards to the void, mitigating the risk of discharging lower quality water to the groundwater system (noting that this lower quality water is not anticipated).
- Dewatering rates are anticipated to be less than under historical dewatering activities and therefore not result in geomorphological or waterway formation impacts.

Mitigation and monitoring measures are proposed to confirm that the actual operation of the system is in accordance with the predictions of this assessment, and therefore confirming that impacts are not significant.

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1. Introduction

1.1 Background

Hornsby Quarry is a former breccia hard rock quarry that was operated by private business from the early 1900s and ceased in the late 1990s. The quarry is considered a safety risk and has therefore been closed to the public since that time.

Hornsby Shire Council (Council) acquired the site in 2002 and has since undertaken a number of investigations and studies with regard to the future use of the site and the environmental and technical constraints that the site poses. Through these studies, Council identified the need to:

- stabilise the quarry
- manage the site in a safe and environmentally sustainable manner, and
- actively seek opportunities to fill the quarry void with spoil arising from major infrastructure projects in the region

Council also resolved to ultimately develop the site into a community parkland.

In 2016 approval was granted to Roads and Maritime Services, to beneficially reuse up to 1.5 million cubic metres of excavated rock and soil (spoil) from the construction of the NorthConnex tunnel to partially fill the Hornsby Quarry (the '2016 Planning Approval'). Filling has been undertaken at the site under this approval.

Following completion of filling by NorthConnex, Council is proposing to rehabilitate and reshape the site in a suitable way to ensure public safety and allow future development into a parkland for community use (the project).

1.2 Purpose of this report

GHD Pty Ltd (GHD) has been engaged by Council to prepare documentation to support a development application for approval of the project under Part 4 of the New South Wales (NSW) *Environmental Planning and Assessment Act 1979* (the EP&A Act). The Environmental Impact Statement (EIS) is being prepared in accordance with the provisions of the EP&A Act.

This report has been prepared by GHD to provide an assessment of any water related impacts as an input to the EIS. This report addresses the Secretary of the NSW Department of Planning and Environment's Environmental Assessment Requirements (EAR 1167) dated 6 September 2017.

1.3 Project location

The project is located in the Hornsby local government area (LGA), approximately 21 kilometres (km) to the north west of the Sydney central business district. The site is accessible via Quarry Road (off Dural Street and other local roads) from the south east and from Bridge Road (off the Peats Ferry Road from the north east.

Figure 1.1 shows the location of the site.

1.4 Project overview

Key features of the project include:

- Rehabilitation, stabilisation and geotechnical safety management works around various parts of the site

- Earthworks and placement of material won from within the site to create a final landform similar to Option 1 in the Clouston Associates (2014) 'Recreation Potential Study for Hornsby Quarry and Old Mans Valley Lands' (p88).

Approximately 500,000 m^3 of spoil is expected to be generated onsite from earthworks. Much of this material would be placed on the NorthConnex spoil to create a landform that generally slopes from the proposed lake up to the top of the western quarry face and would allow for the creation of a new parkland to be constructed within the quarry void. The landform would include a lake directly below the exposed eastern face of the quarry. There would also be cut and fill works on Old Mans Valley to create a landform suitable for future development into playing fields and other recreational activities.

It is expected that a combination of ripping, rock breaking and rock sawing will be required to shift the material. Rock fragments would be crushed onsite using a mobile crusher or rock breaker prior to placement as fill.

No additional spoil is proposed to be imported to the site for filling purposes nor would the excavated material be transported off the site.

The project is expected to take approximately two years to complete.

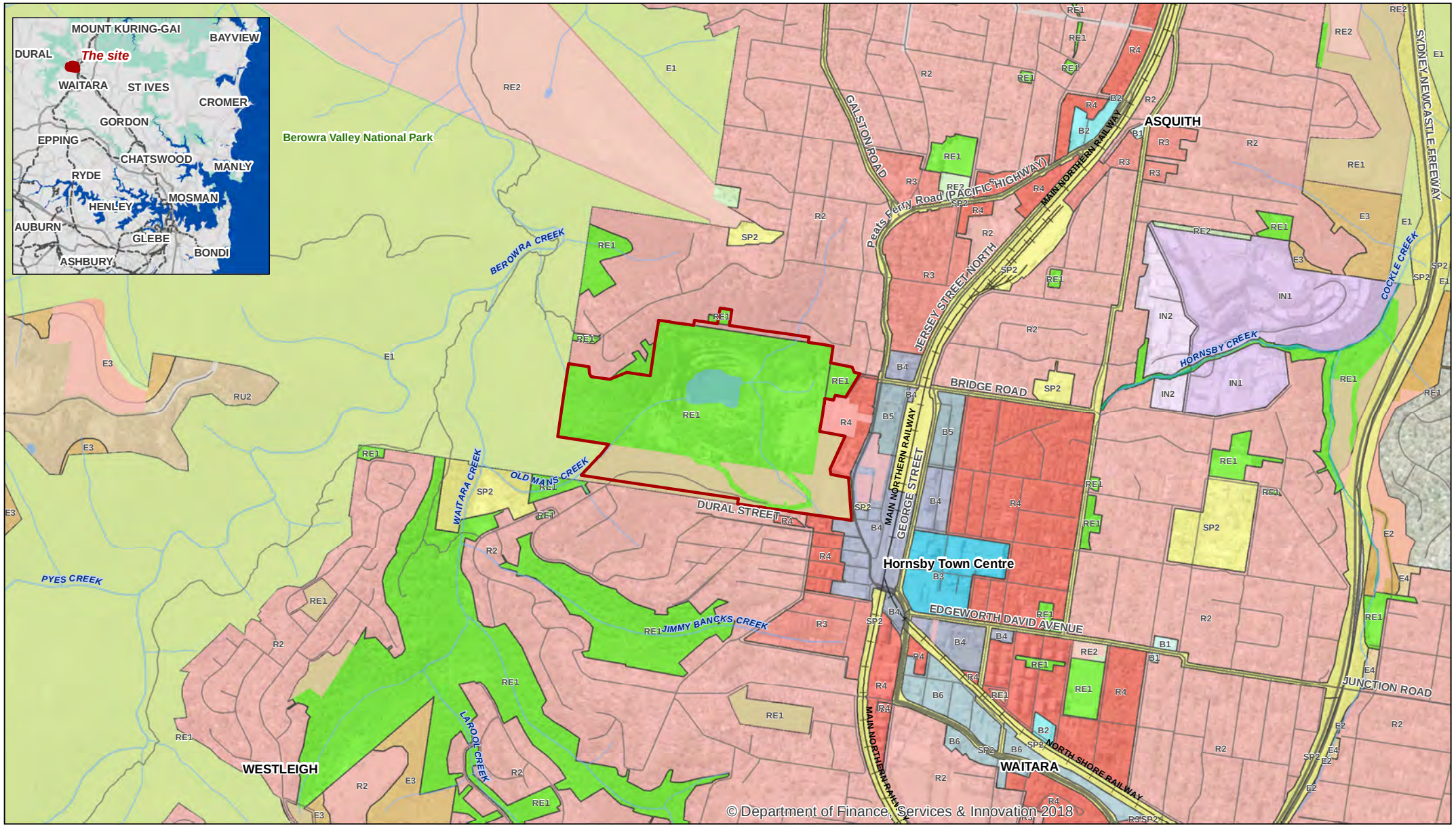
The proposed extent of works is shown in Figure 1.2.

1.5 Definitions

The following terms are used within this report:

- The 'site' refers to the entirety of:
  - Lots A, B, C, D and E in Deposited Plan (DP) 318676
  - Lot 1 DP 926103
  - Lot 1 DP 926449
  - Lot 1 DP 114323
  - Lots 1 and 2 in DP 169188
  - Lot 7306 DP 1157797
  - Lot 1 DP 859646
  - Lot 1 DP 926449
  - Lot 13 DP 734459
  - Lot 114 DP 749606
  - Lot 213 DP 713249
  - Summers Avenue, Hornsby partly formed
  - Old Mans Valley Trail

  The boundary of the site is shown on Figure 1.2
- The 'extent of works' refers to both the quarry pit filling extent and the earthworks design extent plus an additional 2 to 5 m outside these areas to allow for construction fencing, etc. The boundary of the extent of works is shown on Figure 1.2.
- GDE refers to Groundwater Dependent Ecosystem
- ANZECC, 2000 refers to the Australian and New Zealand Environment and conservation Council guidelines published in 2000.



Paper Size A4

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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Legend

- The site
- Watercourses
- Parks and reserves
- Crown parcel
- Crown road
- Crown waterway

Hornsby Shire Council
Hornsby Quarry Rehabilitation

Job Number 21-26457
Revision A
Date 09 Nov 2018

Site location, surrounding land uses and zoning

Figure 1.1

N:\AU\Sydney\Projects\21\26457\GIS\Maps\Deliverables\21_26457_Z001_SMA.mxd (SMA record: 1)

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: NSW LPI (DTDB), Topographic base data, 2012; NSW LPI (DCDB), Topographic base data, 2015. Created by:jwatson2

LEGEND

- CADASTRE
- ASSUMED EXISTING SURFACE
- PIT FILLING EXTENT
- EARTHWORKS DESIGN EXTENT
- EXTENT OF WORKS

VEGETATION COMMUNITY

- SYDNEY BLUE GUM - BLACKBUTT SMOOTH-BARKED APPLE MOIST SHRUBBY OPEN FOREST (CEEC TSC A□□) (MODERATE/GOOD - POOR)
- BLACKBUTT GULLY FOREST (POOR)
- BLACKBUTT GULLY FOREST (MODERATE/GOOD - HIGH)
- BLACKBUTT GULLY FOREST (MODERATE/GOOD - POOR)

0 30 60 90m

SCALE 1:3000 AT ORIGINAL SIZE

N

HORNSBY SHIRE COUNCIL
HORNSBY QUARRY REHABILITATION
EXTENT OF WORKS

Job Number 21-26457
Revision A
Date SEP 2018

Figure 1.2

Level 15, 133 Castlereagh Street, Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Plot Date: 25 September 2018 - 3:53 PM Plotted by: Celine El-Khouri Cad File No: G:\21\26457\CADD\Drawings\21-26457-SK206.dwg

1.6 Secretary's Environmental Assessment Requirements and agency requirements

The specific SEARs and agency requirements addressed in this report are summarised in Table 1.1. These consist of all of the SEARs categorised as being with relation to water, as well as key agency requirements with relation to water.

Table 1.1 Secretary's Environmental Assessment Requirements and agency requirements (extract)

Assessment requirements	Section(s) of this report where addressed
SEARS	
An assessment of any volumetric water licensing requirements, including a description of site water demands, water disposal methods (inclusive of volume and frequency of any water discharges), water supply infrastructure and water storage structures	2.3, 5.4, 6.1
Identification of any licensing requirements or other approvals required under the *Water Act 1912* and/or *Water Management Act 2000*	3, 7
Demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP)	6.1, 7
An assessment of activities, including but not limited to watercourse reestablishment, that could cause erosion or sedimentation, and the proposed measures to prevent or control these impacts	4.2, 6.2, 7
An assessment of any likely flooding impacts of the development; an assessment of potential impacts on the quality and quantity of existing surface and ground water resources, including a detailed assessment of proposed water discharge quantities and quality against receiving water quality and flow objectives	2.4, 4.2, 5.4, 6.2, 6.3, 7
A detailed description of the proposed water management system, water monitoring program and other measures to mitigate surface and groundwater impacts	4.1, 7
Fisheries NSW	
Please ensure the EIS takes into consideration proper isolation measures including water course routing and sediment control measures for the portion of Old Man Creek that will be impacted (reconstructed) by the Quarry Rehabilitation effort	4.2
DPI Water	
Assessment of impacts on surface water, including details of proposed stormwater management systems, having consideration to impacts on Old Mans Creek and all other watercourses and riparian corridors potentially affected by the proposal. The assessment of water quality impacts is to have reference to relevant public health and environmental water quality criteria, including those specified in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ 2000), and any applicable regional, local or site-specific guidelines	2.4, 6.2, 6.3
Assessment of impacts of erosion and sedimentation during earthworks activities and implementation of erosion and sediment control measures in accordance with the requirements of the Managing Urban Stormwater Manual, Volume 1, Soils and Construction (Landcom, 4th Edition, March 2004) and maintain	4.2, 6.2, 7

the control measures to prevent sediment and dirty water entering the waterways	
Assessment of groundwater flows at the proposal site, appropriate management measures for dewatering during site establishment, and ongoing dewatering and site management processes during spoil emplacement works. The assessment must consider: extent of drawdown; impacts to groundwater quality; volume of inflows and water licence requirements; discharge requirements; location and details of groundwater management and implications for groundwater-dependent surface flows, groundwater-dependent ecological communities, and groundwater users. The assessment should be prepared having consideration to the requirements of the NSW Aquifer Interference Policy	4.1, 5.4, 6.1, 6.3, 7
Monitoring of groundwater levels and primary quality in the emplaced fill and in the surrounding bedrock at least North, East and South of the quarry, from commencement of filling and then quarterly for a period of 3 years following cessation of emplacement	7
A Groundwater Monitoring and Management Plan shall be prepared to the satisfaction of DPI Water to take into account all matters regarding groundwater at the site; with an emphasis on groundwater post filling; and in respect of primary quality assessment, shall be developed to include at least pH, EC, Fe, heavy metals and BTEX measurements in an appropriate timeframe	7
Consideration of relevant policies and guidelines	3
A statement of where each element of the SEARs is addressed in the EIS (i.e. in the form of a table	1.6
NSW EPA	
Provide details of the project that are essential for predicting and assessing impacts to waters including: a) the quantity and physic-chemical properties of all potential water pollutants and the risks they pose to the environment and human health, including the risks they pose to Water Quality Objectives in the ambient waters (as defined on http:l/www.environment.nsw.qov.au/ieo/index.htm, using technical criteria derived from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality, ANZECC 2000) b) the management of discharges with potential for water impacts c) drainage works and associated infrastructure; land-forming and excavations; working capacity of structures; and water resource requirements of the proposal	2.4, 4, 6.2, 6.3, 7
Outline site layout, demonstrating efforts to avoid proximity to water resources (especially for activities with significant potential impacts e.g. effluent ponds) and showing potential areas of modification of contours, drainage etc.	
Outline how total water cycle considerations are to be addressed showing total water balances for the development (with the objective of minimising demands and impacts on water resources). Include water requirements (quantity, quality and source(s)) and proposed storm and wastewater disposal, including type, volumes, proposed treatment and management methods and re-use options	
Describe the catchment including proximity of the development to any waterways and provide an assessment of their sensitivity/significance from a public health, ecological and/or economic perspective. The Water Quality and River Flow Objectives on the website: http://www.environment.nsw.gov.au/ieo/index.htm should be used to identify the agreed environmental values and human uses for	

any affected waterways. This will help with the description of the local and regional area	
Describe existing surface and groundwater quality - an assessment needs to be undertaken for any water resource likely to be affected by the proposal and for all conditions ….	
Provide site drainage details and surface runoff yield	
State the ambient Water Quality and River Flow Objectives for the receiving waters ….	
State the indicators and associated trigger values or criteria for the identified environmental values ……	
State any locally specific objectives, criteria or targets ….	
Where site specific studies are proposed to revise the trigger values …	
Describe the state of the receiving waters and relate this to the relevant Water Quality and River Flow Objectives….	
An outline of baseline groundwater information ….	
Historic river flow data where available for the catchment …	
Assess impacts …	
Describe management and mitigation measures…..	

1.7 Scope and structure of the report

1.7.1 Scope of report

This report provides an assessment of the potential impacts of the project with relation to water. This includes both the quantity and quality of surface water and groundwater. Relevant management and mitigation measures are also provided.

1.7.2 Structure of report

This report is structured as follows:

- Section 1 – introduces the project and describes the site
- Section 2 – describes the existing environmental characteristics of the site relevant to water and the assessment
- Section 3 – presents the key regulatory requirements and guidelines
- Section 4 – presents they key features of the likely water conditions during the project and the subsequent potential water related risks
- Section 5 – details the assessment methodology, developed based on the identified risks
- Section 6 – provides an impact assessment based on the identified risks and assessment methodology
- Section 7 – presents the required management and mitigation measures
- Section 8 – concludes the report

1.8 Limitations

This report: has been prepared by GHD for Hornsby Shire Council and may only be used and relied on by Hornsby Shire Council for the purpose agreed between GHD and the Hornsby Shire Council.

GHD otherwise disclaims responsibility to any person other than Hornsby Shire Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Hornsby Shire Council and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

2. Existing environment

Hornsby Quarry is located in the suburb of Hornsby, NSW, approximately 800 m to the north-west of Hornsby Train Station. The quarry void is located in a natural valley knows as Old Mans Valley.

Under natural conditions, this valley is a low level compared to surrounding topography. Material was extracted historically from the quarry for a number of decades such that it forms a depressed pit in the surrounding topography.

The alignment of Old Mans Creek has been altered such that the upstream catchment area generally does not drain into the pit but is diverted to the north and east around the quarry void. Figure 1.1 shows the location of the site.

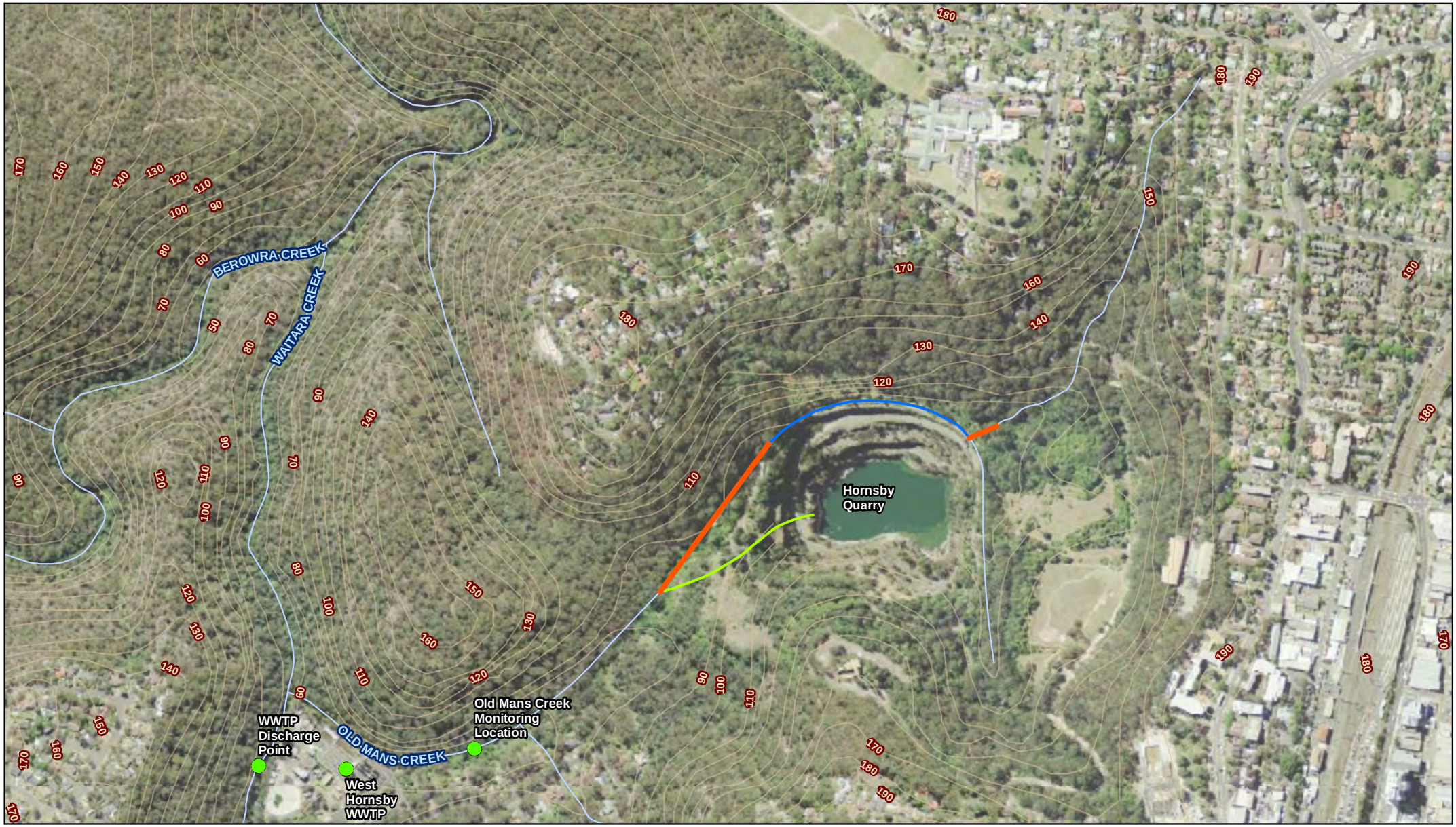
The following sections detail the existing water-related environment with respect to surface water, groundwater, current water management for the void, water licencing and water quality.

2.1 Surface water

The quarry is located in Old Mans Valley. This valley collects runoff from the east including urban areas within the suburb of Hornsby as well as vegetated areas surrounding the quarry site. Upstream flows through the valley have been diverted around the quarry via constructed channels and culverts, resulting in the quarry only receiving surface runoff from the immediate vicinity.

Downstream of the quarry site Old Mans Creek flows in a westerly direction, flowing into Waitara Creek. Waitara Creek in turn flows into Berowra Creek which flows into the Hawkesbury River, discharging into the ocean at Broken Bay. The Hornsby West Wastewater Treatment Plant discharges treated effluent into Waitara Creek a short distance upstream of the confluence with Old Mans Creek.

Figure 2.1 shows the surface water systems at and surrounding the site, including the diversion of flows around the quarry void.



Service Layer Credits: © Department of Finance, Services

Paper Size A4

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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LEGEND

- Diversion Culverts
- Diversion Channels
- Dewatering Pumping Line
- Watercourse
- Contours (10m)

Hornsby Shire Council
Hornsby Quarry Rehabilitation

Job Number	21-26457
Revision	A
Date	20 Nov 2018

Surface Water Environment

Figure 2.1

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: Aerial imagery - SIXmaps 2017; General topo - NSW LPI DTDB 2017, 2015, & 2012. Created by:jwatson2

2.2 Groundwater

As outlined in (AECOM Pty Ltd, 2015), two groundwater systems occur at the quarry void. These consist of a shallow perched water system and a deeper system located within the fresh breccia and surrounding Hawkesbury Sandstone

Groundwater is present within secondary structural features such as joints, fractures and bedding planes. Water flows into the quarry void due to the elevated surrounding groundwater levels compared to the levels within the pit. Historically this groundwater inflow resulted in filling of the base of the void with water, which was subsequently pumped out.

After the emplacement works under the 2016 Planning Approval commences, this groundwater inflow is anticipated to result in the "filling up" of void spaces in the emplaced material without significant observed standing water until the voids of the emplaced material have been filled.

2.3 Current void water management

As the base of the void is located below the surrounding groundwater levels, inflow into the void continuously occurs. During historical operation of the quarry dewatering and discharge to Old Mans Creek occurred for operational purposes. More recently, Hornsby Council undertook a dewatering program for the void to maintain stability of the quarry walls. This was undertaken from 2009 under bore licence 10BL602742 ('the dewatering licence') under the *Water Management Act 2000* (WM Act).

The dewater licence allows for dewatering up to 370 ML over the term of the licence (per annum). The term of the licence is not clear in the most recent (2014) version of the licence, however the allowance is understood to be 370 ML/year, based on the original 2009 version of the licence. The dewatering licence requires Council to record the volumes of dewatering, with these volumes equating to approximately 200 ML/year on average between 2010 and 2014.

NorthConnex has undertaken management of water in the void since the commencement of works under the 2016 planning approval. This has involved dewatering the void below the level previously maintained by Council to allow emplacement of material. As of January 2018 emplacement of material is ongoing. The potential impacts of dewatering undertaken under the 2016 planning approval were assessed in (AECOM Pty Ltd, 2015).

2.4 Water quality

Water quality data is available for two key locations relevant to the quarry:

- Monthly physio-chemical measurements from the discharges of water from the quarry void taken by Council between 2010 and 2014 (prior to the works undertaken under the 2016 planning approval). This monitoring was undertaken in accordance with the requirements of the dewatering licence.
- Monitoring in Old Mans Creek, downstream of the site undertaken as documented in (Hornsby Shire Council, 2013) and (Hornsby Shire Council, 2014).

Furthermore, analysis of water quality data for unimpacted reference sites has been undertaken by Hornsby Shire Council for over 15 years. As documented in (Hornsby Shire Council, Undated) regional environmental health values (REHVs) have been calculated by Council based generally on the 95th percentile values at the reference sites.

(ANZECC, 2000) forms the central technical reference of the National Water Quality Management Strategy, which the federal and all state and territory governments have adopted for managing water quality. This document notes that local environmental health values can be developed based on long-term data from suitable reference sites. Furthermore, the development of the REHV's considered relevant water quality objectives, for example through

setting faecal coliforms requirements based on the primary recreation trigger in (ANZECC, 2000).

Therefore, the REHVs are considered to be an appropriate representation of natural background conditions, against which the existing and future level of impact in the catchment can be assessed. As discussed above, this is considered to be consistent with the National Water Quality Management Strategy, (ANZECC, 2000) and (NSW Department of Environment, Climate Change and Water, 2006).

Table 2.1 shows the sampling results for the two key locations described above for key analytes. The REHV trigger values are also provided in the table.

Table 2.1 Water quality sampling results

			Old Mans Creek (Hornsby Council Site 115)					Quarry dewatering (monitored as per dewatering licence 10BL602742)				
Parameter	Unit	REHV	Number of samples	Mean	Minimum	80th Percentile*	Maximum	Number of samples	Mean	Minimum	80th Percentile	Maximum
Electrical conductivity	ms/cm	0.32	19	0.45	0.12	0.5	0.82	63	0.84	0.71	0.879	0.92
Turbidity	NTU	8.1	19	1.84	0	2.98	10.5	64	0.9	-0.2	1.58	7
Dissolved oxygen	% saturation	75-118	19	89.8	60.3	83.5 (20th) 97.6 (80th)	106.2	64	99.92	59	93.6 (20th) 111.9 (80th)	128.8
pH	pH	4.8-7	19	6.52	4.65	6.22 (20th) 6.94 (80th)	8.28	63	8.24	7.15	8.06 (20th) 8.47 (80th)	8.68
Suspended solids	mg/L	7	19	2.95	1	6.75	17	60	1	1	2	6
Ammonium nitrogen	mg/L	0.02	19	0.026	0.01	0.045	0.17	61	0.008	0.005	0.005	0.04
Oxidised nitrogen	mg/L	0.05	19	0.025	0.01	0.040	0.12	61	0.011	0.005	0.01	0.06
Total nitrogen	mg/L	0.32	19	0.22	0.08	0.26	0.54	61	0.21	0.16	0.24	0.29
Total phosphorus	mg/L	0.01	19	0.021	0	0.025	0.05	61	0.009	0.004	0.011	0.026
Faecal coliforms	CFU/100 ml	Median < 150 80th% < 600	19	2969	6	749	51000	61	11	1	17	36

* 80th Percentile values provided in (Hornsby Shire Council, 2013) and (Hornsby Shire Council, 2014) for respective years of monitoring. Overall 80th percentile approximated based on average of 80th percentile for each monitoring years

It can be seen that for the majority of analytes, the REHVs are exceeded when considering the maximum monitored values. This is to be expected with the REHVs based on the 95th percentile values for two unimpacted reference sites (Hornsby Shire Council, Undated).

Therefore, even the maximum values observed in a non-impacted location would be expected to exceed the REHVs. Therefore, comparing against the 80th percentile values (the highest percentile presented in the creek monitoring data) is considered to be more appropriate in assessing existing impacts than comparison with natural conditions.

Key results are as follows:

- For the 80th percentile results in Old Mans Creek (HSC Site 115) compared to the REHVs there are exceedances for Electrical Conductivity, Total Phosphorus and Faecal Coliforms.
- For the 80th percentile results for the dewatering discharge compared to the REHVs there are exceedances for Electrical Conductivity, pH, Ammonia and Total Phosphorus.
- All exceedances in the creek are within an order of magnitude of the REHVs, likely due to relatively slight disturbances in the catchment or natural differences in the catchment compared to the REHV reference catchments.
- Water in the quarry void of a generally similar nature to the receiving creek.
- An exception to the above is that the pH of dewatering discharges are consistently higher than the receiving environment and exceed the REHV trigger for all observations. However, the monitored period in the creek coincides with the period of dewatering for the quarry. Therefore, as pH in the creek during this period does not exceed REHV values it is likely that the discharges have not altered the pH above natural levels for similar environments.
- On some occasions faecal coliform levels in the creek have been monitored at highly elevated levels compared to background or average conditions. The peak concentration measures was 51,000 CFU/100 mL. A point source of faecal contamination at this point in time, such as a sewer overflow, may be the cause of these concentrations, which are not reflected in the quarry dewatering

In summary, the existing water quality in Old Mans Creek and in the historic dewatering activities is generally similar to an unimpacted or slightly disturbed catchment. The pH of the dewatering is elevated compared to natural catchments, however this does not appear to be affecting the downstream creek such that pH levels are outside those expected for a natural catchment of this nature.

Elevated faecal contamination has been observed in the creek potentially due to point sources such as sewage overflows. The nature of the water quality and flow conditions are expected to change significantly after entering Waitara Creek, which receives treated effluent from the West Hornsby WWTP.

There is potential for the water quality in the void to be altered (compared to the historically monitored dewatering) through seepage through the material placed under the 2016 planning approval. This potential impact would not be recognised through analysis of existing water quality data (as above) which is for the period before emplacement commenced. However, the EIS for the emplacement activities (AECOM Pty Ltd, 2015) assessed the potential impact of the emplaced material on water quality noting “the project is unlikely to affect groundwater quality as the quarry would be filled with ENM and VENM and would not include contaminated material”.

On this basis, the water quality of historical dewatering is considered for this assessment to an appropriate indicator for the existing water quality in the void at the commencement of this project.

3. Regulatory requirements and guidelines

Key relevant regulatory requirements and guidelines are discussed as follows.

3.1 Environmental Planning and Assessment Act 1979

The EP&A Act, administered by the NSW Department of Planning and Environment, is the core legislation relating to planning and development activities in NSW and provides the statutory framework under which development proposals are assessed. The EP&A Act aims to encourage the proper management, development and conservation of resources, environmental protection and ecologically sustainable development.

3.2 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) is administered by the EPA, which is an independent statutory authority and the primary environmental regulator for NSW. The objectives of the POEO Act are to protect, restore and enhance the quality of the environment.

Some of the mechanisms that can be applied under the POEO Act to achieve these objectives include programs to reduce pollution at the source and monitoring and reporting on environmental quality. The POEO Act regulates and requires licensing for environmental protection, including for waste generation and disposal and for water, air, land and noise pollution.

3.3 Water Management Act 2000

The *Water Management Act 2000* (WM Act) is intended to ensure that water resources are conserved and properly managed for sustainable use benefitting both present and future generations. It is also intended to provide a formal means for the protection and enhancement of the environmental qualities of waterways and their catchments.

The WM Act controls the extraction and use of water, the construction of works such as dams and weirs, and the carrying out of activities in or near water sources in NSW. 'Water sources' are defined very broadly to include any river, lake, estuary or place where water occurs naturally on or below the surface of the ground and NSW coastal waters.

Part 2 of the WM Act applies to the requirement to obtain a licence for the "taking of water" from a water source. An access licence entitles its holder to specified shares in the available water within a specified water management area or from a specified water source. It enables the licence holder to take water from the environment in accordance with specified rates and conditions under the terms of the licence.

The licencing provision apply to areas of New South Wales that have a water sharing plan (WSP). Provisions within WSPs provide water to support the ecological processes and environmental needs of groundwater dependent ecosystems (GDEs) and waterways. WSPs also provide how the water available for extraction is shared between the environment, basic landholder rights, town water supplies and commercial uses.

3.4 The Water Act

The *Water Act 1912* (Water Act) has historically been the main legislation managing water resources in NSW. The Water Act governs access, trading and allocation of licences associated

with both surface and underground water sources, where Water Sharing Plans (WSPs) under the more recent WM Act have not been put in place. The elements to which the Water Act applies include extraction of water from a river, extraction of water from underground sources, aquifer interference and capture of surface runoff in dams.

Council possesses the bore licence 10BL602742 ('the dewatering licence') which was issued under the Water Act. The dewatering licence allows for dewatering up to 370 ML over the term of the licence (per annum) and is discussed in Section 2.3.

3.5 Australian and New Zealand Guidelines for Fresh and Marine Water Quality

The National Water Quality Management Strategy (NWQMS) provides a national framework for improving water quality in Australia's waterways. The main policy objective of the NWQMS is to achieve sustainable use of the nation's water resources, protecting and enhancing their quality, while maintaining economic and social development.

The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC, 2000) is a benchmark document of the NWQMS which provides a guide for assessing and managing ambient water quality in a wide range of water resource types and according to specified environmental values, such as aquatic ecosystems, primary industries, recreation and drinking water. (ANZECC, 2000) provide a framework for determining appropriate guideline values or performance criteria to evaluate the results of water quality monitoring programs.

3.6 Hornsby Shire Council Regional Environmental Health Values

Analysis of water quality data for unimpacted reference sites has been undertaken by Hornsby Shire Council for over 15 years. As documented in (Hornsby Shire Council, Undated) regional environmental health values (REHVs) have been calculated by Council based generally on the 95th percentile values at the reference sites. ANZECC, 2000 notes that local environmental health values can be developed based on long-term data from suitable reference sites and therefore the REHVs are considered a suitable indication of baseline water quality against which to assess potential impacts of the proposal.

3.7 Managing Urban Stormwater: Soils and Construction – Volume 1 (Landcom, 2004)

The document *Managing Urban Stormwater: Soils and Construction, Volume 1 (Landcom, 2004)* outlines the basic principles for the design and construction of sediment and erosion control measures. This document relates particularly to urban development sites, however it is relevant to the Project as it provides guidance on the configuration of erosion and sedimentation controls required during construction.

3.8 Managing Urban Stormwater: Soils and Construction – Volume 2E Mines and Quarries (DECC, 2008)

Managing Urban Stormwater: Soils and Construction, Volume 2E (DECC; 2008) is a companion document to Volume 1 described in Section 3.7. It provides specific guidelines, principles and minimum design standards for good management practice in erosion and sediment control during the construction and operation of mines and quarries.

Typically the methods and requirements specified in Volume 1 and Volume 2E of Managing Urban Stormwater are presented on the basis that stormwater has the potential to discharge to

receptors via gravity flows. As the site is an enclosed void, many of the requirements and methods are not directly applicable.

4. Water risk assessment

In order to develop an assessment methodology (Section 5) that can appropriately assess the potential water related impacts of the project, a risk assessment was undertaken. This involved conceptualising the surface and groundwater conditions for the project (Section 4.1) and subsequently identifying potential water related risks (Section 4.2).

4.1 Project surface water and groundwater conditions

The project would commence at the completion of the 2016 Planning Approval works and involves the works required to modify the final landform from the 2016 Planning Approval emplacement project such that the quarry is suitable for ongoing recreational use. The proposed project includes a permanent waterbody in the pit void with the water level maintained at approximately 55 m AHD.

The sketches shown in Figure 4.1 (SK224), indicate the proposed final landform of the project, and also provide a general indication of the levels and configuration of the quarry configuration.

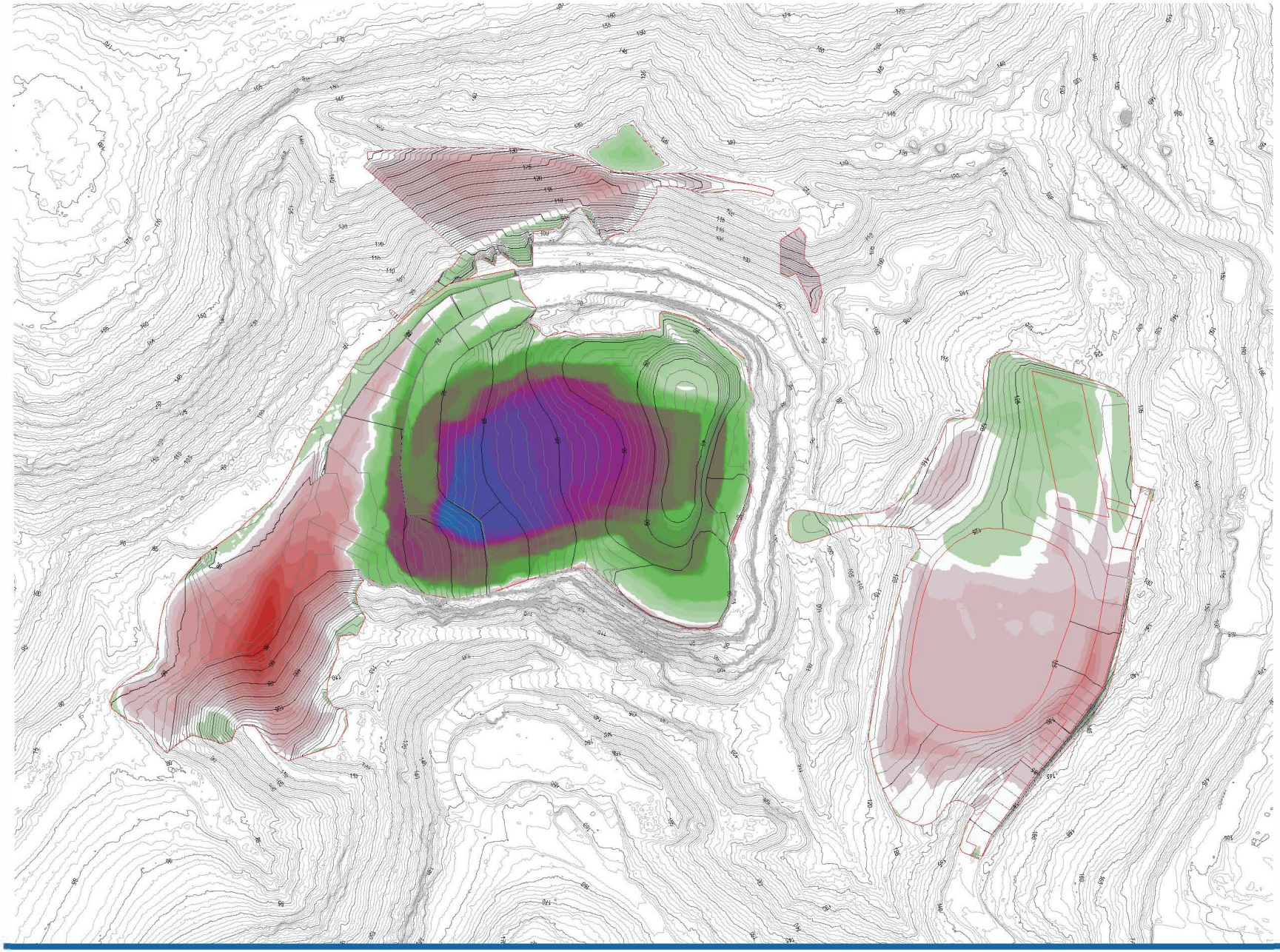
As discussed in Section 2, due to the depth of the quarry pit floor relative to regional groundwater conditions the quarry has historically experienced groundwater inflow and dewatering of this water from the void has been undertaken. As an indication the invert of the quarry floor is in the order of 10 m AHD.

Management of water in the void has recently been undertaken by NorthConnex since the commencement of works under the 2016 planning approval. This involved dewatering the void below the level previously maintained by Council to allow emplacement of material.

It is anticipated that as the emplacement project commences and the fill level rises this groundwater ingress will progressively “fill up” the voids of the fill material and the water table in the pit will rise.

Therefore, the key elements of the groundwater and surface water system during and after the Council project are as follows:

- Ongoing ingress of groundwater filling up the void spaces of the fill, continuing upwards from the groundwater level in the void at the end of the works under the 2016 Planning Approval.
- Concurrently to the above, earthworks would be undertaken to modify the final landform as required for ongoing recreational use. This includes the provision of a relatively low-lying area, below 55 m AHD to allow for a future lake filled by groundwater ingress.
- When the rising groundwater levels reach the invert of the low-lying area water the lake would begin to fill, as well as the voids of the fill material outside the extent of the lake at the same level.
- When the target water level for the lake of 55 mAHD is reached, dewatering of the void, as per the dewatering licence that Council possesses, would recommence.
- The final level of the void would remain low-lying compared to downstream waterways such that the pit still does not discharge to downstream waterways via gravity.
- The current (historically diverted around the void) alignment and configuration of Old Mans Creek will be maintained such that creek diversion works and their associated risk are not required.



LEGEND

ASSUMED EXISTING SURFACE

PIT AREA DESIGN SURFACE

VOLUME CALCULATION BOUNDARY

CUT FILL DEPTH RANGE

25m CUT
22.5m
20m
17.5m
15m
12.5m
10m
7.5m
5m
2.5m
0
2.5m
5m
7.5m
10m
12.5m
15m
17.5m FILL

17.5m FILL
20m
22.5m
25m
27.5m
30m
32.5m
35m
37.5m
40m
42.5
45m
47.5m
50m
52.5m
55m
57.5m
60m FILL

VOLUMES

AREA	CUT (m³)	FILL (m³)
QUARRY VOID AND SW FILL AREA	273,000	1,346,600
OLD MANS VALLEY	176,300	32,700
NORTHERN SPOIL MOUND	63,800	6,400
TOTAL	513,900	1,385,700

0 30 60 90m

SCALE 1:3000 AT ORIGINAL SIZE

N

HORNSBY SHIRE COUNCIL
HORNSBY QUARRY REHABILITATION
PROJECT FINAL LANDFORM
CONCEPT DESIGN SURFACE

Job Number 21-26457
Revision A
Date SEP 2018

Figure 4.1

Level 15, 133 Castlereagh Street, Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Plot Date: 12 November 2018 - 10:26 AM Plotted by: Rashnith Grewal

Cad File No: G:\21\26457\CADD\Drawings\21-26457-FIG6.2.dwg

4.2 Identified potential water related risks

Based on conceptualising the surface water and groundwater conditions for the project the following key potential risks were identified for the project with relation to water:

- Impacts on groundwater levels and availability external to the site through drawdown of the aquifer as groundwater flows into the quarry void. The rate, frequency and duration of dewatering has the potential to influence this impact.
- Resultant non-compliance with water licencing requirements with relation to the above under the Water Act and the WM Act.
- Impact of the quality of groundwater external to the void through alteration of groundwater quality within the void and the interconnection of the aquifer internal to and external to the void.
- Quality of water discharged from the void via dewatering resulting in an impact on downstream water quality.
- Modification to the morphology of downstream systems through void dewatering altering downstream flow regimes.

It should be noted that these risks are not necessarily expected to occur, rather they were estimated as requiring impact assessment for the project.

Identification of these risks allowed for development of a tailored assessment and mitigation measures as outlined in Sections 5, 6 and 7.

The conceptualisation of the surface and groundwater systems also allowed for the some risks to be identified as not major for this project, as listed below:

- The location of the proposed works within the quarry void reduces or eliminates some potential surface water risks. For example, as the works drain inwards to a contained low-point (the quarry lake). The risk of discharging sediment laden water is low as water is contained, after which settlement of sediments would occur and the timing of discharge can be controlled via pumping. This is in contrast to many typical proposals where runoff drains and discharges from the site via gravity.
- The perimeter of the quarry is also located at an elevated level compared to surrounding regional waterways and is therefore not subject to regional flooding events. Major upstream flows are diverted around the void.
- No external natural watercourses are to be realigned and no increased discharges via flows to watercourses are anticipated. This eliminates the risks associated with manual watercourse realignment and adjustments to flood flow regimes and corresponding geomorphological impacts.

5. Assessment methodology

5.1 Overview

Based on the water related risks identified in Section 4.2 an assessment methodology was developed to appropriately assess the risks and develop mitigation measures. It was determined that two key components were required to form the basis of the assessment. These are listed below and detailed in the following sections:

- A daily time step water balance model was developed to represent likely inflows and outflows to the system. This included rainfall, runoff, evaporation, groundwater inflows and dewatering.
- Groundwater inflow for the water balance model was established by reviewing previous assessments, completing additional analytical calculations and by calibration of the water balance to recent observed water levels in the void.

The results of the above two key components of the assessment were combined and reviewed to inform the impact assessment (Section 6) and development of management/mitigation measures (Section 7).

5.2 Water balance model development

The water balance model was developed using the GoldSIM software package and represented daily transfers of water for key elements of the site water cycle as indicated on Figure 5.1. GoldSIM is a computational software package or a “visual spreadsheet” allowing for flexible and robust quantification of time series simulations. For each of the transfers represented on Figure 5.1, operational rules or natural processes were numerically quantified in the model as detailed in Table 5.1. Other key assumptions of the model are as follows:

- The period modelled commenced on 1 August 2017 with a starting water level in the pit of 9 m AHD and no further dewatering undertaken under the NorthConnex emplacement project. This was based on information provided to GHD on the lake level during an inspection of the site by GHD. The model was simulated for a sufficient period of time to represent the initial “filling up” period and ongoing operational conditions. Rainfall was simulated as outlined in Table 5.1.
- In order to estimate the storage volume in the pit void, the wet surface area for evaporation and the current water level for groundwater inflows, a relationship between level, area and volume was developed. It is noted that, this relationship is dependent on the final outcome of the current emplacement project and the Council rehabilitation project. The relationship between area, level and volume for the lake was developed using the following approach:
  - The landform simulated equates to the final landform at the end of the Council rehabilitation project.
  - When the modelled water level was entirely beneath the landform levels (e.g. below infilled material at the base of the pit void) it was assumed no evaporation occurred and that the void space in emplaced material must be “filled up” and become saturated.
  - A void ratio (porosity) of 30% was assumed for the material placed in the pit void. This void volume was required to be filled up in the water balance by water inputs before expression of lake levels above the landform (material placed in the pit) level of 55 m AHD.

- Where the water level is above the final landform levels surface evaporation occurs over the extent of water ponded above the landform..
- During emplacement and rehabilitation activities water inputs may exceed the void capacity in some instances, thus creating a temporary lake. The model assumes that the material has already been emplaced and therefore does not simulate this conceptual condition (additional evaporation). However, based on the results of the initial water balance modelling the additional evaporative water loss is small and as such this limitation is considered to be acceptable. Furthermore, this would not affect the total volume requiring “filling up”.

- Dewatering was simulated to occur when lake levels exceeded 55 m AHD with a maximum dewatering rate of 370 ML per annum as indicated in the dewatering licence for the quarry.
- The model was simulated for the period required to represent conditions during “filling up” of the void to the target water level (55 m AHD) and for one year after “filling up” was achieved. This allowed an assessment of the likely conditions during the filling up period and of ongoing water level management requirements.
- The model was simulated for 92 different realisations of rainfall and evaporation data based on the amount of meteorological data. This allowed assessment of the impact of the range of potential climatic conditions that could be experienced during ‘filling up’ given a one year period subsequent to filling up.

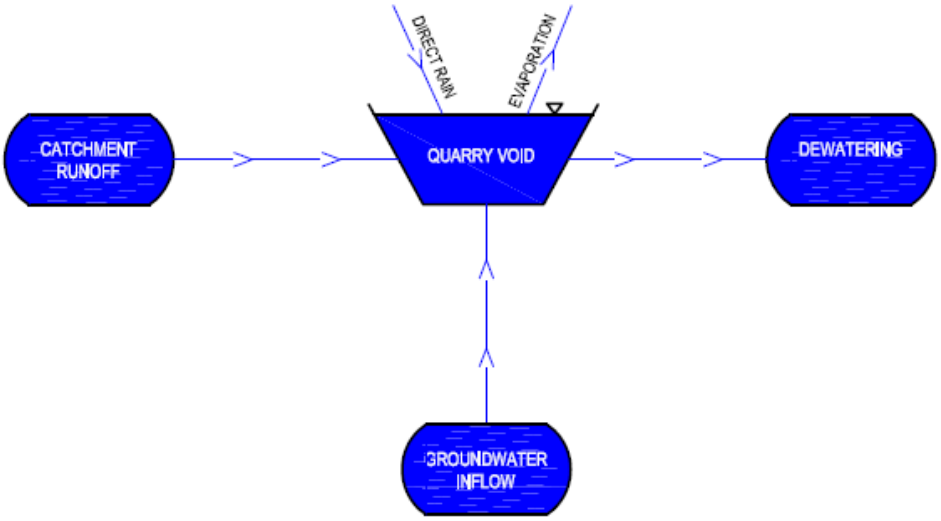


Figure 5.1 Water balance schematic

Table 5.1 Water balance representation

Transfer	Representation
Direct rainfall	100% of the rainfall volume falling on the wet surface area. Rainfall was sourced from the SILO database managed by the Queensland Government. For a selected Bureau of Meteorology Rainfall Station input into the database by the user, the database returns a daily time-series of meteorological data including rainfall, consisting of the data from the selected station where available and infilled from nearby stations where not available. Data was sourced from 1925 to 2016, selecting the Hornsby (Pretoria Parade) Station (66028) and input into the 92 different realisations of the model. The 92 representations are based on the availability of 92 years of data and beginning each representation at the beginning of a different calendar year.
Runoff	A catchment area contributing directly to the quarry was estimated as 12 hectares based on review of aerial survey data and the site inspection undertaken by GHD. Quantification of the proportion of rainfall converted to runoff is challenging given the unique nature of the site consisting of in-situ cutting faces, vegetated areas and emplaced material. Therefore, no significant applicable data is available and a proportion of 30% was selected based on GHD experience. Sensitivity analysis on the runoff co-efficient was undertaken by simulating a value of 20% and 50% as well as the selected 30% and observing the impact on results.
Groundwater inflow	Refer Section 5.3
Evaporation	The daily pan evaporation depth was obtained from the SILO database as described previously for rainfall. Pan factors to convert the pan evaporation to lake evaporation were estimated based on McMahon et al 2012, Estimating Evaporation Using Standard Meteorological Data. The daily evaporation volume was then calculated as the lake evaporation depth multiplied by the current wetted surface area.
Dewatering	Dewatering was established as an operational rule where it occurs as required if the target water level of 55 m AHD is exceeded. Furthermore, dewatering was limited such that it does not occur if the annual dewatering allowance of 370 ML is exceeded.

Results were then extracted for key elements including and in particular the time required for filling up to be achieved and the ongoing dewatering requirements after filling up has occurred.

These results were presented as a range of potential results for the different potential climatic conditions experienced, as well as for two groundwater inflow scenarios as discussed in Section 5.3.

There is potential for ongoing accumulation and concentration of substances in the final lake above the concentrations in the inflows. This has potential impacts on the assessment of discharge quality. It could occur due to outflows such as evaporation reducing the volume of water without removing the mass of water quality constituents. This was assessed by adjusting the representation of the water balance to estimate a dilution factor for water in the final lake.

This dilution factor represented the potential accumulation of concentrations above the concentrations in incoming groundwater and surface water runoff. Final predicted concentrations would be equal to the dilution factor multiplied by the concentration of incoming flows. Therefore, if the dilution factor remains similar to 1, then this indicates that significant long term accumulation and concentration of substances is not anticipated.

5.3 Groundwater assessment

The estimation of groundwater inflow rates is a predominant/key input parameter for the water balance. Therefore, a multifaceted approach was adopted to assess groundwater inflows. The aim of the approach was to develop an appropriate relationship of pit water level vs inflow rate for input into the water balance. The assessment included the following works:

- An analytical assessment of inflows.
- Comparison against previous estimates outlined in Appendix M (PSM, 2007) of the EIS completed for disposing of construction spoil into the pit void (AECOM Pty Ltd, 2015).
- Model calibration to recent observed water levels in the void.

A discussion of these groundwater inflow estimation methods is provided below.

5.3.1 Analytical assessment of groundwater inflows

Groundwater flows into the pit void from the surrounding Hawkesbury Sandstone lithology were estimated using an analytical pit inflow equation (Marinelli & Niccoli, 2000). The analytical equations and conceptual diagram are presented below.

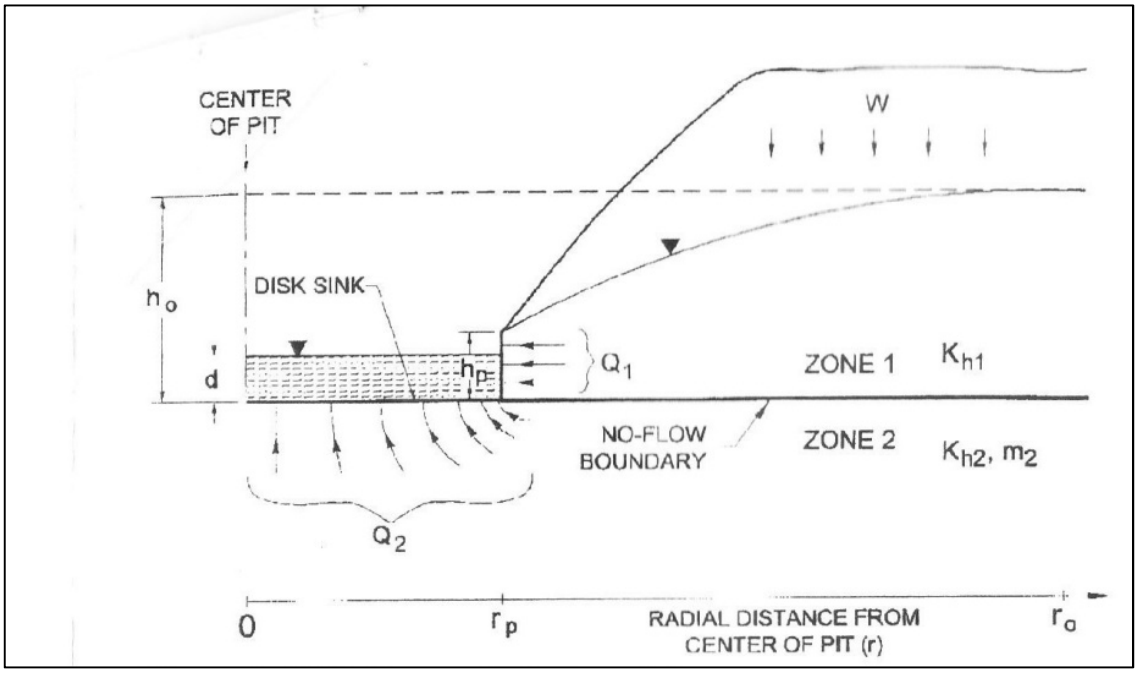


Figure 5.2 Groundwater inflow estimation parameters

$$Q_1 = W\pi(r_o^2 - r_p^2)$$

$$Q_2 = 4r_o\left(\frac{K_{h2}}{m_2}\right)(h_o - d)$$

$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

$$h_o = \sqrt{h_p^2 + \frac{W}{K_{h1}}\left[r_o^2 \ln\left(\frac{r_o}{r_p}\right) - \frac{\left(r_o^2 - r_p^2\right)}{2}\right]}$$

Where:

Q_1 = discharge from the fill aquifer into the excavation

Q_2 = discharge from the bedrock aquifer into the base of the excavation

r_p = effective radius of the excavation (m)

h_o = initial saturated thickness of the aquifer (m)

h_p = saturated thickness above base of zone 1 (m)

d = depth of water in excavation (m)

W = distributed recharge flux (m/s)

K_{h1}, K_{h2} = hydraulic conductivity of zone 1 and zone 2 aquifers respectively (m/s)

K_{v2} = vertical hydraulic conductivity of zone 2 (bedrock).

r_o = radius of influence (m)

This equation assumes flow from all sides of the pit for the fill aquifer (zone 1).

The input parameters adopted for the assessment are provided in Table 5.2 and the results are summarised in Table 5.3.

Low, median and high inflow estimates were developed to incorporate the uncertainty in understanding of the bulk formation hydraulic conductivities around the pit. The hydraulic conductivities were established from a statistical summary of 363 packer tests in 117 bores that intersected Hawkesbury Sandstones in the Sydney region (Tammetta & Hewitt, 2004). Figure 5.3 presents the statistical summary.

The low, likely and high end hydraulic conductivities selected for the assessment from the statistical range presented in Figure 5.3 were 0.001 m/day, 0.004 m/day (50th percentile) and 0.1 m/day respectively. These values do not include the minimum and maximum values in the data set as these are unlikely to be representative of the bulk formation hydraulic conductivity, which is a collective manifestation of all of the packer test results and which is responsible for overall groundwater flows.

The range of input values adopted is expected to suitably account for the potential range in bulk formation hydraulic conductivities recommended in the literature (Heuer 1995, Hewitt 2005 and Raymer 2001). Visual observations of seepage into the pit during the site visit indicate that the

geological is low yielding and therefore it is expected that groundwater seepage into the pit would approximate the low end to likely values.

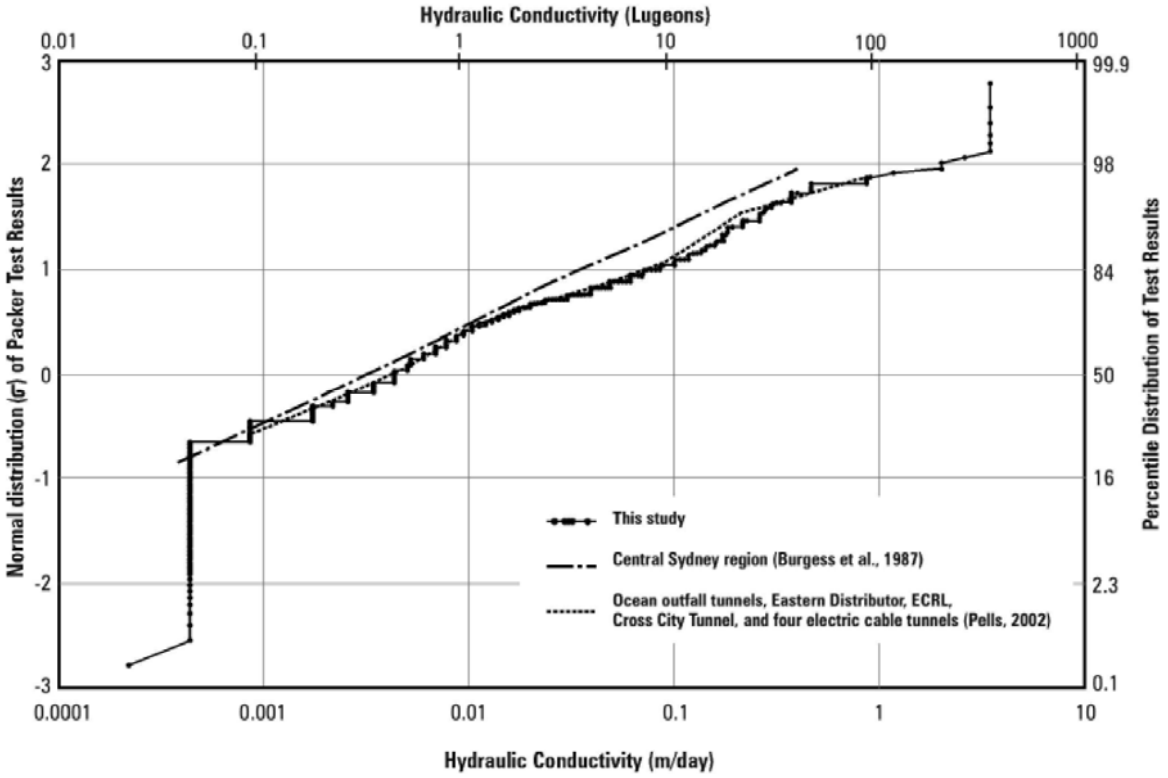


Figure 5.3 Hydraulic conductivity range for the Hawkesbury Sandstone (Tammetta & Hewitt, 2004)

Table 5.2 Input parameters

Parameter	Identifier	Unit	Low estimate	Median estimate	High estimate	Comments
Effective Pit Radius	r_p	m	Calculated using contour plots of the pit void contours. The effective pit radius was changed to be the surface area occupied by the lake at different lake levels within the pit void.			
Initial saturated thickness (measured)	h_o	m	92	92	92	Based on the difference between observed groundwater elevations around the pit and pit void depth.
Saturated thickness above base zone 1	h_p	m	0 - 92	0-92	0-92	Was varied based on the depth of the lake above the pit base. This assumed the pit had not been infilled.
Depth of pit lake	D	m	0 - 92	0-92	0-92	Was varied based on the depth of the lake above the pit base. This assumed the pit had not been infilled.
Distributed Recharge Flux	W	mm /year	70.9	70.9	70.9	Assumed annual recharge of 6 % of annual rainfall of 1318 mm (70.9

Parameter	Identifier	Unit	Low estimate	Median estimate	High estimate	Comments
						mm/yr). This was based on annual percentage recharge rates adopted in the water sharing plan for this aquifer system as well as GHDs experience on relevant projects
Hydraulic Conductivity (horizontal) Zone 1	K_h	m/day	1E-3	1.9E-3	1E-2	Literature value (Tammetta & Hewitt, 2004) with low end representing approximately
Hydraulic Conductivity (vertical) Zone 2	K_v2	m/day	1E-3	1.9E-3	1E-2	Assumed to be 1.0 for the fractured Hawkesbury Sandstone aquifer system.
Radius of Influence	r_o	m	168 - 272	168 - 323	168-1355	Iterative estimation to match saturated thickness. It varied as the lake depth varied.

Table 5.3 Inflow results

Lake level (mAHD)	Inflow rate (m^3/day)		
	Low	Likely	High
8	114	622	49221
10	114	617	48458
20	111	583	44110
30	107	538	39079
40	100	483	33433
50	91	418	27453
60	80	347	21261
70	66	268	15108
80	50	186	9183
90	31	101	3728
92	0	0	0

5.3.2 Previous estimations of inflows

Works completed for the 2016 Planning Approval (AECOM Pty Ltd, 2015) indicated that groundwater inflows would range between 12.8 L/s (1106 m^3/day) at a lake level of 8 m AHD and 2.8 L/s (242 m^3/day) at a lake level of 64 m AHD).

5.3.3 Model calibration to groundwater pumping data

Calibration of the water balance to observed historical water levels was undertaken based on the following:

- Information was sourced from Council that the water level was approximately 20 m AHD at May 2018.

- Based on this information and the starting condition of the water balance model being August 2017 with a water level in the pit of 9 m AHD, a calibration window was available during which the model could be calibrated.
- The groundwater relationships developed in Section 5.3.1 were then scaled proportionally for different iterations of the model until the predicted water level at May 2018 was approximately 20 m AHD.
- The scaling of the relationships was such that the “shape” of the relationship remained but was linearly scaled. That is, the decline in groundwater inflow as water level in the void increases was maintained, with the flows for both the higher and lower void levels scaled proportionally based on the calibration results.

5.3.4 Adopted groundwater inflows

Based on considerations outlined in Sections 5.3.1, 5.3.2 and 5.3.3, adopted groundwater inflow rates were as indicated in Table 5.4. As discussed in Section 5.2, a sensitivity of runoff on model predications was undertaken through varying the proportion of rainfall converted to runoff. As groundwater flows were developed based on calibration to observed water levels, and these water levels in turn being affected by runoff, the calibration was undertaken for each runoff proportion as indicated in the Table.

The calibrated groundwater flows were found to be less than or similar to the lower inflow estimate for analytical assessment of groundwater flows (refer Section 5.3.1).

Table 5.4 shows the adopted groundwater inflow rates.

Table 5.4 Groundwater inflow scenarios

Pit water level (m AHD)	Groundwater inflow 20% runoff (m^3/day)	Groundwater inflow 30% runoff (m^3/day)	Groundwater inflow 50% runoff (m^3/day)
8	114	91.2	68.4
10	114	91.2	68.4
20	111	88.8	66.6
30	107	85.6	64.2
40	100	80	60
50	91	72.8	54.6
60	80	64	48
70	66	52.8	39.6
80	50	40	30
90	31	24.8	18.6
92	0	0	0

5.4 Water balance results

Figure 5.5 shows the results of the water balance for the 30% runoff scenario. The range of results presented on each figure indicate the potential variation based on the climatic conditions that are experienced. Review of the figures indicates that:

- Prior to reaching the target water level groundwater inflow is approximately 30 ML/year with minimal variation for climatic conditions.
- Catchment runoff is approximately 30 ML/year for average climatic conditions but is subject to greater variability with climatic conditions.
- Direct rain is a significantly smaller input and approximately offset by evaporation.

- After reaching the target water level the predicted range of the annual dewatering requirement is from 30 ML/year for the minimum climatic conditions to over 100 ML/year for the maximum climatic conditions. These results are all less than the volumetric allowance of Council's groundwater licence.
- After reaching the target water level groundwater inflow at approximately 25 ML/year is relatively smaller than the "filling up" stage due to the relatively higher water level.

Table 5.5 indicates the estimated time to reach the target water level for the three runoff scenarios. It can be seen that the predicted time to reach the target water levels varies from August 2021 to July 2025. There is more variation in the time to fill for the higher runoff scenario because for this scenario the calibrated groundwater inflows were relatively less due to the higher surface water contribution. As the groundwater inflows are less variable than rainfall derived surface flows, the higher ratio of groundwater reduces the range of prediction.

It should be noted that the terms "minimum" and "maximum" refer to the upper and lower range climatic conditions for a given set of other parameters, rather than guaranteed bounds after all other non-climatic factors are considered.

Table 5.5 Time to reach target water level

Climatic conditions	20% runoff	30% runoff	50% runoff
Minimum	2/12/2023	28/03/2023	2/08/2021
10th Percentile	12/03/2024	31/07/2023	29/04/2022
Mean	06/11/2024	28/05/2024	13/03/2023
90th Percentile	06/05/2025	22/01/2025	25/11/2023
Maximum	19/07/2025	4/05/2025	19/04/2024

Figure 5.4 indicates the dilution factor results for the final quarry lake after the target water level is reached for the 30% runoff scenario.

The results indicate the dilution factors expected are similar to 1 and less than or equal to 1.05 at all times, suggesting no significant ongoing accumulation and concentration. This factor represents the potential accumulation of concentrations above the concentration in incoming groundwater. Final predicted concentrations equal the factor multiplied by the concentration of incoming flows.

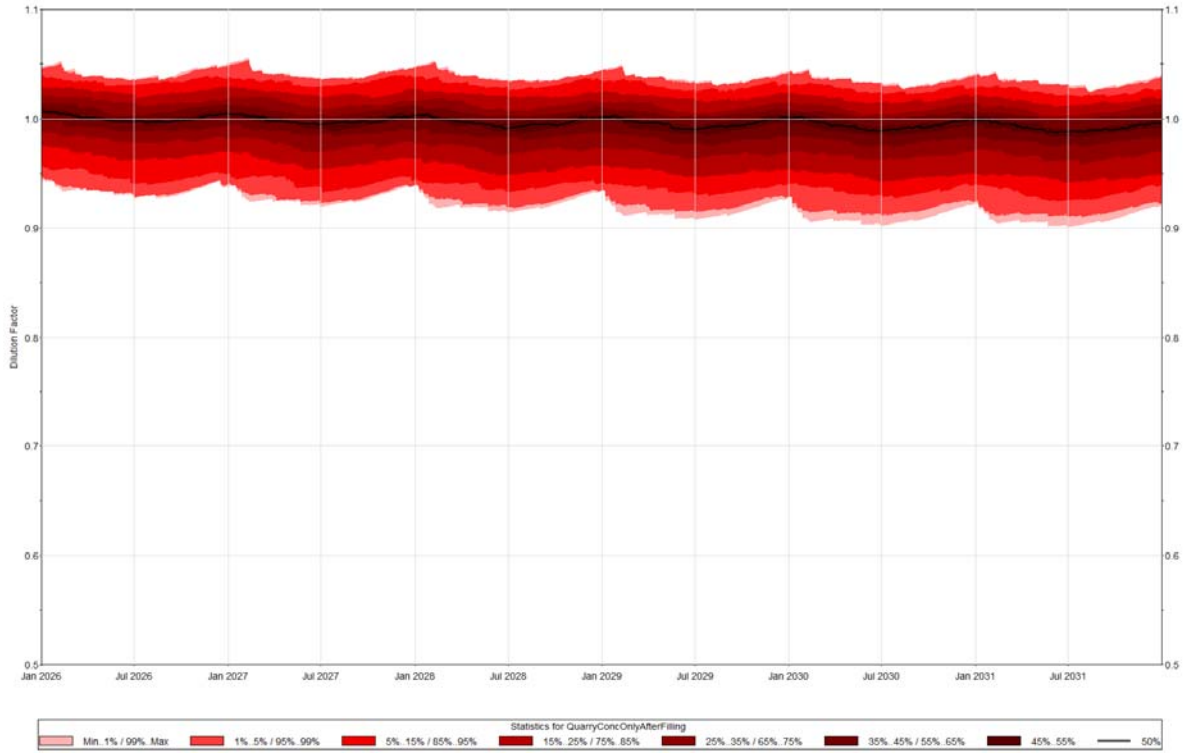
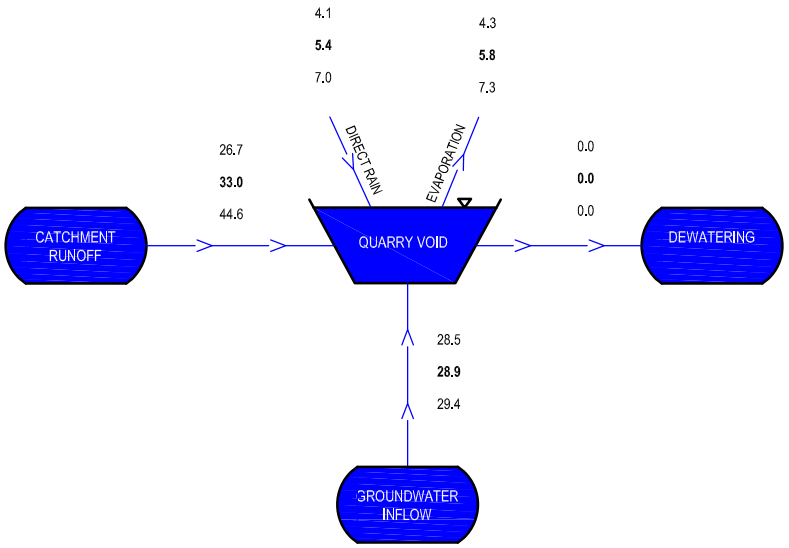
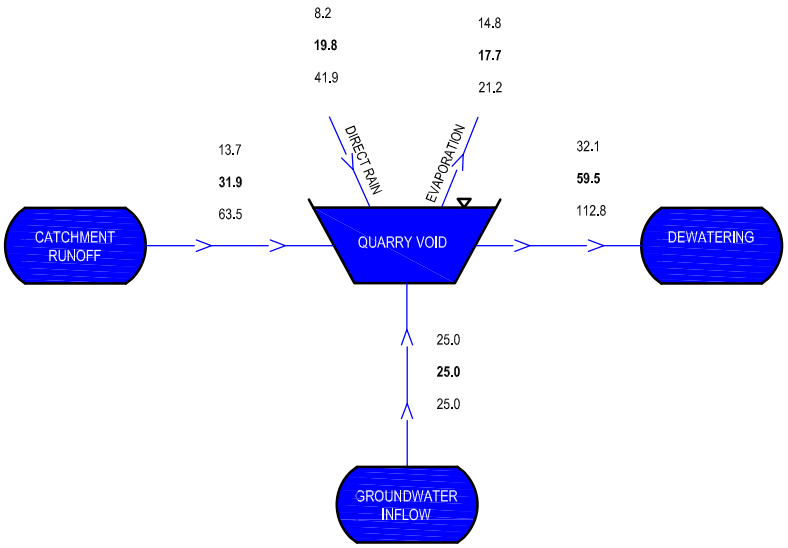


Figure 5.4 Water balance results – dilution factor



PRIOR TO REACHING TARGET WATER LEVEL



AFTER REACHING TARGET WATER LEVEL

LEGEND

MINIMUM (ML/YR)
AVERAGE (ML/YR)
MAXIMUM (ML/YR)

HORNSBY SHIRE COUNCIL
HORNSBY QUARRY REHABILITATION

WATER BALANCE RESULTS

Job Number	21-26457
Revision	B
Date	JUN 2018

Figure 5.5

Level 15, 133 Castlereagh Street, Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Plot Date: 22 June 2018 - 3:54 PM Plotted by: Rod Towner Cad File No: N:\AU\Sydney\Projects\21\26457\Tech\Water\WaterBalance\Hornsby Water Cycle Schematic.dwg

6. Impact assessment

The following sections provide an assessment of the key risks identified in Section 4.2, identifying where mitigation measures are required, allowing for their identification in Section 7.

6.1 Groundwater quantity and water licencing

As conceptualised in Section 4.2 and quantified through the results of the water balance in Section 5.4 significant volumes of surface water and particularly groundwater are intercepted by the quarry void. This intercepted water is then either evaporated or conveyed to the downstream surface water system.

The results of the water balance indicate that the net flow of water to the surface water system is positive (that is more dewatering to the surface water system than capture of runoff), other than during the relatively brief period before reaching the target water level.

Therefore, the primary consideration with relation to water take and licencing is the abstraction of groundwater through inflow into the quarry void and the conveyance of this water to the surface water system (or evaporation), rather than return to the groundwater system. Under the *NSW Aquifer Interference Policy* (refer Section 3.4) this is likely to be considered a licenced extraction and therefore require a licence under the *Water Act* or *WM Act.*

It can be noted from the water balance results (Figure 5.5) that the sum of evaporation and dewatering for the maximum year is approximately 130 ML/year, which is significantly less than the entitlement under the dewatering licence of 370 ML/year. This demonstrates that whilst the extraction rate is significant, it is within the current entitlement amount and therefore not expected to result in groundwater impacts outside those permissible under relevant legislation (refer Sections 3.3 and 3.4). This is on the basis of the maintenance of a target water level of 55 m AHD.

It should also be noted that maintaining the target water level at 55 m AHD results in less groundwater inflows than under historical activities before the works under the 2016 Planning Approval on the basis that the higher water level in the void reduces the hydraulic gradient from the surrounding aquifer and therefore reduces inflows.

6.2 Surface water quality

The following potential pathways exist for potential impact on surface water quality by extracting water from the void (supplied by groundwater) and dewatering to the surface water system:

- Elevated concentrations of substances naturally in the groundwater system, in excess of the surface water system concentrations.
- Introduction of elevated concentrations through leaching of the material placed under the 2016 Planning Approval.
- Introduction of elevated concentrations through the activities associated with the construction and operation of the proposed works.
- Elevation of concentrations through ongoing accumulation in the void through processes such as evaporation.

In relation to elevated concentrations naturally in the groundwater system, Section 2.4 outlines how water in the quarry void of a generally similar nature to the receiving creek. An exception to this is that the pH of dewatering discharges are consistently higher than the receiving environment and exceed the REHV trigger for all observations. However, as stated in Section 2.4 it is likely that the discharges have not altered the pH above natural levels for similar

environments. Furthermore, these impacts are expected to reduce for the project compared to historical conditions on the basis that the dewatering volume will be reduced.

With relation to elevated concentrations through leaching of the 2016 Planning Approval material, the impact of this material on lake water quality was considered to be negligible in the EIS for the approval (AECOM Pty Ltd, 2015). This was on the basis of the material consisting of natural crushed sandstone, shale, clay and soil that has been characterised in accordance with NSW waste regulation exemptions as excavated natural material (ENM) and/or virgin excavated natural material (VENM). ENM and VENM represent natural uncontaminated materials.

While data characterising the pore water quality from the material being used to fill the quarry void, it can be expected that the water quality would be similar to that found within the natural shale and sandstone groundwater environments along the NorthConnex alignment. Although greater contact with water in the pore space of emplaced material (as opposed to fractures insitu) may allow for higher concentrations of naturally occurring constituents in the media to develop in lake water. This issue can only be assessed further by ongoing monitoring of quarry pit water quality as infilling occurs and/or by laboratory analysis of pore water emanating from infilling material samples.

With relation to the introduction of elevated concentrations through activities associated with the project, vehicular access to the parkland in proximity to the quarry lake during the operational phase will be generally minimal, with primarily pedestrian activity occurring. Furthermore, consistent with a parkland, the installation of impervious surfaces will be minimal.

Therefore, the water quality risks associated with the project are small and are primarily with relation to nutrients from parkland maintenance (fertilizers etc) as well as introduction of pathogens from human recreation in the quarry lake, as well as construction phase activities. These risks are anticipated to be manageable through the development of a construction phase water management plan as well as an operational phase water quality monitoring program (refer Section 7).

With relation to accumulation of concentrations in the void the results of the water balance (Section 5.4) indicate a dilution factor of less than 1.05 at all times, indicating no significant accumulation.

Therefore, with implementation of appropriate mitigation measures, the project is not anticipated to result in significant impacts with respect to surface water quality.

6.3 Groundwater quality

The results of the groundwater assessment (Table 5.4) show that for all void water levels under the project (that is up to 55 m AHD) there is anticipated to be an inflow of groundwater into the void, not an outflow. Therefore, the risk of impacting on surrounding groundwater quality conditions through the project is minimal. Furthermore, as outlined in Section 2.4 and Section 6.2, the quality of water in the void (current and future) is not dissimilar to receiving environments, further reducing the risk of adverse groundwater quality impacts.

6.4 Watercourse stability and morphology

Discharges associated with the dewatering have the potential to impact on the formation of downstream waterways through affecting the patterns of sediment mobilisation and deposition. However, the impact for the proposed works is not anticipated to be significant on the basis of the following:

- Downstream waterways are generally well vegetated, with defined stream patterns and outcrops of bedrock providing control on potential incisions.

- The downstream waterways, immediately downstream of the discharge point are of a significant catchment area where natural flood flows are likely to be of a much larger flow rate, and therefore the governing geomorphological process behind the system.
- The dewatering rates under the project will be less than historical dewatering, on the basis of the higher water level in the void, therefore if there are impacts associated with the dewatering, they may have already occurred or be lessened in the future by the project relative to historical conditions.

7. Management and mitigation measures

As outlined and assessed in Section 4 and Section 6 the water related risks associated with the project are not anticipated to be significant. This is on the basis of a number of factors, considered in detail in these previous sections, including:

- The 'inwards draining' nature of the site mitigating any runoff of uncontrolled water from the site.
- The possession of an existing groundwater extraction licence of sufficient volume for ongoing inflow rates.
- The inflow of groundwater into the void (rather than outflow) reducing the risk of groundwater contamination.
- The existing water quality of the void being of a generally similar nature to receiving environments.
- The assessment in (AECOM Pty Ltd, 2015) that the importing of material into the void under the 2016 Planning Approval incurs minimal water quality risk.

Therefore, management and mitigation measures have been developed with the purpose of confirming that the actual operation of the system is in accordance with the predictions of this assessment, and therefore confirming that impacts are not significant.

These mitigation measures would include the following:

- Measurement of pumped dewatering volumes when they occur using the existing flow measurement weir available to Council. Data would be stored in a central location and maintained for the duration of the project.
- Continuation of the current groundwater extraction licencing arrangements. Due to predicted extraction rates (Section 6.1) being significantly less than the current entitlement, the licenced amount may be reduced based on at least three years of dewatering volumetric monitoring after reaching the target water level of 55 m AHD.
- Monitoring of the quality of the water in the void, at the location of extraction for dewatering. This monitoring would be undertaken every three months until two years after the target water level is reached, and every 6 months subsequent to that. It would include the following analytes:
  - pH
  - Total Dissolved Solids
  - Turbidity
  - Dissolved Oxygen
  - Total Suspended Solids
  - Ammonia
  - Oxidised Nitrogen
  - Total Nitrogen
  - Total Phosphorus
  - Faecal Coliforms
  - Enterococci
- Procedures for the management of water quality with respect to human health and primary contact recreation have been developed, including regular monitoring of faecal indicators

and appropriate mitigation of impacts. These are considered separate to this assessment, which focuses on potential environmental impacts.

- Continuation of all other requirements of the groundwater licence not already covered in the above items.

The following triggers have been developed. Activation of one of these triggers does not necessarily imply significant impact or that the site is not operating as predicted in this assessment, but suggests that further assessment and review of the sites operation is required. Therefore, should one of the below be triggered an appropriate management plan would be developed and implemented within 6 months of the second occurrence.

- Annual dewatering volume exceeds the maximum predicted rate of 112 ML/year (Figure 5.5.) in two consecutive years.
- In an annual period, the following are observed for any monitored water quality analyte. The following were selected on the basis that the suggest the possibility that regional environmental values are at risk and to a greater extent than prior to the project being implemented:
  - The 80th percentile monitored concentration over a two year period exceeds the REHV trigger value (Refer Section 2.4); and
  - The median concentration exceeds the median concentration for monitored historical discharges before commencement of the project (Refer Section 2.4)

During construction, a Soil and Water Management Plan would be developed, in accordance with (Landcom , 2005) ‘The Blue Book’, including consideration of erosion and sediment control impacts, noting that the ‘inwards draining’ nature of the site reduces sedimentation risks dramatically.

8. Conclusions

A risk assessment was undertaken to assess the water related risks of the project. The primary risks identified were with relation to impacts on groundwater levels and availability, non-compliance with water licencing requirements, impact on the quality of external groundwater and impact on the quality or quantity of water in downstream surface water systems due to dewatering activities.

Impact assessment was undertaken finding that the water related impacts of the project are not anticipated to be significant. This is on the basis of:

- A water balance and groundwater flow assessment identifying that groundwater take is significantly less than current licence entitlements, with the take predicted to be less than under historic dewatering activities.
- The water quality of water discharged from the void is anticipated to be generally similar to that of the receiving environment. This is supported by existing void water quality monitoring data, assessment of the impacts of emplacing material undertaken for the NorthConnex project, and water balance results showing no increasing accumulation of concentrations of water quality constituents.
- The flow direction of groundwater being inwards to the void, mitigating the risk of discharging lower quality water to the groundwater system (noting that this lower quality water is not anticipated).
- Dewatering rates are anticipated to be less than under historical dewatering activities and therefore not result in geomorphological or waterway formation impacts.

Mitigation and monitoring measures are proposed to confirm that the actual operation of the system is in accordance with the predictions of this assessment, and therefore confirming that impacts are not significant.

9. References

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2126457-3565/https://projects.ghd.com/oc/Sydney/hornsbyquarryrehabil/Delivery/Documents/2126457-REP_EIS Water Specialist Report.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	R Towner	D Gamble		D Gamble		22/1118

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Appendix F – Biodiversity assessment

Hornsby Shire Council

Hornsby Quarry Rehabilitation EIS
Biodiversity Impact Assessment

December 2018

Executive summary

Hornsby Shire Council proposes to rehabilitate the Hornsby Quarry void to create a landform suitable for future development as community parkland, which will require filling and stabilisation. The landform would include a lake directly below the exposed eastern face of the quarry. This Biodiversity Impact Assessment has been prepared in accordance with the Secretary's Environmental Assessment Requirements to describe the biodiversity values present in the study area and assess impacts of the project, and in particular assess whether the project is likely to have a significant impact.

The project site operated as a hard rock quarry from the early 1900s to the late 1990s. The quarry void has been closed to the public as it poses a potential risk to public safety due to its depth and steep exposed sides. The quarry pit is approximately 300 m wide and prior to the commencement of filling by NorthConnex was more than 100 m deep.

The majority of the project site has been highly modified as a result of historical quarrying and rehabilitation works, and the landform and soil profile has been significantly altered. Vegetation within the project site is a mixture of remnant, regrowth, revegetation and rehabilitation. Two native plant community types are present at the site:

- Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest (HN596, Moderate/good - poor), which is commensurate with Blue Gum High Forest in the Sydney Basin Bioregion (BGHF), a critically endangered ecological community (CEEC) listed under the TSC Act. This form of the community does not meet the condition criteria for inclusion as the EPBC Act-listed community.
- Blackbutt Gully Forest (HN648) (not a threatened community).

The proposal would remove 0.74 ha of Blue Gum High Forest, 1.76 ha of Blackbutt Gully Forest and 3.39 ha of exotic grassland. Mapping of biodiversity values, in particular threatened ecological communities, early in the project has allowed some avoidance of impacts in the detail design phase. Notably the project has been purposefully designed to minimise direct impacts on areas of good condition Blue Gum High Forest. A number of iterations of the proposal design have been made, each one further minimising impacts on native vegetation and fauna habitat, and increasing impacts on exotic vegetation and/or hardstand or quarry areas. This has allowed impacts on biodiversity values to be substantially reduced. Clearing of this community has been reduced from 4.65 ha to 0.74 ha as a result of redesign, and a total of 14.83 ha would be retained within the wider Hornsby Quarry site.

The site generally has patches of good fauna habitat values, due to moderate habitat complexity, allowing for a moderate diversity of fauna species. Species recorded included species that require large tracts of native vegetation to persist, as well as generalist species able to utilise disturbed urban areas. Threatened species recorded at the site during recent and previous surveys include the Powerful Owl (*Ninox strenua*), Varied Sittella (*Daphoenositta chrysoptera*), Grey-headed Flying-fox (*Pteropus poliocephalus*) and Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) (possible identification based on anabat analysis).

The project would remove up 2.50 hectares of canopied native vegetation and 3.39 hectares of exotic grassland vegetation within the project site. This habitat is highly modified and subject to disturbance including edge effects and noise from the surrounding urban environment. Up to five hollow-bearing trees would be removed. These have small hollows and would not provide breeding habitat for forest owls or cockatoos, but may provide roosting habitat for microchiropteran bats.

An assessment of significance pursuant to s5A of the EP&A Act has been prepared for Blue Gum High Forest. The project is highly unlikely to have a significant adverse effect on the local occurrence of Blue Gum High Forest as:

- The project has been designed specifically to avoid impacts on good quality patches and to minimise impacts on poor quality patches.
- While up to 0.74 ha of poor condition will be removed, extensive, better condition areas of this community will be retained within the wider Hornsby Quarry site outside of the project footprint.
- The vegetation to be impacted comprises the highly modified and degraded, poor condition edges of larger tracts of vegetation, and the proposal will not substantially increase existing levels of fragmentation and isolation from other areas of habitat

Landscaping works following completion of the proposal will focus on revegetating areas of Blue Gum High Forest, and will improve the condition of the community at the site in the long-term.

An assessment of significance pursuant to s5A of the EP&A Act has been prepared for the Powerful Owl. Given the small area of disturbed edge-effected vegetation, and the very large areas of surrounding good quality habitat, and lack of impact on breeding habitat, the project is unlikely to result in a significant impact on this species. Similarly, gen the small area of disturbed edge-effected vegetation, and the very large areas of surrounding good quality habitat, the project is unlikely to have a significant impact on the Varied Sittella or hollow-roosting microchiropteran bats.

Given that the project would not have a significant impact on any threatened biota, a Species Impact Statement is not required. No biodiversity offsets calculated in accordance with the Biobanking Assessment Method are required. As the proposal is unlikely to have a significant impact on any MNES, no referral is considered necessary and no offset is required for threatened biota listed under the EPBC Act.

A range of mitigation measures have been proposed to ameliorate potential impacts of the proposal on habitat throughout the study area, as well as areas downstream of the proposed works. These include provision of no-go zones to protect native vegetation, fauna management protocols, site-specific erosion and sedimentation management strategies and revegetation following construction. The future rehabilitation of the project site, including replantings using species sourced from Blue Gum High Forest and the use of salvaged fauna habitat features, would improve biodiversity values at the site in the long-term.

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Appendices

1. Introduction

1.1 Background

Hornsby Quarry is a former breccia hard rock quarry that was operated by private business from the early 1900s and ceased in the late 1990s. The quarry is considered a safety risk and has therefore been closed to the public since that time.

Hornsby Shire Council (Council) acquired the site in 2002 and has since undertaken a number of investigations and studies with regard to the future use of the site and the environmental and technical constraints that the site poses. Through these studies, Council identified the need to:

- stabilise the quarry
- manage the site in a safe and environmentally sustainable manner, and
- actively seek opportunities to fill the quarry void with spoil arising from major infrastructure projects in the region

Council also resolved to ultimately develop the site into a community parkland.

In 2016 approval was granted to Roads and Maritime Services, to beneficially reuse up to 1.5 million cubic metres of excavated rock and soil (spoil) from the construction of the NorthConnex tunnel to partially fill the Hornsby Quarry (the '2016 Planning Approval'). Filling has recently commenced at the site under this approval.

Following completion of filling by NorthConnex, Council is proposing to rehabilitate and reshape the site in a suitable way to ensure public safety and allow future development into a parkland for community use (the project).

1.2 Purpose of this report

GHD Pty Ltd (GHD) has been engaged by Council to prepare documentation to support a development application for approval of the project under Part 4 of the New South Wales (NSW) *Environmental Planning and Assessment Act 1979* (the EP&A Act). The Environmental Impact Statement (EIS) is being prepared in accordance with the provisions of the EP&A Act.

This report has been prepared by GHD to provide an assessment of potential biodiversity impacts as an input to the EIS. This report addresses the Secretary of the NSW Department of Planning and Environment's Environmental Assessment Requirements (EAR 1167) dated 6 September 2017.

1.3 Project overview

Key features of the project include:

- Rehabilitation, stabilisation and geotechnical safety management works around various parts of the site
- Earthworks and placement of material won from within the site to create a final landform similar to Option 1 in the Clouston Associates (2014) 'Recreation Potential Study for Hornsby Quarry and Old Mans Valley Lands' (p.88).

Approximately 500,000 m^3 of spoil is expected to be generated from stabilisation of the northern face as well as obtained from nearby onsite earthworks. Much of this material would be placed on the NorthConnex spoil to create a landform that generally slopes from the proposed lake up to the top of the western quarry face and would allow for the creation of a new parkland to be constructed within the quarry void. The landform would include a lake directly below the

exposed eastern face of the quarry. There would also be cut and fill works on Old Mans Valley to create a landform suitable for future development into playing fields and other recreational activities.

It is expected that a combination of ripping, rock breaking and rock sawing will be required to shift the material. Rock fragments would be crushed onsite using a mobile crusher or rock breaker prior to placement as fill.

No additional spoil is proposed to be imported to the site for filling purposes nor would the excavated material be transported off the site.

The project is expected to take approximately two years to complete.

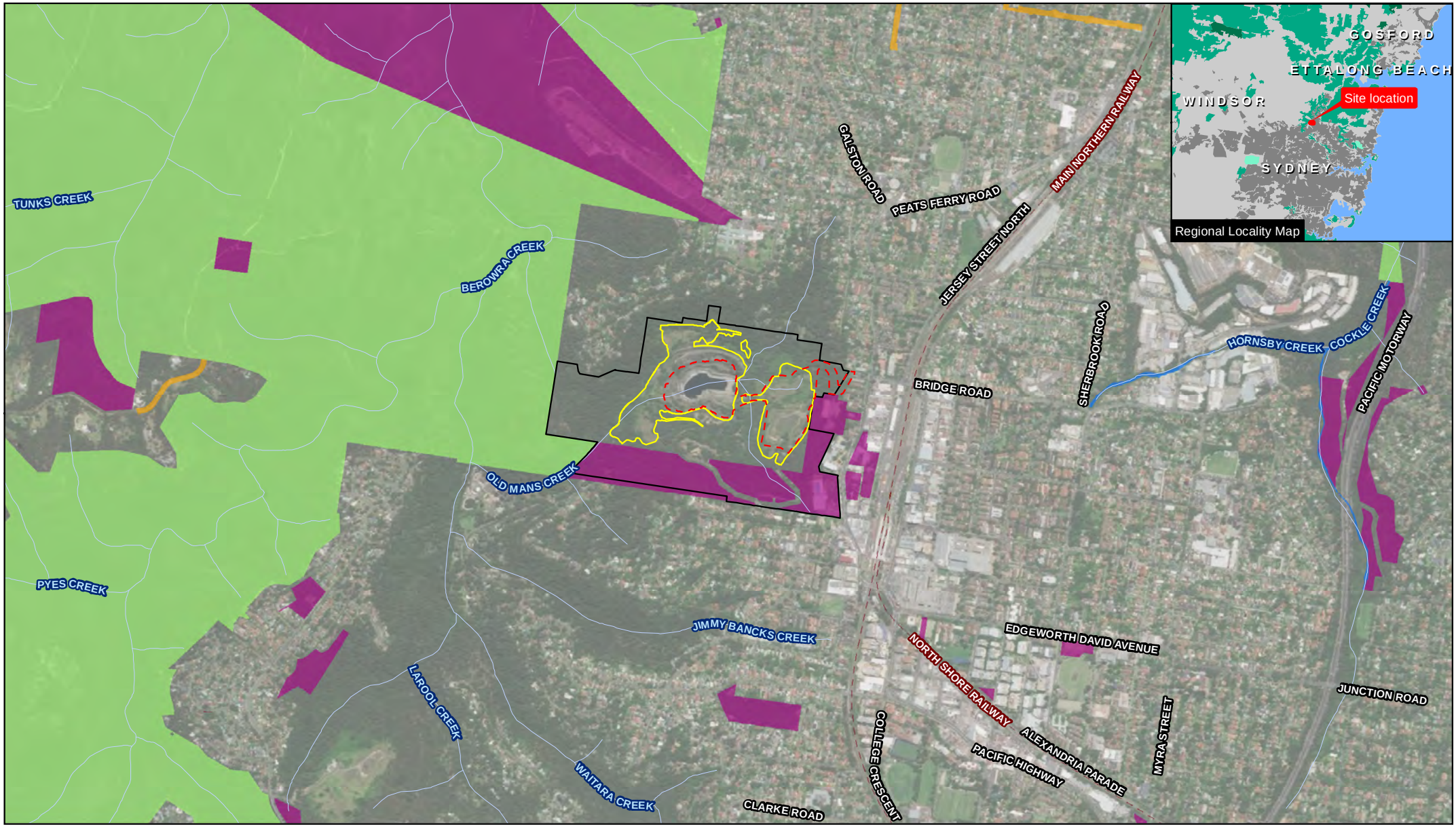
The proposed extent of works is shown in Figure 1.2.

1.4 Definitions

The following terms are used within this report:

- The 'site' refers to the entirety of:
  - Lots A, B, C, D and E in Deposited Plan (DP) 318676
  - Lot 1 DP 926103
  - Lot 1 DP 926449
  - Lot 1 DP 114323
  - Lots 1 and 2 in DP 169188
  - Lot 7306 DP 1157797
  - Lot 1 DP 859646
  - Lot 1 DP 926449
  - Lot 13 DP 734459
  - Lot 114 DP 749606
  - Lot 213 DP 713249
  - Summers Avenue, Hornsby partly formed
  - Old Mans Valley Trail

  The boundary of the site is shown on Figure 1.1.
- The 'extent of works' refers to both the quarry pit filling extent and the earthworks design extent plus an additional 2 to 5 m outside these areas to allow for construction fencing, etc. The boundary of the extent of works is shown on Figure 1.2.
- Project site – The focus of the rehabilitation works, not including the area within the NorthConnex impact area.
- Locality – land within 10 km of the project site.



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics,

Paper Size A4

0 100 200 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- The site
- Project site
- NorthConnex impact area
- Parks and reserves
- Crown parcel
- Crown road
- Crown waterway
- Rail
- Watercourse

Hornsby Shire Council
Hornsby Quarry Rehabilitation
Biodiversity Assessment

Job Number 21-26457
Revision A
Date 20 Nov 2018

Site location

Figure 1.1

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: Aerial imagery - SIXmaps 2017 & esri 2017; General topo - NSW LPI DTDB 2017, 2015, & 2012; Vegetation mapping - Kleinfelder 2017. Created by:jwatson2

LEGEND

- CADASTRE
- ASSUMED EXISTING SURFACE
- PIT FILLING EXTENT
- EARTHWORKS DESIGN EXTENT
- EXTENT OF WORKS

VEGETATION COMMUNITY

- SYDNEY BLUE GUM - BLACKBUTT SMOOTH-BARKED APPLE MOIST SHRUBBY OPEN FOREST (CEEC TSC A□□) (MODERATE/GOOD - POOR)
- BLACKBUTT GULLY FOREST (POOR)
- BLACKBUTT GULLY FOREST (MODERATE/GOOD - HIGH)
- BLACKBUTT GULLY FOREST (MODERATE/GOOD - POOR)

0 30 60 90m

SCALE 1:3000 AT ORIGINAL SIZE

N

HORNSBY SHIRE COUNCIL
HORNSBY QUARRY REHABILITATION
EXTENT OF WORKS

Job Number 21-26457
Revision A
Date SEP 2018

Figure 1.2

Level 15, 133 Castlereagh Street, Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

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1.5 Environmental assessment requirements

GHD has been engaged by Hornsby Shire Council to prepare an EIS for the rehabilitation of the quarry void and surrounds, to be assessed under Part 4 of the NSW *Environment Planning and Assessment Act 1979* (EP&A Act). The Secretary's Environmental Assessment Requirements (SEARs) for the project were published on 28 August 2017 and are provided in Table 1.1, and required preparation of a Species Impact Statement if a significant impact was likely. The Office of Environment and Heritage (OEH) provided the agency requirements, which required that the biodiversity assessment be prepared in accordance with the *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC 2004). This methodology requires assessments of significance to determine if a significant impact is likely, and if a Species Impact Statement is required. Offsets are required for residual impacts assessed in the Species Impact Statement. OEH's agency requirements recommended that the Biobanking Assessment Methodology (BBAM) (OEH 2014) be used to determine the quantum of offsets required to compensate for residual impacts on biodiversity (Table 1.2).

The SEARs and OEH requirements were provided after the *Threatened Species Conservation Act 1995* (TSC Act) was repealed and the *Biodiversity Conservation Act 2016* (BC Act) came into force. GHD requested further clarification from OEH regarding the assessment methodology given the timing of the publication of the SEARs. Following liaison with OEH and the Department of Planning and Environment (DPE), the approach detailed in the SEARs and OEH requirements were confirmed for this project by DPE on 15 June 2018, given that detailed surveys in accordance with the FBA (which is similar in methodology to the BBAM) and the BBAM had already been carried out at the site. GHD was also provided exemption from assessing the project in accordance with the Biodiversity Assessment Method and the BC Act.

In summary, this Biodiversity Assessment has been prepared in accordance with the TSC Act and to assess the likely significance of impacts on threatened biota. Surveys were conducted in accordance with the BBAM so that appropriate data was collected to enable calculation of offset in the event that a significant impact was likely. As the project has been assessed as unlikely to have a significant impact on threatened biota, offsets have not been calculated in accordance with the BBAM. However, given there will be residual impacts on biodiversity that cannot be avoided or mitigated, an offset package for the project in accordance with Hornsby Shire Council's Green Offsets Code is proposed (see Section 6.3).

Table 1.1 Secretary's Environmental Assessment Requirements and agency requirements (extract)

Requirement	Where addressed
Biodiversity, including:	
Accurate predictions of any vegetation clearing on site	Section 5.1.1
A detailed assessment of the potential biodiversity impacts of the development, paying particular attention to threatened species, populations and ecological communities and groundwater dependent ecosystems	Section 5
A detailed description of the proposed measures to maintain or improve the biodiversity values of the site in the medium to long term, as relevant; and	Section 6.2.2
An assessment of whether a Species Impact Statement is required.	Section 5.4

Table 1.2 OEH assessment requirements

Requirements	Where addressed
1. Biodiversity	
It is recommended the EARs include a biodiversity assessment to be undertaken in accordance with the draft *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (November 2004) and the *NSW Guide to Surveying Threatened Plants* (February 2016).	Section 3.1
OEH further recommends that the proposal be designed to avoid and minimise impacts on biodiversity and offset remaining direct and indirect biodiversity impacts. In determining and appropriate offset package, it is recommended that the EIS:	Given that the project will have residual impacts on native vegetation, offsets are proposed in accordance with Council's Green Offsets Code (see section 6.3) and with reference to the offsetting principles. As there will be no significant impacts on threatened biota and a Species Impact Statement is not required, offsets have not been calculated in accordance with the Biobanking Assessment Methodology (BBAM). Impacts on MNES have been assessed in section 5.5.
a. Accord with the 13 OEH offsetting principles.	
b. Use the Biobanking Assessment Methodology (OEH, 2014) to determine the quantum of offsets required to compensate for those remaining biodiversity impacts.	
c. Identify conservation mechanisms to be used to ensure the in-perpetuity protection and management of proposed offset sites	
d. Include a specific Statement of Commitments for the proposed offset package which is informed by a., b., and c. above and by consultation with OEH.	
With regards to the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*, the EIS should identify any relevant Matters of National Environmental Significance and whether the proposal has been referred to the Commonwealth or already determined to be a controlled action.	
2. Impacts on OEH estate	Potential impacts on OEH estate have been assessed in this report and in other specialist reports prepared for the EIS.
As the development adjoins Berowra Valley National Park, the EIS must address the matters to be considered as outlined in the Guidelines for developments adjoining land managed by the OEH (OEH, 2013) which include: a. erosion and sediment control b. stormwater runoff c. wastewater d. management implications relating to pests, weeds and edge effects e. fire and the location of asset protection zones f. boundary encroachments and access through OEH lands g. visual, odour, noise, vibration, air quality and amenity impacts h. threats to ecological connectivity and groundwater dependent ecosystems; and i. cultural heritage.	

1.6 Scope and structure of the report

1.6.1 Scope of report

This report has been prepared to meet the requirements of the SEARs. The aims and scope of this report are to:

- Outline the methods used for the biodiversity assessment

- Describe the existing environment of the project site, including the results of the desktop assessment and field surveys
- Identify the presence or likely presence of threatened species, populations and ecological communities and their habitats listed under the TSC Act and *Fisheries Management Act 1994* (FM Act)
- Assess the potential for any matters of national environmental significance (MNES) listed under the EPBC Act to occur within the project site and/or to be affected by the project
- Identify the potential impacts of the project on biodiversity values including threatened biota and their habitats
- Recommend mitigation and environmental management measures to avoid or minimise adverse impacts on threatened biota and biodiversity values
- Assess the likely significance of impacts on threatened biota listed under the TSC Act and EPBC Act that would be affected by the project
- Quantify the biodiversity impacts of the proposal and to determine the biodiversity credits that would be required to offset these impacts, as calculated by the BBAM
- Outline measures to maintain and improve biodiversity values at the project site.

1.6.2 Structure of report

This report is structured as follows:

- Chapter 1 – Introduction – this chapter introduces the project and describes the site
- Chapter 2 – Legislative context – summary of the relevant state and commonwealth legislation
- Chapter 3 – Methods – a description of the assessment approach and methods
- Chapter 4 – Existing environment – a description of the existing site, vegetation and flora, fauna and fauna habitats, connectivity and conservation significance
- Chapter 5 – Impact assessment – an assessment of potential biodiversity impacts of the project
- Chapter 6 – Mitigation – including proposed avoidance, mitigation measures and offsets
- Chapter 7 – Conclusion – summary of conclusions
- Chapter 9 – References

1.7 Abbreviations

Abbreviation	Definition
BBAM	BioBanking Assessment Methodology 2014
BC Act	NSW *Biodiversity Conservation Act 2016*
BGHF	Blue Gum High Forest in the Sydney Basin Bioregion or Blue Gum High Forest
BM	Benchmark
CEEC	Critically endangered ecological community
CMA	Catchment Management Authority
DECCW	Department of Environment, Climate Change and Water (now OEH)
DEE	Commonwealth Department of the Environment and Energy
DLWC	Department of Land and Water Conservation, now part of the Department of Industry

Abbreviation	Definition
DPE	Department of Planning and the Environment
DPI	NSW Department of Primary Industries
EEC	Endangered ecological community
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
FM Act	NSW *Fisheries Management Act 1994*
GDE	Groundwater dependant ecosystem
GHD Pty Ltd	GHD
GIS	Geographic information system
Ha	Hectare
IBRA	Interim Biogeographic Regionalisation of Australia
km	Kilometre
LGA	Local Government Area
m	Metre
mm	Millimetre
MNES	Matter of national environmental significance
NSW	New South Wales
OEH	Office of Environment and Heritage
PCT	Plant community type
PFC	Percentage foliage cover
PMST	Protected Matters Search Tool
TEC	Threatened ecological community
TSC Act	NSW *Threatened Species Conservation Act 1995*
VIS	NSW Vegetation Information System

1.8 Assumptions

As part of a number of recent studies that encompass the quarry, Kleinfelder was commissioned by Hornsby Shire Council to complete vegetation mapping for Hornsby Quarry and Old Man's Valley (Kleinfelder, 2017). Kleinfelder conducted vegetation surveys in line with the *BioBanking Assessment Methodology 2014* (BBAM 2014) (OEH, 2014). Eco Logical Australia also completed a Biodiversity Assessment Report to support the EIS for placement of spoil from NorthConnex, which employed methods prescribed by the Framework for Biodiversity Assessment (FBA) , which are equivalent to those required by the BBAM 2014 (ELA, 2015).

The impact assessment provided in this report is based on field surveys conducted in November 2017, and builds on data gathered by Eco Logical Australia (2015) and Kleinfelder (2017). Most parts of the project site were surveyed, however some parts of the project site were not able to be accessed due to steep slopes, dangerous edges, and access constraints due to the NorthConnex boundary. Vegetation zones and habitats in these areas were extrapolated by visual inspection, existing vegetation mapping, soil mapping, and aerial photography interpretation.

1.9 Scope and limitations

This report: has been prepared by GHD for Hornsby Shire Council and may only be used and relied on by Hornsby Shire Council for the purpose agreed between GHD and the Hornsby Shire Council as set out in section 1.3 of this report.

GHD otherwise disclaims responsibility to any person other than Hornsby Shire Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) 1.5 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Hornsby Shire Council and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, in particular steep slopes. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

2. Legislative context

2.1 State legislation

2.1.1 Environmental Planning and Assessment Act 1979

The EP&A Act forms the legal and policy platform for Project assessment and approval in NSW and aims to, amongst other things, 'encourage the proper management, development and conservation of natural and artificial resources'. All development in NSW is assessed in accordance with the provisions of the EP&A Act and the Environmental Planning and Assessment Regulation 2000. The Project is being assessed by a development application (DA) prepared in accordance with Part 4 of the EP&A Act. The development will be notified and assessed by the local Council, however the consent authority is the Joint Regional Planning Panel.

Section 111(4) of the EP&A Act states that the determining authority must consider the effect of an activity on:

- 'Critical habitat' (as defined under the TSC Act and FM Act)
- Species, populations or ecological communities, or their habitats (as listed under the TSC Act and FM Act) and whether there is likely to be a 'significant effect' on those species, populations or ecological communities.
- Other protected fauna or protected native plants listed under the *National Parks and Wildlife Act 1974*.

As noted in section 1.5, this report has been prepared in accordance with the now repealed TSC Act. The previous section 5A of the EP&A Act list listed seven factors that must be taken into account when determining the significance of potential impacts of a proposed activity on threatened species, populations or ecological communities (or their habitats) listed under the TSC Act and the FM Act. The 'seven-part test' is used to assist in the determination of whether a Project is 'likely' to impose 'a significant effect' on threatened biota and thus whether a species impact statement (SIS) is required. Seven part tests have been prepared for threatened biota that would be impacted or are likely to be impacted by the Project (see Section 5.4).

2.1.2 Threatened Species Conservation Act 1995

The TSC Act provides legal status for biota of conservation significance in NSW. The TSC Act aims to, amongst other things, 'conserve biological diversity and promote ecologically sustainable development'. It provides for:

- The listing of 'threatened species, populations and ecological communities', with endangered species, populations and communities listed under Schedule 1, 'critically endangered' species and communities listed under Schedule 1A, and vulnerable species and communities listed under Schedule 2
- The listing of 'Key Threatening Processes' under Schedule 3
- The preparation and implementation of Recovery Plans and Threat Abatement Plans
- Requirements or otherwise for the preparation of a SIS.

The TSC Act has been considered in this assessment through:

- Desktop review to determine the threatened species, populations or ecological communities that have been previously recorded within the locality and hence could occur subject to the habitats present

- Targeted field surveys for listed threatened species, populations and ecological communities
- Identification, assessment and mapping of listed threatened communities and threatened species (or their habitat)
- Assessment of potential impacts on listed threatened species, populations and ecological communities, including identification of key threatening processes relevant to the Project
- Identification of suitable impact mitigation and environmental management measures for listed threatened species, where required.

Note that the TSC Act was repealed on August 25 2017, and replaced with the *Biodiversity Conservation Act 2016* (BC Act). Since the SEARs for this Project were requested prior to the change in legislation, this Project is being assessed under the TSC Act under the transitional arrangements.

2.1.3 Threatened Species Conservation Amendment (Biodiversity Banking) Bill 2006

BioBanking was established by the New South Wales (NSW) Department of Environment, Climate Change and Water (DECCW) (now the Office of Environment and Heritage (OEH)) as a method to address the loss of biodiversity and threatened species. The scheme attempts to create a market framework for the conservation of biodiversity values and the offsetting of development impacts.

BioBanking is established under Part 7A of the *NSW Threatened Species Conservation Act 1995* (TSC Act), which was enabled by the *Threatened Species Conservation Amendment (Biodiversity Banking) Bill 2006*. The *Threatened Species Conservation (Biodiversity Banking) Regulation 2008* provides additional rules for specific aspects of the scheme that are important for its operation.

The Biobanking Assessment Methodology (BBAM) sets out how biodiversity values will be assessed, establishes rules for calculating the number and class of credits, and determines the trading rules that will apply. The methodology includes a software package known as the BioBanking Credit Calculator (the credit calculator) which processes site survey and assessment data. The credit calculator specifies the type and extent of surveys required for a BioBanking assessment and then processes survey data to calculate the number and type of biodiversity credits that are either required at a development site or will be generated at a biobank site.

To establish credits for a biobank site a landholder must commit to enhancing and protecting biodiversity values over time. A biobanking agreement is entered into and registered on the title of the land, binding both the current and future landholders to maintaining biodiversity through the completion of a range of management actions on the site. Each biobank site may generate a number of different ecosystem credits and any of these credits may be sold separately or as a group.

The BioBanking Trust Fund ensures that landowners have the money needed to carry out the management actions required each year and provides a financial incentive to landowners to carry out those actions. The scheme is administered by OEH and ensures accountability and compliance through legislation, regular reporting requirements and financial measures.

2.1.4 Fisheries Management Act 1994

The objects of the FM Act are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations. It provides for:

- The listing of threatened species, populations and ecological communities
- The listing of 'Key Threatening Processes'
- Identification and management of diseases affecting fish and marine vegetation
- Identification and management noxious fish and noxious marine vegetation
- The preparation and implementation of Recovery Plans and Threat Abatement Plans
- Requirements or otherwise for the preparation of a SIS.

One of the objectives of the FM Act is to 'conserve key fish habitats ' which includes aquatic habitats that are important to the maintenance of fish populations generally and the survival and recovery of threatened aquatic species. To assist in the protection of key fish habitats, DPI has produced the *Policy and guidelines for fish habitat conservation and management* (2013 update). This policy applies to the following developments, works or activities, each of which can impact on key fish habitat:

- Dredging or reclamation
- Impeding fish passage
- Damaging marine vegetation
- De-snagging.

The FM Act has been considered in this assessment through undertaking:

- A desktop review to determine the threatened species, populations or ecological communities that have been previously recorded within the locality of the Project and hence could occur subject to the habitats present
- Assessment of aquatic habitats
- Assessment of potential impacts on aquatic habitats, including identification of key threatening processes of relevance to the Project, impacts on key fish habitat and fish passage
- Assessment of the potential for impacts on listed threatened species, populations and ecological communities
- Identification of suitable impact mitigation and environmental management measures to avoid or mitigate impacts on the aquatic environment.

2.1.5 Biosecurity Act 2015

The *Biosecurity Act 2015* provides for risk-based management of biosecurity in NSW. It provides a statutory framework to protect the NSW economy, environment and community from the negative impact of pests, diseases and weeds.

The primary object of the Act is to provide a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers.

In NSW, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought

to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

One priority weed was recorded in the study area. Legal requirements to minimise the potential for the introduction and/or spread of weeds as a result of the Project are discussed in Section 4.2.3.

2.2 Commonwealth legislation

2.2.1 Environment Protection and Biodiversity Conservation Act 1999

The purpose of the EPBC Act is to ensure that actions likely to cause a significant impact on 'matters of national environmental significance' undergo an assessment and approval process. Under the EPBC Act, an action includes a Project, a development, an undertaking, an activity or a series of activities, or an alteration of any of these things. An action that 'has, will have or is likely to have a significant impact on a matter of national environmental significance' is deemed to be a 'controlled action' and may not be undertaken without prior approval from the Australian Minister for the Environment.

The EPBC Act identifies MNES as:

- World heritage properties
- National heritage places
- Wetlands of international importance (Ramsar wetlands)
- Threatened species and ecological communities
- Migratory species
- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- Nuclear actions (including uranium mining)
- A water resource, in relation to coal seam gas development and large coal mining development.

The EPBC Act has been considered in this assessment through:

- Desktop review to determine the listed biodiversity matters that are predicted to occur within the locality of the Project and hence could occur, subject to the habitats present
- Targeted field surveys for listed threatened biota and migratory species
- Assessment of potential impacts on threatened and migratory biota, including assessments of significance where relevant
- Identification of suitable impact mitigation and environmental management measures for threatened and migratory biota, where required
- Identification of the need or otherwise for biodiversity offsets for impacts on listed biodiversity matters.

3. Methods

3.1 Approach

This Biodiversity Assessment Report has been prepared to describe the impacts of the project on biodiversity values with reference to the *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC 2004)*, *NSW Guide to Surveying Threatened Plants (February 2016)* and the *Biobanking Assessment Methodology* (OEH 2014).

The main components of the methodology for the biodiversity assessment were:

- Desktop assessment to describe the existing environment and landscape features of the study area and to identify the suite of threatened biota potentially affected by the proposal.
- Field survey to describe the biodiversity values of the project site and surrounding Hornsby Quarry site and determine the likelihood of threatened biota and their habitats occurring in the project site or being affected by the proposal.
- Assessment of potential impacts.

3.2 Desktop assessment

A desktop database review was undertaken to identify threatened flora and fauna species, populations and ecological communities (biota) listed under the TSC Act and FM Act, and MNES listed under the EPBC Act, that could be expected to occur in the locality, based on previous records, known distribution ranges, and habitats present. Biodiversity resources pertaining to the project site and locality (i.e. within a 10 km radius of the site) that were reviewed prior to conducting field investigations included:

- The Commonwealth Department of the Environment and Energy (DEE) Protected Matters Search Tool (PMST), for MNES (threatened and migratory biota) known or predicted to occur in the locality (DEE, 2017a).
- DEE online species profiles and threats database (DEE, 2017b).
- OEH Wildlife Atlas database (licensed) for records of threatened species, populations and endangered ecological communities listed under the TSC Act that have been recorded within the locality of the proposal (OEH, 2017a).
- OEH threatened biota profiles for descriptions of the distribution and habitat requirements of threatened biota (OEH, 2017b). This resource was used to identify the suite of threatened ecological communities (TECs) that could potentially be affected by the proposal and to inform habitat assessments.
- The NSW BioNet Vegetation Classification (OEH, 2017c) to identify plant community types (PCTs) known or likely to occur in the study area.
- Regional-scale vegetation mapping of the site (Tozer *et. al*., 2010; Smith and Smith, 2008).
- Mapping and descriptions of the NSW Mitchell landscapes (DECC 2008a, 2008b).
- DPI Threatened species distributions in NSW for indicative distributions of species listed under the FM Act that may occur in the locality (DPI, 2017a).
- Previous surveys and reporting conducted at the site (PB 2004, Ecological Australia 2015, Kleinfelder 2017).
- The list of species credit-type species identified by the BBAM Credit Calculator based on the initial credit calculations.

- Aerial photographs and satellite imagery of the study area.

The threatened and migratory species identified in the desktop assessment are presented in Appendix A. Following collation of database records and threatened species and community profiles, a 'likelihood of occurrence' assessment was prepared for threatened and migratory species and ecological communities with reference to the broad vegetation types and habitats contained within the site. This was further refined following field surveys and verification of vegetation types and identification and assessment of habitat present within the site, or if the species was found to occur in the project site. A likelihood of occurrence ranking was attributed to these biota based on this information (see Appendix A).

3.3 Site survey

3.3.1 Survey history

A number of surveys have been conducted within the Hornsby Quarry site over recent years for various projects. These have included:

- Detailed field surveys within part of the Hornsby Quarry land for NorthConnex by Ecological (2015) (much of which is encompassed by the project site for this project, but has been excised from within the project site boundary)
- Detailed vegetation mapping across the site by Kleinfelder (2017) (ie includes the project site and additional areas).
- Current field surveys by GHD within the study area to ground-truth previous mapping, assess impacts of the rehabilitation, and to calculate offset requirements in accordance with the BBAM.

The project site boundary and Northconnex boundary are mapped on Figure 4.1.

These surveys are described below in sections 3.3.2 and 3.3.3 and survey effort is summarised in section 3.5.

3.3.2 Previous survey methods

Ecological Australia (2015)

Ecological Australia undertook field surveys in accordance with the Framework for Biodiversity Assessment (OEH 2014b) for use of Hornsby Quarry for the handling, management and reuse of spoil from the NorthConnex project. Surveys were conducted over five days, two days in December 2013, two days in December 2014 and one day in February 2015. In addition, a hollow-bearing tree survey was conducted over two days by AECOM in December 2013. Survey comprised:

- Floristic surveys
- Biometric plots
- Targeted searches for *Genoplesium baueri*
- Fauna habitat assessment
- Anabat detectors
- Hollow-bearing tree survey
- Aquatic surveys.

Kleinfelder (2017)

Vegetation surveys were conducted by Kleinfelder across the wider Hornsby Quarry site over four days in December 2016, and one day in January 2017. Surveys comprised:

- Vegetation mapping based on data collection at rapid data points and along walked transects
- 12 plot/transects with data collected in accordance with the BBAM
- Incidental fauna surveys.

  Quadrat and rapid data point locations are mapped on Figure 4.1.

3.3.3 Current survey methods

Surveys were undertaken by three GHD ecologists on 23 and 24 November 2017. Methods are described below.

Site stratification

Pre-existing vegetation mapping (e.g. Tozer *et. al*., 2010; Smith and Smith, 2008) and vegetation mapping of the quarry surrounds (Ecological, 2015; Kleinfelder, 2017) were ground-truthed in the field via systematic walked transects across the entire project site and by walking the boundary of vegetation units. Necessary adjustments were made by hand on aerial photographs of the study area. The site was divided into relatively homogenous or discrete zones for assessment based on observed vegetation structure, species composition, soil type, landscape position and condition. Native vegetation was divided into vegetation zones which represented a distinct PCT and broad condition state.

Plot/transect surveys

Plot and transect surveys were conducted in the project site in accordance with the BBAM to confirm vegetation types, assess site condition and where required to calculate biodiversity credits. The site value was determined by assessing ten site condition attributes against benchmark values. Benchmarks are quantitative measures of the range of variability in condition in vegetation with relatively little evidence of alteration, disturbance or modification by humans since European settlement. Cover abundance data was also collected for each species within the 20 metre x 20 metre portion of each plot/transect.

Plots were used to sample potential vegetation zones (i.e. PCTs and broad condition classes) based on the initial site stratification. Seven plots were sampled within the project site as shown on Figure 4.1.

Plot data was compared with Tozer (2010) diagnostic plant species lists using a modified version of a spreadsheet that has been provided to GHD by OEH in order to assign each vegetation type to the appropriate PCT.

Targeted threatened flora surveys

Threatened plant surveys were conducted throughout the project site during surveys in November 2017. The suite of threatened plants potentially present was identified based on the desktop assessment results and results of previous surveys and the species credit-type species identified by the Credit Calculator (see Appendix A). Habitat for these species was identified based on OEH threatened species profiles and the experience and judgement of GHD ecologists. The majority of the project site contains highly modified landforms dominated by exotic or planted native species, or regenerating native vegetation. These areas feature very little native plant cover, do not contain natural soil profiles or soil seed banks and could be readily discounted as containing any threatened plant species. Areas of potential threatened

plant habitat (i.e. near-intact native vegetation and areas with natural topsoil) were traversed on foot and inspected for threatened plants.

Identification of groundwater dependent ecosystems

The NSW Groundwater Dependent Ecosystem (GDE) Policy defines GDEs as ecosystems, which have their species composition, and their natural ecological processes determined by groundwater (DLWC 2002). The Policy defines groundwater as the water beneath the earth's surface that has filtered down to the zone where the earth or rocks are fully saturated (DLWC 2002). Ecosystems vary dramatically in the degree of dependency of groundwater, from having no apparent dependence through to being entirely dependent on it (DLWC 2002). With the exception of the Great Artesian Basin's mound springs, the level of scientific understanding of the role that groundwater plays in maintaining ecosystems in Australia is generally low (DLWC 2002). Currently the approach for assessment of terrestrial groundwater dependent ecosystems is not well documented or understood.

The Australian Government Atlas of Groundwater Dependent Ecosystems was used to identify any previously mapped GDEs that occur in or near the study area. This atlas identifies GDEs reliant on surface groundwater (rivers, springs and wetlands) and subsurface groundwater (vegetation). The Atlas was reviewed to ascertain whether any GDEs are likely to occur in the study area.

The *Risk Assessment Guidelines for Groundwater Dependent Ecosystems – The Conceptual Framework* (Serov et. al., 2012) was developed by the NSW Office of Water (NOW) and the OEH. This presents an approach to GDE identification, classification, ecological valuation, and ecological risk assessment for a given activity or potential impact on a groundwater source. This also details a series of steps to identify and infer the level of groundwater dependency and provides a summary of risk assessment guidelines for GDEs. This risk assessment has assigned probabilities of vegetation types in the Sydney Metro CMA being a GDE (Kuginis et al 2012). Vegetation types mapped in the project site were cross-checked against this risk assessment, and their probability of being a GDE was assessed.

Fauna habitat assessment

An assessment was made of the type and quality of habitats present in the project site for native fauna. Habitat quality was based on the level of breeding, nesting, feeding and roosting resources available. The study area was searched for habitat features of particular relevance to threatened species, such as hollow-bearing trees, specific feed trees, termite mounds (breeding habitat for Rosenberg's Goanna), rock outcrops (potential den sites for the Spotted-tailed Quoll), and water bodies. Areas of planted trees that may provide habitat for fauna were inspected.

Habitat assessments included searches for and inspection of:

- rocks, logs, peeling bark and leaf litter for small reptiles
- winter-flowering eucalypts (important for the Swift Parrot (*Lathamus discolor*), and Grey-headed Flying-fox (*Pteropus poliocephalus*)), and food trees of the Koala (*Phascolarctos cinereus*) and Glossy Black-cockatoo (*Calyptorhynchus lathami*)
- hollow-bearing trees and logs which provide refuge, nest and den sites for a range of threatened fauna species
- stags and other roost sites for raptors and owls
- termite mounds comprising potential habitat for Rosenberg's Goanna (*Varanus rosenbergi*)
- wetlands, moist grassland and other foraging habitat for waterbirds (including migratory birds) and frogs

- mammal scats at the base of trees or along tracks and runways
- tracks in soft substrate
- nest/den sites within logs, tree bases or tree trunks
- owl pellets, whitewash or animal remains beneath trees (diagnostic of owl or raptor roosts).

Searches for hollow-bearing trees were undertaken throughout the fauna habitat assessment and opportunistic fauna surveys. Positions of hollow-bearing trees were logged on a hand-held GPS, and details of tree species, height, diameter, and number, position and size of hollows recorded on a proforma.

Anabat surveys

Microbat ultrasonic echolocation call recordings (Anabat surveys) were undertaken at two locations in the study area on one evening. One anabat was placed on an access road near the quarry and the other in a cleared area. The anabats were deployed about one hour before sunset and collected the following morning. Calls were identified using zero-crossing analysis and AnalookW software (version 3.8v, Chris Corben 2012). *The Bat calls of NSW: Region based guide to the echolocation calls of microchiropteran bats* (Pennay et al. 2004) was used to assist call analysis. Call identification was also assisted by consulting distribution information for possible species (Pennay et al 2011; Churchill 2008; van Dyck and Strahan 2008) and records from the Atlas of NSW Wildlife (OEH 2017a).

Hollow-bearing trees

Hollow-bearing trees in the site were mapped where possible. Details regarding tree species, height, diameter at breast height and size and number of hollows were recorded.

Spotlighting and call playback

Spotlighting for nocturnal fauna, including in particular forest owls, was also carried out on one evening. Stag-watching was conducted at dusk at one large hollow-bearing stag located near a clearing. Spotlighting was then conducted along roads and tracks within the site. Call playback for the Powerful Owl, Masked Owl, Barking Owl, and Sooty Owl were conducted from above the quarry on the access road. Call playback for the Red-crowned Toadlet was conducted near seepages throughout the study area.

Opportunistic fauna surveys

Opportunistic and incidental observations of fauna species were recorded at all times during field surveys while traversing the project site. This included visual inspection of trees and woody debris, active searches for small fauna and opportunistic observation of scats, tracks, burrows or other traces.

Aquatic habitat assessment

Habitat descriptions were documented with reference to the NSW Australian River Assessment System (AUSRIVAS) Sampling and Processing Manual (Turak *et al*, 2004), and included assessment of different instream habitat types, and the structure and condition of riparian vegetation. The information recorded was used to describe the nature of aquatic habitats present within the study area, and identify any areas of potential habitat for threatened aquatic fauna species or key fish habitat.

Descriptions of aquatic habitat were based on visual estimates of characteristics such as streambed composition (percentage of total composition for each substrate category), aquatic and riparian vegetation cover, amount of in stream organic material, and area of aquatic habitat and canopy cover. Estimates of channel morphology characteristics were made including width

(wetted width in metres), bank full width (mean width between top of banks), and estimated depth.

Given the lack of natural waterways within the study area, no fish trapping or electrofishing surveys were carried out.

3.4 Weather conditions

Weather conditions were warm and sunny during surveys, with no rain recorded. Observations for the Terrey Hills weather station (066059) are provided in Table 3.1.

Table 3.1 Weather conditions during surveys

Date	Minimum temperature (°C)	Maximum temperature (°C)	Rainfall (mm)
Week prior	14.7-17.8	21.5-23.6	7.8
23/11/2017	15.0	24.5	0
24/11/2017	16.2	26.9	0

3.5 Survey limitations

Surveys carried out by GHD built on previous work conducted in the Hornsby Quarry site by Ecological (2015) and Kleinfelder (2017). The survey effort was determined based on the habitats present and landscape context of the study area, and took into consideration the previous surveys and the highly modified and degraded nature of much of the study area.

Given the duration, extent and timing of the GHD field surveys it is likely that some species that occur in the project site (permanently, seasonally or transiently) were not detected during the survey. These species are likely to include: flora species that flower at other times of year as well as annual, ephemeral or cryptic species; and frogs which call at other times of year or after heavy rainfall. Some fauna species are also mobile and transient in their use of resources and it is likely that not all species were recorded during the survey period. Weather during the preceding week has been mostly warm and dry, although there had been a day of rainfall earlier in the week (7.2 mm recorded), with small amounts of rain on some other days.

The habitat assessment conducted for the proposal allows for identification of habitat resources for such species, in order to make an assessment of their likelihood of occurring within the project site. As such, the survey was not designed to detect all species, rather to provide an overall assessment of the ecological values within the project site in order to predict potential impacts of the proposal, with particular emphasis on TECs, threatened species and their habitats.

Some parts of the project site were not able to be accessed because of steep slopes, dangerous edges, and access constraints due to the NorthConnex boundary. Vegetation zones in these areas were extrapolated by visual inspection and aerial photography interpretation.

3.6 Likelihood of occurrence of threatened biota

The likelihood of threatened and migratory biota occurring in the project site was assessed based on presence of records from the locality since 1990, species distribution and habitat preferences, and the suitability of potential habitat present in the study area. The results of this assessment are provided in Appendix A.

4. Existing environment

4.1 Site context

4.1.1 Surrounding land use

Land use and existing development in the areas surrounding the Hornsby Quarry site are predominantly suburban residential, with commercial and light industrial land uses along Peats Ferry Road. Residential areas are located to the south of the site and on the southern side of Quarry Road. Residential development also occurs to the north of the site, off Fern Tree Close and Manor Road. The Hornsby Aquatic and Leisure Centre is located to the east of the site. Vegetation to the west of the site is linked to Berowra Valley National Park.

4.1.2 Topography and hydrology

The site is characterised by dramatic topography, which generally falls from the east to the west. The steeper parts of the site includes many slopes that exceed a gradient of 25 percent. The quarry is located in the centre of the project site.

The site is located within Old Mans Creek catchment. Old Mans Creek has three minor tributaries which converge upstream of the quarry. Downstream of the site, Old Mans Creek forms part of the Berowra Creek system, ultimately draining into the Hawkesbury-Nepean River.

There are other drainage lines to the east of the quarry site, which convey stormwater towards the quarry, where it is diverted around the quarry void via a concrete lined channel, discharging into Old Mans Creek.

Watercourses in proximity to the project are heavily urbanised and ephemeral. The water quality is expected to be generally poor, typical of an urbanised environment.

Council has been pumping water from the base of the quarry since late 2009 in order to keep the water level below RL 40 m AHD. NorthConnex has almost completed filling of the void in accordance with the 2016 Planning Approval. This work also included dewatering of the quarry void prior to filling.

4.1.3 Mitchell landscapes

Mitchell landscapes that occur in the project site are detailed in Table 4.1.

Table 4.1 Mitchell landscapes

Mitchell landscape	Description	Comment
Hornsby Plateau	Benched hill slopes and steep hills with narrow flat-topped ridges and broader plateau tops on horizontal Triassic quartz sandstone with occasional conglomerate and thin discontinuous shales. Isolated thicker shales and areas of 'laterite' development on plateaus. General elevation 0 to 220 m, local relief 30 to 120 m. Shallow uniform sands amongst rock outcrops. Deep gradational yellow earths on some plateau areas, yellow texture-contrast soils on benches, deep uniform sands, organic sands and limited podsols in depositional areas. Very diverse vegetation related to site and soil conditions. Crests and ridges, scribbly gum (*Eucalyptus haemostoma*), red bloodwood	The majority of vegetation within the project site occurs within this Mitchell Landscape

Mitchell landscape	Description	Comment
	(*Corymbia gummifera*), brown stringybark (*Eucalyptus capitellata*), silvertop ash (*Eucalyptus sieberi*) and old man banksia (*Banksia serrata*) with a high proportion of Proteaceae and Acacia in the understorey. Slopes; smooth-barked apple (*Angophora costata*), Sydney peppermint (*Eucalyptus piperita*), yellow bloodwood (*Corymbia eximia*), *Leptospermum* sp., and forest oak (*Allocasuarina torulosa*); protected valley floors with rainforest elements including turpentine (*Syncarpia glomulifera*), Sydney blue gum (*Eucalyptus saligna*), blackbutt (*Eucalyptus pilularis*), water gum (*Tristaniopsis laurina*), coachwood (*Ceratopetalum apetalum*), cabbage-tree palm (*Livistona australis*). Extensive wet and dry heaths on plateau, Sydney blue gum, blackbutt, turpentine tall forest on thicker shale ridge tops with deep gradational red clay loam to clay soil.	
Sydney basin Diatremes	Widely distributed across the Sydney Basin and distinguished as a landscape because they always contain locally different landform, soil and vegetation. Diatremes are circular volcanic vents filled with layered, brecciated country rock cemented by a fine-grained basaltic matrix. Some contain a core of basalt. In sandstone country the volcanic breccia weathers and erodes more rapidly than the sandstone and the landform is a deep circular with the appearance of a crater. Soils in the crater are dominated by sandstone detritus from the surrounding slopes but the subsoils is a fertile well, structured clay derived from the breccia and these protected sites carry more mesic variants of the local vegetation. In shale country the breccia is more resistant than the shale and the diatremes form a low rounded hill with red-brown gradational profiles of clay loam and structured clay with moderate to high fertility. General elevation varies considerably across the basin, local relief of positive landforms up to 25 m, negative landforms (‘craters’) 180 m.	Most of the vegetation associated with this Mitchell Landscape was removed historically during quarrying

4.1.4 Historical quarry works

The project site operated as a hard rock quarry from the early 1900s to the late 1990s. The quarry pit is approximately 300 m wide and prior to the commencement of filling by NorthConnex was more than 100 m deep. A number of facilities associated with past quarrying operations also remain in the project site including remains of buildings, a network of security fencing and gates, and sealed and unsealed roads.

There are four areas where fill was placed over the period of quarrying: the eastern fill area, the southwestern fill area, the crushing plant fill area and the northern fill area. The northern slope fill area has a gradient of 35 degrees with the depth of fill being 15 m or more. This area is considered to be ‘oversteep’ and potentially unstable. Fill thicknesses across the other areas varies up to a maximum of about ten metres to 15 m in the eastern fill area, and five metres to ten metres in the southwestern and crushing plant fill areas.

As a result of the historical quarrying operations, much of the project site is highly modified. Vegetation clearing has occurred across much of the site, with planting and regrowth occurring in some areas as described in Section 4.2.

4.2 Vegetation and flora

4.2.1 Flora species

A total of 82 flora species from 39 families were identified within the site during the field survey, including 39 exotic species and 43 native species. The Poaceae (grasses, 16 species, six native), Asteraceae (daisies; flowering herbs and sub-shrubs, seven species, one native) and Myrtaceae (flowering trees and shrubs, 10 species, all native) were the most diverse families recorded. Species were recorded within the seven plots completed during the field survey. No threatened flora species were recorded. The full list of species recorded is presented in Appendix B.

4.2.2 Vegetation

Overview

The results of the GHD field survey largely support the findings of Kleinfelder (2017). The Kleinfelder survey considered a larger area than the current study area, and vegetation mapping completed by Kleinfelder extends well beyond the current project site. As a result, several of the vegetation zones identified by Kleinfelder either do not occur within the smaller study area considered for this assessment, or occur in such small amounts that they were combined with adjacent vegetation zones in the closest comparable condition. This is in line with the guidelines provided in the BioBanking Assessment Methodology and Credit Calculator Operational Manual (DECC 2008), which specifies that the minimum size of a vegetation zone be 0.25 ha.

Vegetation has been mapped and described in the study area with reference to the BBAM. Using this methodology, field surveys confirmed the presence and distribution of two PCTs at the site. The stands of these vegetation types are in varying condition (according to the BBAM) and were split into broad condition states yielding vegetation zones as shown on Figure 4.1. The vegetation zones are summarised in Table 4.2 and described below. Note that for the purposes of this report, exotic vegetation has been mapped as such, and not assigned to a low condition form on Blackbutt Gully Forest.

The majority of the project site has been highly modified as a result of historical quarrying and rehabilitation works, and the landform and soil profile has been significantly altered. Vegetation within the project site is a mixture of remnant, regrowth, revegetation and rehabilitation.

One of the vegetation zones within the project site comprises a local occurrences of Blue Gum High Forest in the Sydney Basin Bioregion, which is listed as a critically endangered ecological community (CEEC) under the NSW TSC Act. Note that the vegetation at the project site does not meet the condition criteria for the related CEEC listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) TSC Act (see Table 4.2 and Section 4.5.1).

Table 4.2 Vegetation within the project site

Zone ID	Veg Zone	PCT ID	Smith & Smith Map Unit	Kleinfelder Veg Type	GHD Veg Type	Condition	Conservation Significance	Area (ha)
HN648	1	1841	L1	Blackbutt Gully Forest (moderate-good_high)	Blackbutt Gully Forest (HN648, Moderate/good - high)	Moderate/good - high	Not listed	0.26
HN648	2	1841	L1	Blackbutt Gully Forest (moderate-good_poor)	Blackbutt Gully Forest (HN648, Moderate/good - poor)	Moderate/good - poor	Not listed	1.50
HN596	5	1237	BG2	Blue Gum Diatreme Forest (moderate-good_poor) (CEEC)	Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest (HN596, Moderate/good - poor) (CEEC)	Moderate/good - poor	CEEC listed under the BC Act: Blue Gum High Forest in the Sydney Basin Bioregion	0.74
NA	6	N/A	N/A	Exotic Vegetation	Exotic Vegetation (Blackbutt Gully Forest HN648, Low)	Low	Not listed	3.39
N/A	8	N/A	N/A	Excluded	Hardstand	N/A	N/A	0.90
N/A	9/A	N/A	N/A	Quarry Void	Quarry Void	N/A	N/A	2.28
TOTAL								**9.07**

The structure, species composition and condition of the vegetation zones within the project site are described in Table 4.3. Species lists are provided in Appendix B. Species lists and plot/transect data is also provided in Appendix B.

Table 4.3 Vegetation zone descriptions

Blackbutt Gully Forest (HN648, Moderate/good - high)	
PCT (OEH, 2017c)	Smooth-barked Apple - Turpentine - Blackbutt tall open forest on enriched sandstone slopes and gullies of the Sydney region
PCT ID	1841
Photo	
NSW Veg Type ID	HN648
Equivalent Map Units	Blackbutt Gully Forest (moderate-good_high) (Kleinfelder, 2017); Blackbutt Gully Forest (L1) (Smith and Smith, 2008); Hinterland Sandstone Gully Forest (DSF 142) (Tozer *et al*., 2010).
Survey effort	Plot/transect 7
Conservation significance	Not listed
Condition	Moderate/good - high Mixture of regrowth and mature native vegetation with a native over storey cover that was below benchmark values in the plot/transect sampled. Native midstorey cover was at benchmark, while species richness was below benchmark. Native ground cover (grass) was within benchmark in the plot/transect sampled, while native ground cover (shrubs) and native ground cover (other) was below benchmark values. Over storey regeneration was observed within this vegetation zone, with all species present regenerating. There were three trees with hollows in the plot/transect sampled and total length of fallen timber was below benchmark. There is low exotic plant cover (10 per cent in plot/transect sampled).

Blackbutt Gully Forest (HN648, Moderate/good - high)	
Evidence used to define vegetation unit	Characteristic soil types and geomorphology. The dominant plant species described below are consistent with the NSW VIS Classification (OEH 2018b) and the species list in Smith and Smith (2008) and Tozer *et al.* (2010). The equivalent vegetation map unit is mapped within the site (Smith and Smith; 2008; Kleinfelder, 2017).
Landscape position	Typically occurs in sandstone gullies in areas with a shale influence.
Structure	Open forest with a moderately shrubby midstorey and a diverse understorey.
Over storey	Includes Sydney Red Gum (*Angophora costata*), Red Bloodwood (*Corymbia gummifera*), Blackbutt (*Eucalyptus pilularis*), Red Mahogany (*Eucalyptus resinifera*), Turpentine (*Syncarpia glomulifera*) and Black She-Oak (*Allocasuarina littoralis*).
Mid storey	Comprises *Acacia longifolia*, Coffee Bush (*Breynia oblongifolia*), Large-leaf Hop-bush (*Dodonaea triquetra*) and Sweet Pittosporum (*Pittosporum undulatum*).
Groundcover	Includes herbaceous species such as Native Wandering Jew (*Commelina cyanea*) and Thyme Spurge (*Phyllanthus hirtellus*); climbers and vines such as Hairy Apple Berry (*Billardiera scandens*), Old Man's Beard (*Clematis aristata*) and Wombat Berry (*Eustrephus latifolius*); rushes such as *Lomandra cylindrica* and Blue Flax-lily (*Dianella caerulea*); grasses including Wiry Panic (*Entolasia stricta*) and Blady Grass (*Imperata cylindrica*); the orchid *Dipodium variegatum*; the low shrub Crinkle Bush (*Lomatia silaifolia*) and the fern Bracken (*Pteridium esculentum*).
Exotic species	A small range of exotic plants are present throughout this vegetation zone, including woody weeds such as Canary Island Date Palm (*Phoenix canariensis*), Small-leaved Privet (*Ligustrum sinense*) and Large-leaved Privet (*Ligustrum* lucidum); Rhodes Grass (*Chloris gayana*); and herbaceous species such as Cobbler's Pegs (*Bidens pilosa*), Asparagus Fern (*Asparagus aethiopicus*) and Paddy's Lucerne (*Sida rhombifolia*).

Blackbutt Gully Forest (HN648, Moderate/good - poor)	
PCT (OEH, 2017c)	Smooth-barked Apple - Turpentine - Blackbutt tall open forest on enriched sandstone slopes and gullies of the Sydney region
PCT ID	1841
Photo	
NSW Veg Type ID	HN648
Equivalent Map Units	Blackbutt Gully Forest (moderate-good_high) (Kleinfelder, 2017); Blackbutt Gully Forest (L1) (Smith and Smith, 2008); Hinterland Sandstone Gully Forest (DSF 142) (Tozer *et al*., 2010).
Survey effort	Plot/transect 2, 6
Conservation significance	Not listed
Condition	Moderate/good – poor. This vegetation zone has a modified forest structure. There are infestations of woody weeds, and the vegetation appears to be largely planted with species that are broadly characteristic of vegetation that would naturally occur within the site. Native over storey cover and native mid storey cover was below benchmark in all plot/transects. Species richness was well below benchmark in plot/transects sampled. Native ground cover (grasses, shrubs and other) were all below benchmark. Exotic plant cover was low to moderate (2-37.5%). Overstorey regeneration was 0.57 (meaning four of the seven canopy species present were observed regenerating), and hollow-bearing trees were observed in both of the plot/transects sampled. The total length of fallen logs was below benchmark values.
Evidence used to define	Open forest vegetation structure. Characteristic soil types and geomorphology. The dominant plant species described below are consistent with the NSW VIS Classification (OEH 2018b) and the species list in Smith and Smith (2008) and

Blackbutt Gully Forest (HN648, Moderate/good - poor)	
vegetation unit	Tozer *et al.* (2010). The equivalent vegetation map unit is mapped within the site (Smith and Smith; 2008; Kleinfelder, 2017).
Landscape position	Typically occurs in sandstone gullies in areas with a shale influence.
Structure	A modified open forest, including areas of historical revegetation.
Over storey	Includes the following species: Narrow-leaved Apple (*Angophora bakeri*), Sydney Red Gum (*Angophora costata*), River Oak (*Casuarina cunninghamiana* subsp. *cunninghamiana*), Bangalay (*Eucalyptus botryoides*), Blackbutt (*Eucalyptus pilularis*), Sydney Blue Gum (*Eucalyptus saligna*) and Turpentine (*Syncarpia glomulifera*).
Mid storey	Comprises frequent Sweet Pittosporum (*Pittosporum undulatum*) as well as scattered Coffee Bush (*Breynia oblongifolia*) and occasional Willow Bottlebrush (*Callistemon salignus*).
Groundcover	Includes grasses such as Blady Grass (*Imperata cylindrica*), Weeping Grass (*Microlaena stipoides*), *Oplismenus aemulus* and *Poa affinis*; the climber Snake vine (*Stephania japonica*) and the rush Spiny-headed Mat-rush (*Lomandra longifolia*).
Exotic species	Comprises herbaceous species such as Crofton Weed (*Ageratina adenophora*), Asparagus Fern (*Asparagus aethiopicus*), Cobbler's Pegs (*Bidens pilosa*), Flaxleaf Fleabane (*Conyza bonariensis*), White Clover (*Trifolium repens*) and Common vetch (*Vicia sativa*); woody weeds such as Camphor Laurel (*Cinnamomum camphora*), Lantana (*Lantana camara*),Large-leaved Privet (*Ligustrum lucidum*) and Small-leaved Privet (*Ligustrum sinense*); the climber Japanese Honeysuckle (*Lonicera japonica*); the grass Panic Veldtgrass (*Ehrharta erecta*); and the highly invasive and declared priority weed Pampas Grass (*Cortaderia selloana*).

Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest (HN596, Moderate/good - poor) (CEEC)	
PCT (OEH, 2017c)	Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion
PCT ID	1237
Photo	
NSW Veg Type ID	HN596
Equivalent Map Units	Blue Gum Diatreme Forest (moderate-good_poor) (Kleinfelder, 2017); Blue Gum Diatreme Forest (BG2) (Smith and Smith, 2008); Blue Gum High Forest (WSF 153) (Tozer *et al*., 2010).
Survey effort	Plot/transects 1, 4, 5
Conservation significance	Listed as the critically endangered ecological community Blue Gum High Forest in the Sydney Basin Bioregion under the TSC Act. Does not meet the condition criteria for inclusion as the EPBC Act-listed CEEC as it lacks characteristic native plant species in all structural layers (DEE, 2018). There are occasional and scattered native species in the midstorey and understorey, and the canopy is patchy and variable and primarily comprised of regrowth or planted vegetation. EPBC Act-listed forms of the CEEC include either a tree canopy cover >10%, patch area > 1 ha, or a tree canopy cover <10%, patch area > 1 ha and require that the patch is located within native vegetation with an area >5 ha (DEE, 2018). Further, the SPRAT profile for the EPBC Act-listed CEEC notes that "*only high quality remnant patches*…" (DEE, 2018) are considered part of this CEEC. This vegetation zone is considered to comprise a mixture of revegetation and regrowth vegetation on highly disturbed soils, rather than remnant vegetation. The soil profile present across the majority of the site has been highly modified, with placement of fill, excavations, benching and other historical disturbance evident

Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest (HN596, Moderate/good - poor) (CEEC)	
	throughout the site. Given the lack of a natural and intact soil profile across much of the site, it is unlikely that regeneration within the site is from remnant or indigenous specimens. Instead, any observable regeneration is likely to be from revegetation and stabilisation planting works. While vegetation within the site does meet the patch size condition criteria, the lack of dominant native species in all structural layers and modified nature of canopy vegetation means that this vegetation zone does not meet condition criteria for inclusion as the EPBC Act-listed form of the community. Nearby and adjacent vegetation outside of the project site does meet the condition criteria for inclusion as the EPBC-Act listed community, given the dominance of native species in all structural layers, and the presence of an intact, remnant canopy. These patches of vegetation would not be impacted by the current project.
Condition	Moderate/good – poor. This vegetation zone has a modified forest structure, and is dominated by a mixture of regrowth and planted vegetation. There are significant infestations of woody weeds that dominate the midstorey, and understorey vegetation is predominantly exotic. Planted vegetation includes species that are broadly characteristic of vegetation that would naturally occur within the site. Native over storey cover was below or at the lower end of benchmark values. Native mid storey cover was below benchmark in all plot/transects (0-7.5 versus the benchmark of 14.6-67) and was zero in two of the three plot/transects sampled). Species richness was well below benchmark (7-10, versus the benchmark value of >= 40) in plot/transects sampled. Native ground cover (grasses) was 0-2 (zero in two of the three plots) versus the 0-15 benchmark values, while native ground cover (shrubs) was 0-4 (benchmark 0-5), with zero cover in two of the three plot/transects sampled. Native groundcover (other) was 0-2, which is well below benchmark values of 22-42.8. Exotic plant cover was low to high (9.5-49%). Overstorey regeneration was 1, meaning all four of the canopy species present were observed regenerating, however it was unclear whether this was as a result of natural regeneration, regeneration of planted specimens or recent revegetation works. One hollow-bearing tree was observed in one of the plot/transects sampled. The total length of fallen logs was below benchmark values (0-16 m versus the >=50 m benchmark value).
Evidence used to define vegetation unit	Open forest vegetation structure. Characteristic soil types and geomorphology. The dominant plant species described below are consistent with the NSW VIS Classification (OEH 2018b) and the species list in Smith and Smith (2008) and Tozer *et al.* (2010). The equivalent vegetation map unit is mapped within the site (Smith and Smith; 2008; Kleinfelder, 2017).
Landscape position	Recorded across the site, on ridges, in gullies and in lower flatter areas where extensive landform modification works are believed to have been undertaken.
Structure	Highly modified forest, with a very dense midstorey typically dominated by woody weed species such as Lantana and Privet, and established infestations of Pampas

Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest (HN596, Moderate/good - poor) (CEEC)	
	Grass. Understorey largely lacking native species, and dominated by exotic species.
Over storey	Variable across the site. Some patches comprise a monoculture of planted River Oak (*Casuarina cunninghamiana* subsp. *cunninghamiana*) on benched landforms. Other patches contain stands of juvenile even-aged Blackbutt (*Eucalyptus pilularis*) and Sydney Blue Gum (*Eucalyptus saligna*) planted in rows, while other patches contain a mixture of the above species in addition to Black She-Oak (*Allocasuarina littoralis*), Rough-barked Apple (*Angophora floribunda*) and Red Bloodwood (*Corymbia gummifera*).
Mid storey	Highly variable across the site. Stands with a mixture of overstorey species contain Cheese Tree (*Glochidion ferdinandi*) and Sweet Pittosporum (*Pittosporum undulatum*), while modified stands typically lack a native midstorey altogether and instead support a midstorey dominated by exotic woody weeds.
Groundcover	Generally quite limited in terms of species diversity and abundance. Includes the herbaceous species Native Wandering Jew (*Commelina cyanea*) and Shade Plantain (*Plantago debilis*); grasses such as Common Couch (*Cynodon dactylon*), Wiry Panic (*Entolasia stricta*), Weeping Grass (*Microlaena stipoides*) and *Oplismenus aemulus*; the sedge Slender Flat-sedge (*Cyperus gracilis*); the rush Spiny-headed Mat-rush (*Lomandra longifolia*) and the climber Variable Glycine (*Glycine tabacina*).
Exotic species	This vegetation zone is dominated by exotic species, including woody weeds such as Silky Oak (*Grevillea robusta*), Jacaranda (*Jacaranda mimosifolia*), Lantana (*Lantana camara*), Large-leaved Privet (*Ligustrum lucidum*), Small-leaved Privet (*Ligustrum sinense*) and Japanese Hackberry (*Celtis sinensis*); herbaceous species such as Crofton Weed (*Ageratina adenophora*), Mistflower (*Ageratina riparia*), Scarlet Pimpernel (*Anagallis arvensis*), Asparagus Fern (*Asparagus aethiopicus*), Cobbler's Pegs (*Bidens pilosa*), Flaxleaf Fleabane (*Conyza bonariensis*), Slender Celery (*Cyclospermum leptophyllum*), Small-flowered Mallow (*Malva parviflora*), Paddy's Lucerne (*Sida rhombifolia*), Black-berry Nightshade (*Solanum nigrum*), Common Sowthistle (*Sonchus oleraceus*) and Wandering Jew (*Tradescantia fluminensis*); climbers such as Cape Ivy (*Delairea odorata*) and Moth Vine (*Araujia sericifera*); and the grasses Panic Veldtgrass (*Ehrharta erecta*), African Lovegrass (*Eragrostis curvula*), Japanese Honeysuckle (*Lonicera japonica*), Fishbone Fern (*Nephrolepis cordifolia*), Mickey Mouse Plant (*Ochna serrulata*), Common Passionfruit (*Passiflora edulis*) and *Poa* sp., as well as the highly invasive and declared priority weed Pampas Grass (*Cortaderia selloana*).

Exotic vegetation (Blackbutt Gully Forest HN648, Low)	
PCT (OEH, 2017c)	Smooth-barked Apple - Turpentine - Blackbutt tall open forest on enriched sandstone slopes and gullies of the Sydney region
PCT ID	1841
Photo	
NSW Veg Type ID	HN648
Equivalent Map Units	Blackbutt Gully Forest (moderate-good_high) (Kleinfelder, 2017); Blackbutt Gully Forest (L1) (Smith and Smith, 2008); Hinterland Sandstone Gully Forest (DSF 142) (Tozer *et al*., 2010).
Survey effort	Plot/transect 3
Conservation significance	Not listed
Condition	Low. No native over storey or mid storey cover. Less than 50 per cent of the ground cover present is native and native cover is frequently less than 20 per cent. All values were below benchmark in the plot/transect sampled.
Evidence used to define vegetation unit	Characteristic soil types and geomorphology. Adjacent vegetation in better condition supports plant species that are consistent with the NSW VIS Classification (OEH 2018b) and the species list in the Smith and Smith (2008) and Tozer *et al.* (2010) reports. The equivalent vegetation map unit is mapped within the site (Smith and Smith; 2008; Kleinfelder, 2017).
Landscape position	Typically occurs in sandstone gullies in areas with a shale influence.
Structure	Highly modified exotic grassland

Exotic vegetation (Blackbutt Gully Forest HN648, Low)	
Over storey	Largely absent.
Mid storey	Absent.
Groundcover	Generally devoid of native species. Limited to grasses such as Common Couch (*Cynodon dactylon*), the climber Variable Glycine (*Glycine tabacina*); the sedge *Juncus usitatus*; and the herbaceous species Native Geranium (*Geranium solanderi*).
Exotic species	A range of exotic species are present in this vegetation zone, including the woody weeds Large-leaved Privet (*Ligustrum lucidum*) and Small-leaved Privet (*Ligustrum sinense*); herbaceous species including Crofton Weed (*Ageratina adenophora*), Scarlet Pimpernel (*Anagallis arvensis*), Cobbler's Pegs (*Bidens pilosa*), Common Centaury (*Centaurium erythraea*), Spear Thistle (*Cirsium vulgare*), Slender Celery (*Cyclospermum leptophyllum*), Purpletop (*Verbena bonariensis*) and Common vetch (*Vicia sativa*); grasses including Oats (*Avena* sp.), Quaking Grass (*Briza maxima*), *Briza subaristata*, Praire Grass (*Bromus catharticus*), Rhodes Grass (*Chloris gayana*) and Paspalum (*Paspalum dilatatum*); the climber Cape Ivy (*Delairea odorata*); and the highly invasive and declared priority weed Pampas Grass (*Cortaderia selloana*).

4.2.3 Priority weeds

The site contains three species declared as priority weeds for the Greater Sydney region (which includes the Hornsby shire Council LGA), as shown in Table 4.4. These species occur in low to moderate densities throughout the site.

The distribution of weeds in the site is closely tied to disturbance, with the concentration of weeds greatest in areas that have been previously cleared areas or that are closest to ongoing disturbance.

Table 4.4 Priority weeds recorded in the site

Scientific name	Common name	Biosecurity duty
Asparagus aethiopicus	Ground Asparagus	Prohibition on dealings Must not be imported into the State or sold
Cortaderia selloana	Pampas Grass	Regional Recommended Measure Land managers should mitigate the risk of new weeds being introduced to their land. Land managers should mitigate spread from their land. The plant should not be bought, sold, grown, carried or released into the environment. Notify local control authority if found.
Lantana camara	Lantana	Prohibition on dealings Must not be imported into the State or sold

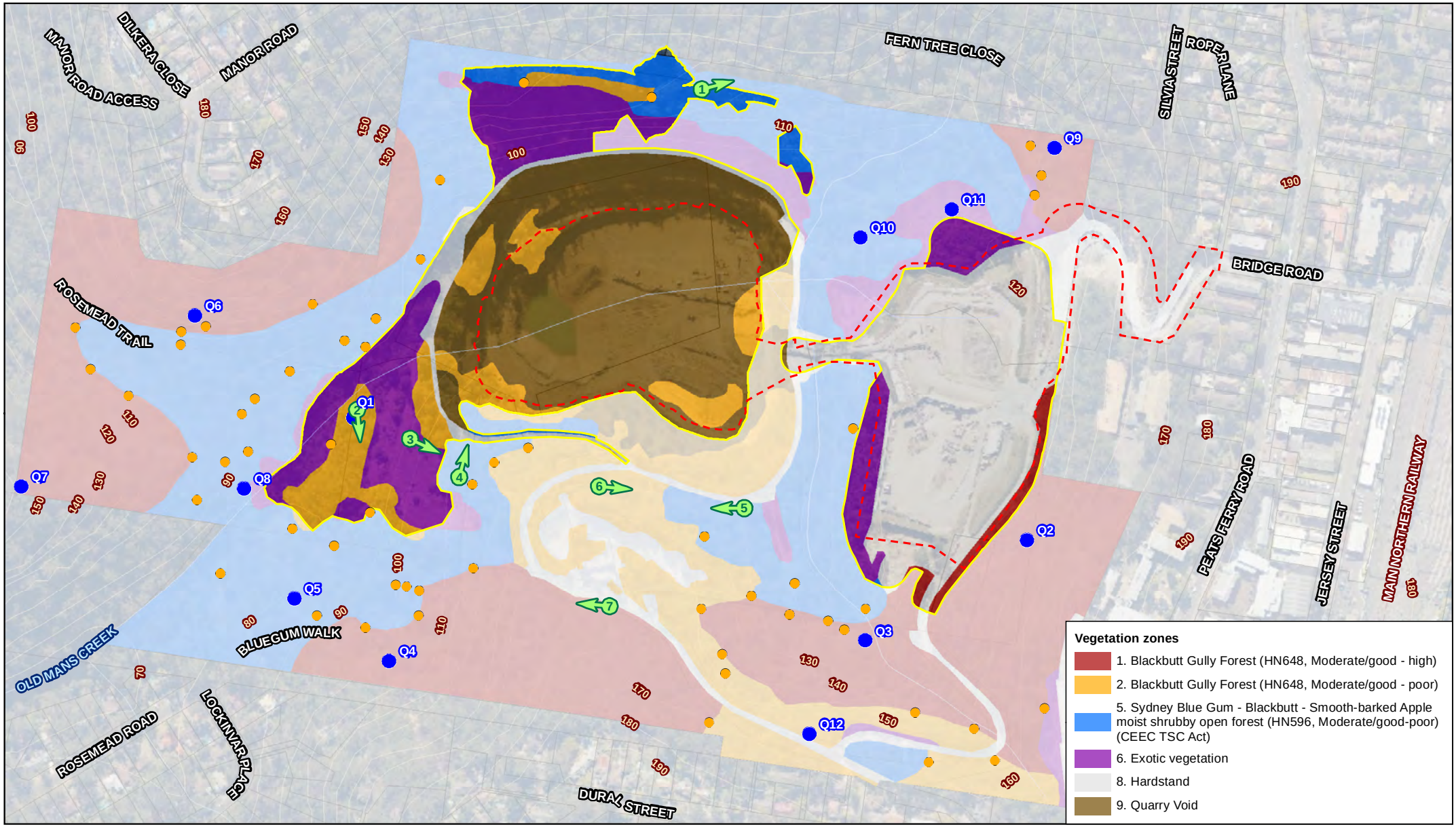
4.2.4 Groundwater-dependent ecosystems

Two groundwater systems occur at the quarry void. These consist of a shallow perched water system and a deeper system located within the fresh breccia and surrounding Hawkesbury Sandstone (AECOM Pty Ltd 2015).

Groundwater is present within secondary structural features such as joints, fractures and bedding planes. Water flows into the quarry void due to the elevated surrounding groundwater levels compared to the levels within the pit. Historically this groundwater inflow resulted in filling of the base of the void with water, which was subsequently pumped out (GHD 2018)

After the emplacement works under the 2016 Planning Approval commences, this groundwater inflow is anticipated to result in the “filling up” of void spaces in the emplaced material without significant observed standing water until the voids of the emplaced material have been filled (GHD 2018).

Land surrounding the quarry rim is between 60 and 180 metres AHD, making the water table between 41 and 161 metres below ground level. This is likely to be beyond the rooting depth of most plant species in the vegetation types present at the site (Ecological 2015). No groundwater dependent ecosystems are mapped at the site (BOM 2018b).



Paper Size A4

0 25 50 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Project site
- NorthConnex impact area
- Cadastre
- Rail
- Waterways
- Contours (10m)
- Kleinfelder Quadrat
- Kleinfelder Rapid Data Points
- GHD plot/transect

Hornsby Shire Council
Hornsby Quarry Rehabilitation

Job Number	21-26457
Revision	A
Date	20 Nov 2018

Vegetation

Figure 4.1

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: Aerial imagery - SIXmaps 2017; General topo - NSW LPI DTDB 2017, 2015, & 2012; Vegetation mapping - Kleinfelder 2017. Created by:jwatson2

4.3 Fauna and fauna habitats

4.3.1 Fauna species

A total of 67 fauna species have been recorded at the project site and adjacent areas during recent surveys by GHD, Kleinfelder (2017), Ecological Australia (2015) and PB (2004). This includes 53 bird species, four terrestrial or arboreal mammal species, five bat species, three reptile species, and two frog species. Two introduced species were recorded, the European Red Fox (*Vulpes vulpes*) and the Red-whiskered Bulbul (*Pycnonotus jocosus*) (Appendix B).

Records of threatened species are shown in Figure 4.2. These are discussed in more detail in 4.5.3.

4.3.2 Fauna habitats

Habitat features and resources in the site are described in Table 4.5 with regards to the native fauna they may support with specific reference to threatened species potentially present in the site. The site generally has patches of good fauna habitat values, due to moderate habitat complexity, allowing for a moderate diversity of fauna species. Species recorded included species that require large tracts of native vegetation to persist, as well as generalist species able to utilise disturbed urban areas.

Table 4.5 Fauna habitats

Eucalypt forest	
Description	Forested areas comprising a mix of PCTs in varying condition are present within much of the site. The structural diversity of the vegetation is generally intact with a complete mature upper canopy of eucalypts up to 25 metres tall over a diverse shrub and ground layer (see Plate 1 and 2). A range of eucalypt species are present that would provide foraging habitat for birds, possums and the Grey-headed Flying-fox throughout much of the year. Species include the spring-summer flowering Red Mahogany (*Eucalyptus resinifera*) and Sydney Red Gum (*Angophora costata*), the summer flowering Blackbutt (*E. pilularis*), and the sap-bearing and late-summer to autumn flowering Red Bloodwood (*C. gummifera*). The winter-flowering shrub, *Acacia longifolia*, is also present. Hollow-bearing trees and stags, which could provide potential nesting habitat for arboreal mammals or birds, are present in low densities in the forested areas. Five hollow-bearing trees were recorded in the project site (see Figure 4.1). Hollows were small (up to 10 cm). Larger hollows were recorded in trees in the surrounding Hornsby Quarry site. Around 300 vertebrate species use tree-hollows and shedding bark in Australia, and the shelter provided by these habitat features is essential for the survival of many of these species (Gibbons and Lindenmayer 2002). Hollows present are likely to be used by common parrot species, but would be too small for threatened cockatoos and owls. A shrubby understory is present in most locations, dominated by either native or exotic species depending on the degree of historical disturbance and modification within the area. Native midstorey species include *Acacia longifolia*, Large-leaf Hop-bush (*Dodonaea triquetra*), Coffee Bush (*Breynia oblongifolia*), Cheese Tree (*Glochidion ferdinandi*) and Sweet Pittosporum (*Pittosporum undulatum*). Exotic species include Canary Island Date Palm

Eucalypt forest	
	(*Phoenix canariensis*), Small-leaved Privet (*Ligustrum sinense*), Large-leaved Privet (*Ligustrum lucidum*), Camphor Laurel (*Cinnamomum camphora*), Lantana (*Lantana camara*), Silky Oak (*Grevillea robusta*), Jacaranda (*Jacaranda mimosifolia*) and Japanese Hackberry (*Celtis sinensis*). A low to moderate density of fallen timber and leaf litter is also present throughout forested areas, however as outlined above, fallen timber values were below benchmark values in all vegetation zones (see Section 4.2.2, Table 4.3). Habitat condition is considered to be good, based on the high levels of breeding, nesting, feeding and roosting resources mentioned above.
Typical fauna species	Myrtaceous trees would provide foraging resources for a range of birds, including cockatoos, parrots and honeyeaters. Few honeyeaters were recorded during the surveys, most likely due to the low numbers of flowering trees at the time of the survey. Small honeyeaters recorded include the Eastern Spinebill (*Acanthorhynchus tenuirostris*), Lewin's Honeyeater (*Meliphaga lewinii*), and the Scarlet Honeyeater (*Myzomela sanguinolenta*) and large honeyeaters included the Red Wattlebird (*Anthochaera carunculata*). Parrots recorded included the Rainbow Lorikeet (*Trichoglossus haematodus*). Black Sheoak (*Allocasuarina littoralis*), a preferred feed tree of the Glossy Black-cockatoo, is present in low densities at the site. Most casuarinas at the site are planted River Oaks (*Casuarina cunninghamiana*), which is not a preferred feed tree of the Glossy Black-cockatoo. No evidence of foraging (chewed cones) was observed at the site. Hollow-dependent fauna recorded at the site that could use hollows present included various microchiropteran bats and small parrots. Feathers from a Powerful Owl were recorded at the site, however no hollow-bearing trees suitable for this species were recorded. Sacred Kingfishers were observed nesting in hollows in arboreal termite nests on a large stag. Termite mounds were recorded on the southern side of the site. These provide foraging habitat for the Short-beaked Echidna (*Tachyglossus aculeatus*), recorded in a fox scat at the site, and can also provide nesting habitat for the threatened Rosenberg's Goanna (*Varanus rosenbergi*). A suite of small insectivorous woodland bird species, including thornbills (*Acanthiza* spp.), White-browed Scrub-wrens (*Sericornis frontalis*) and Fairy-wrens (*Malurus* spp.), were recorded foraging in the understory throughout the site. Other birds recorded included the Grey Fantail (*Rhipidura albiscapa*), Grey Shrike-thrush (*Colluricincla harmonica*) and Eastern Yellow Robin (*Eopsaltria australis*). Large ground birds recorded included the Australian Brush-turkey (*Alectura lathami*), including a nest mound, and the Superb Lyrebird (*Menura novaehollandiae*). Numerous sunskinks (*Lampropholis* sp.) were observed in leaf litter.

Eucalypt forest	
Threatened fauna recorded	• Powerful Owl (*Ninox strenua*) – vulnerable species listed under the TSC Act (feathers found) • Grey-headed Flying-fox (*Pteropus poliocephalus*) – vulnerable species listed under the TSC Act and EPBC Act (recorded by PB 2004) • Varied Sittella (*Daphoenositta chrysoptera*) - vulnerable species listed under the TSC Act.(recorded by PB 2004) • Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) – vulnerable species listed under the TSC Act (possible identification from call analysis).

Plate 1. Blue Gum High Forest on hillslope

Plate 2. Forest on lower slopes, with adjacent exotic grassland

Exotic grassland and cleared areas	
Description	Exotic grassland occurs in the south of the site (see plate 2). The understorey is dominated by exotic perennial grass species, with occasional native grass, sedge and herbaceous species.
Typical fauna species	Grassland areas would provide habitat for common reptiles such as sunskinks and snakes. Birds such as Australian Magpies and Sulphur-crested Cockatoos may also forage on occasion in this area.
Threatened fauna recorded	None recorded. Bats such as the Eastern Bentwing Bat may forage over these areas on occasion.

Aquatic habitat	
Description	A small artificial pond is present near the old diesel pumps. This had a variety of emergent aquatic plants present. Drains and culverts are present at the site. These drain west towards Berowra Valley National Park. A number of creeks and drainage lines are present adjacent to the site. None of these had water during the survey. No key fish habitat is present within the site. Berowra Creek, located downstream of the site, is mapped as having a freshwater fish community in fair condition (DPI 2016).
Typical fauna species	The Emerald Spotted Tree Frog (*Litoria peroni*) was heard calling from the artificial pond.
Threatened fauna recorded	No habitat for threatened aquatic species listed under the FM Act or threatened frogs listed under the TSC Act is present at the site. Given the location of the site well below the tops of ridges, and the disturbed nature of the site and presence of surrounding development, water quality in creeks immediately adjacent to the site are likely to be poor, limiting habitat value for the Red-crowned Toadlet.

Plate 3: Old Mans Creek near the site

Plate 4: drainage line adjacent to northern boundary of the project site

4.4 Connectivity

Hornsby Quarry is located on the western side of the Hornsby Plateau. Vegetation at the site is connected to Berowra Valley National Park to the west, which provides a north-south link from Cherrybrook and Westleigh in the south, linking to Berowra Valley National Park in the north.

Berowra Valley National Park contains many PCTs, including three threatened ecological communities. The park is also known habitat for at least 12 threatened flora species and at least 15 threatened fauna species (OEH 2015).

4.5 Conservation significance

4.5.1 Threatened ecological communities

Of the two PCTs identified on site, one is a threatened ecological community (TEC): Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest (HN596, Moderate/good - poor), which is commensurate with Blue Gum High Forest in the Sydney Basin Bioregion (BGHF), a critically endangered ecological community (CEEC) listed under the TSC Act.

This form of the community does not meet the condition criteria for inclusion as the EPBC Act-listed community, as described in detail in Table 4.3 in Section 4.2.2. This is in line with the findings of EcoLogical (2015) who considered a similar study area and found that BGHF within their site did not fulfil the requirements for the EPBC Act-listed form of the community.

The local occurrence of BGHF extends off site into the wider Hornsby Quarry reserve area, as mapped by Kleinfelder (2017). Some of the BGHF outside of the site meets the condition criteria for inclusion as the EPBC Act-listed form of the community, in that it is remnant, supports sufficient canopy cover, and contains a dominant layer of native species in all stratum.

Within the site, BGHF exists as a highly modified form of the CEEC, as a result of historical and ongoing disturbances, including extensive modification of the soil profile and landform of the site, vegetation clearing, quarry works, rehabilitation and revegetation works and weed infestation etc. All vegetation within the site has been impacted by these disturbances, along with fragmentation and disturbance from surrounding residential and infrastructure developments.

4.5.2 Threatened flora species

The full list of threatened flora species recorded or predicted to occur in the locality and likelihood of occurrence at the site is provided in Appendix A. No threatened flora species have been recorded within the site in the past. There is one record of Tangled Bedstraw (*Galium australe*) and one record of *Darwinia peduncularis* along Blue Gum Walk in Old Mans Valley from 2008 (OEH, 2017). These records have an accuracy of 1 km, based on the siting notes available in the licenced version of the NSW BioNet. Blue Gum Walk is located to the west of the site, and supports intact remnant vegetation. These species were not located during the GHD survey or during previous surveys by Kleinfelder (2017) or Ecological (2015).

No other threatened flora species were recorded within the study area during the field surveys conducted by GHD or by Kleinfelder (2017) or Ecological (2015). Ecological (2015) excluded all predicted threatened flora species from occurring within the site considered during their assessment due to a lack of suitable habitat .

A total of 46 threatened flora species have been previously recorded in the locality (OEH, 2017a) or are predicted to occur (DoE, 2017a). Of this number, two are considered to have ‘nil’ likelihood of occurrence, as the project site is located outside of the species natural range, and both are commonly planted street and landscaping trees. These species are not considered further in this assessment. One species is considered ‘unlikely’ to occur due to a lack of suitable soil landscapes at the site, seven species are ‘unlikely’ to occur as the site is outside of their known range and 18 other species are ‘unlikely’ to occur due to a lack of suitable habitat. Lack of habitat relates to lack of suitable vegetation associations, lack of suitable soil profiles or geology, lack of suitable landscape or topographic positions within the site, as well as locations of known populations and preferred habitat types.

A total of 18 species are considered to have a ‘possible’ likelihood of occurrence, given the presence of broadly suitable habitat within the site, however it is likely that the existing level of

disturbance and modification within the site precludes the majority of these species from occurring within the site. It is more likely that that they would occur within intact, good condition vegetation outside of the site boundary.

The habitat values present at the site for these species are detailed in Table 4.6.

Table 4.6 Threatened flora species with potential habitat at the site

Species	TSC Act	EPBC Act	Species Credit species	Habitat values present	Likelihood of occurrence
Tangled Bedstraw (*Galium australe*)	E		Yes	Few records in the locality. Occurs in a range of habitats across NSW, and has previously been recorded along the Blue Gum Walk in Old Mans Valley.	Possible
Asterolasia elegans	E	E	Yes	Not recorded in the locality previously, but suitable habitat present on site. Known from the Hornsby LGA. Occurs on Hawkesbury sandstone on mid to lower slopes and in valleys.	Possible
Netted Bottle Brush (*Callistemon linearifolius*)	V		Yes	Few records in the locality. Recent records from the Hornsby Plateau. Occurs in dry sclerophyll forest.	Possible
Darwinia biflora	V	V	Yes	Numerous records in the locality. Occurs on the edges of shale-capped ridges at the intergrade with Hawkesbury sandstone, in woodland, open forest and heath.	Possible
Darwinia peduncularis	V		Yes	Some records in the locality and has previously been recorded along the Blue Gum Walk in Old Mans Valley. Usually grows in dry sclerophyll forest on hillsides and ridges, on or near rocky outcrops on sandy, well-drained, low nutrient soil over sandstone.	Possible
Epacris purpurascens var. *purpurascens*	V		Yes	Numerous records in the locality. Grows in a range of sclerophyll forest, scrub and swamps, most of which have a strong shale soil influence.	Possible
Camfield's Stringybark (*Eucalyptus camfieldii*)	V	V	Yes	Some records in the locality. Occurs in exposed situations on sandstone plateaus, ridges and slopes, in shallow sandy soils overlying Hawkesbury sandstone.	Possible
Bauer's Midge Orchid (*Genoplesium baueri*)	E	E	Yes	Many records in the locality. Grows in sparse sclerophyll forest and moss gardens over sandstone.	Possible
Narrow-leaf Finger Fern	E		Yes	Few records in the locality. Grows in moist places, usually near streams, on rocks and in	Possible

Species	TSC Act	EPBC Act	Species Credit species	Habitat values present	Likelihood of occurrence
(*Grammitis stenophylla*)				trees in rainforest and moist eucalypt forest.	
Haloragodendron lucasii	E	E	Yes	Not recorded in the locality previously, but suitable habitat present on site and known from the Hornsby area. Occurs on Hawkesbury sandstone in moist sandy loam, and prefers sheltered aspects and gentle slopes below cliff lines near creeks in low open woodland or open forest. Distribution correlated with high soil moisture and phosphorus levels.	Possible
Julian's Hibbertia (*Hibbertia spanantha*)	CE	CE	Yes	Not recorded in the locality previously, but suitable habitat present on site. Grows in eucalypt forest with an open understorey, and within the three known locations, soil is identified as a light clay occurring on a shale sandstone transition.	Possible
Hibbertia superans	E		Yes	Many records in the locality. Grows on sandstone ridgetops, often near the shale sandstone boundary, in open woodland and heathland. Prefers open and/or disturbed areas such as the sides of tracks.	Possible
Lasiopetalum joyceae	V	V	Yes	Many records in the locality. Known from the Hornsby Plateau. Grows on lateritic to shaley ridgetops, in heath on sandstone.	Possible
Deane's Paperbark (*Melaleuca deanei*)	V	V	Yes	Many records in the locality. Mostly grows on broad flat ridgetops, dry ridges and slopes and is strongly associated with low nutrient, sandy loam soils, sometimes with ironstone. Grows in heath and open forest, often in sandstone ridgetop woodland communities.	Possible
Hairy Geebung (*Persoonia hirsuta*)	E	E	Yes	Few records in the locality. Grows in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.	Possible
Persoonia mollis subsp. *maxima*	E	E	Yes	Numerous records in the locality. Grows in sheltered aspects of deep gullies or on the steep upper hillsides of narrow gullies on Hawkesbury sandstone. Often associated with relatively moist, tall forest	Possible

Species	TSC Act	EPBC Act	Species Credit species	Habitat values present	Likelihood of occurrence
				vegetation communities, often with mesic influences.	
Pimelea curviflora var. *curviflora*	V	V	Yes	Many records in the locality. Grows on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Often occurs amongst dense grasses and sedges.	Possible
Tetratheca glandulosa	V		Yes	Numerous records in the locality. Associated with shale sandstone transition habitat, particularly shale-cappings over sandstone. Occupies ridgetops, upper slopes and occasionally mid stope sandstone benches. Soils are generally shallow, yellow, clayey/sandy loam, commonly with lateritic fragments. Vegetation varies from heath to open forest and is broadly equivalent to Sydney Sandstone Ridgetop Woodland community.	Possible

V – vulnerable, E – endangered, CE – critically endangered.

Abundance values: Numerous: >100 records, many: >20 records, some: >10 records; few <10 records in the locality.

4.5.3 Threatened fauna species

The full list of threatened fauna species recorded or predicted to occur in the locality and likelihood of occurrence at the site is provided in Appendix A. Four threatened fauna species have been positively recorded at the site, either during GHD surveys or during previous surveys:

- Powerful Owl (*Ninox strenua*)
- Varied Sittella (Daphoenositta chrysoptera)
- Grey-headed Flying-fox (*Pteropus poliocephalus*)
- Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) (possible identification based on anabat analysis).

The habitat values present at the site for these species are detailed in Table 4.7. Most threatened species that would occur at the site are likely to occur as transient visitors rather than residents. Few large hollow-bearing trees are present, limiting breeding habitat for species such as owls and cockatoos. Habitat at the site is connected to large areas of habitat in the Berowra Valley National Park.

No threatened species listed under the FM Act are likely to occur at the project site or downstream of the project site.

Table 4.7 Threatened fauna species with known or potential habitat at the site

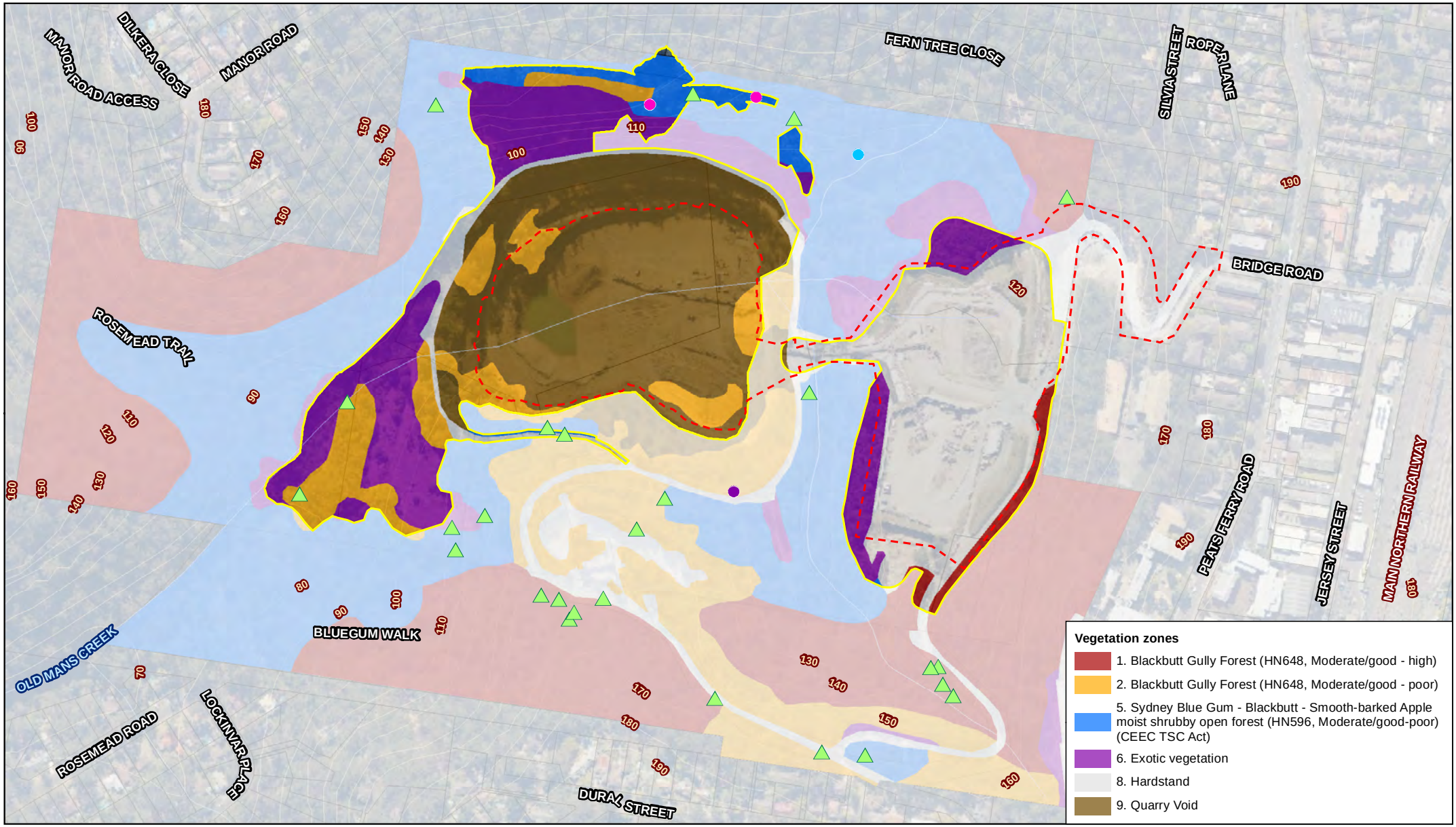
Species	TSC Act	EPBC Act	Species Credit species	Habitat values present	Likelihood of occurrence
Powerful Owl (*Ninox strenua*)	V		No	Numerous local records. Foraging habitat present in wooded areas within the site, where it would hunt for arboreal mammals. While hollow-bearing trees are present, these tend to have small hollows or do not occur along drainage lines. Likely to breed in large, old trees with hollows along drainage lines that are located near the site (eg Dead Man's Gully). Known to roost at the site.	Recorded
Barking Owl (*Ninox connivens*)	V		No	Few local records. Foraging habitat present in wooded areas within the site, where it would hunt for birds and other animals. While hollow-bearing trees are present, these tend to have small hollows or do not occur along drainage lines. Likely to breed in large, old trees with hollows along drainage lines that are located near the site (eg Dead Man's Gully).	Possible
Masked Owl (*Tyto novaehollandiae*)	V		No	Few local records. Foraging habitat present along edges of forest and cleared areas within the site, where it would hunt for terrestrial mammals. While hollow-bearing trees are present, these tend to have small hollows or do not occur along drainage lines. Likely to breed in large, old trees with hollows along drainage lines that are located near the site (eg Dead Man's Gully).	Possible
Sooty Owl (*Tyto tenebricosa*)	V		No	Few local records. Foraging habitat is present in wooded areas within the site, mainly near gullies, where it would hunt for small mammals. While hollow-bearing trees are present, these tend to have small hollows or do not occur along drainage lines. Likely to breed in large, old trees with hollows along drainage lines that are located near the site (eg Dead Man's Gully).	Possible
Gang-gang Cockatoo (*Callocephalon fimbriatum*)	V, EP		Yes	Many local records. Would forage on site on occasion in forested areas where it would feed on seeds of Eucalypts. While hollow-bearing trees are present, these tend to have small hollows, and	Likely

Species	TSC Act	EPBC Act	Species Credit species	Habitat values present	Likelihood of occurrence
				are unlikely to be suitable for this species.	
Glossy Black-cockatoo (*Calyptorhynchus lathami*)	V		No	Many local records. Would forage on site on occasion where it would feed on seeds of *Allocasuarina*. Low densities of these trees are present at the site. While hollow-bearing trees are present, these tend to have small hollows and are not suitable for this species.	Possible
Varied Sittella (*Daphoenositta chrysoptera*)	V		No	Few local records. Habitat present in forested areas where it would forage and nest in the canopy.	Recorded
Grey-headed Flying-fox (*Pteropus poliocephalus*)	V	V	No	Numerous local records. Would forage on site on occasion when eucalypts are in flower. No breeding habitat present.	Recorded
Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*)	V		No	Numerous local records. Would forage above the canopy and in cleared areas of the site on occasion. No breeding habitat present. Could roost in derelict buildings or culverts/pipes in adjacent areas.	Recorded
Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)	V		No	Some records in the locality. May forage on occasion in forested areas of the site. Unlikely to roost or breed at the site, but may roost in forest in adjacent gullies.	Possible.
Eastern Freetail Bat (*Mormopterus norfolkensis*)	V		No	Many local records. May forage on occasion in forested areas of the site. May roost or breed at the site.	Likely
Greater Broad-nosed Bat (*Scoteanax rueppellii*)	V		No	Some records in the locality. May forage on occasion in forested areas of the site. May roost or breed at the site.	Likely
Little Bentwing Bat (*Miniopterus australis*)	V		No	Many local records. Would forage above the canopy and in cleared areas of the site on occasion. No breeding habitat present. Could roost in derelict buildings or culverts/pipes in adjacent areas.	Likely
Yellow-bellied Sheathtailed Bat (*Saccolaimus flaviventris*)	V		No	Some records in the locality. May forage on occasion in forested areas of the site. May roost or breed at the site.	Likely
Rosenberg's Goanna (*Varanus rosenbergi*)	V		Yes	Many local records, although few in close proximity to the site. Habitat at the site is not considered optimal as it is predominantly mesic and highly disturbed. Presence of foxes reduces the quality of habitat, as	Possible

Species	TSC Act	EPBC Act	Species Credit species	Habitat values present	Likelihood of occurrence
				foxes are known to prey on hatchlings.	
Spotted-tailed Quoll (*Dasyurus maculatus*)	V	V	No	Some local records. Potential den sites present. Could forage throughout the site.	Possible.

V – vulnerable, EP – endangered population.

Abundance values: Numerous: >100 records, many: >20 records, some: >10 records; few <10 records in the locality.



Paper Size A4

0 25 50 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Project site
- NorthConnex impact area
- Cadastre
- Rail
- Waterways
- Contours (10m)
- Hollow-bearing tree
- Eastern Bentwing Bat
- Powerful Owl feathers
- Kleinfelder Powerful Owl Observation

Hornsby Shire Council
Hornsby Quarry Rehabilitation
Biodiversity Assessment

Job Number 21-26457
Revision A
Date 20 Nov 2018

Fauna habitats and threatened species

Figure 4.2

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: Aerial imagery - SIXmaps 2017; General topo - NSW LPI DTDB 2017, 2015, & 2012; Vegetation mapping - Kleinfelder 2017. Created by:jwatson2

5. Impact assessment

5.1 Construction

5.1.1 Direct impacts

Clearing of vegetation

The removal of native vegetation would occur during reprofiling, stabilisation and geotechnical safety management and rehabilitation works within the already highly modified project site. Most of the project site comprises highly modified landforms, soil profiles and vegetation types. Proposed works have been located to minimise direct impacts on native vegetation where possible. Notably the project has been purposefully designed to minimise direct impacts on areas of good condition Blue Gum High Forest. A number of iterations of the proposal design have been made, each one further minimising impacts on native vegetation and fauna habitat, with the impact on Blue Gum High Forest substantially reduced from earlier designs (see section 6.1).

The project will result in the removal of 2.5 ha of native vegetation, including 0.74 ha of vegetation commensurate with Blue Gum High Forest (see below for more detail). In addition, the project would remove 3.39 ha of exotic vegetation.

The extent of clearing of vegetation within the site is summarised in Table 5.1.

Table 5.1 Extent of impacts on vegetation within the site

Zone ID	PCT ID	GHD Veg Type	TSC Act Status	EPBC Act Status	Area (ha)
HN648	1841	Blackbutt Gully Forest (HN648, Moderate/good - high)	Not listed	Not listed	0.26
HN648	1841	Blackbutt Gully Forest (HN648, Moderate/good - poor)	Not listed	Not listed	1.50
HN596	1237	Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest (HN596, Moderate/good - poor) (CEEC)	CEEC listed under the BC Act: Blue Gum High Forest in the Sydney Basin Bioregion	Not listed	0.74
		Exotic vegetation (Blackbutt Gully Forest HN648, Low)	Not listed	Not listed	3.39
		Hardstand			0.77
		Quarry void			1.41
				Native vegetation clearing	**2.50**
				Total vegetation clearing	**5.89**
				Total area	**8.28**

Clearing of 5.89 hectares of exotic and native vegetation would involve removal of a mixture of non-threatened native plants, including a number of semi-mature trees. Mature trees have value within plant populations as sources of pollen and seed.

There are extensive areas of comparable vegetation communities in the locality, including in Berowra Valley National Park and Ku-Ring-Gai Chase National Park, which combined protect over 19,000 ha of native vegetation. Berowra Valley National Park contains large areas of gully

forest (over 1800 ha), but only a small area of Blue Gum High Forest (less than 1 ha) according to broad-scale regional vegetation mapping by Tozer et al (2010). Around 15 ha of Blue Gum High Forest would be retained, predominantly within the wider site, and a small area in the adjacent National Park. The total area of native vegetation to be removed (2.5 hectares) is a small percentage of comparable vegetation within the locality of the study area. This minor reduction in the extent of native vegetation would not threaten the persistence Blue Gum High Forest CEEC or the more common Blackbutt Gully Forest within the wider locality.

The majority of the vegetation to be cleared (3.39 ha) is disturbed, modified land containing a mixture of exotic species and planted natives, including a number of priority and/or environmental weeds. The proposal would reduce a source of weed propagules that are currently threatening adjoining areas of intact, better condition native vegetation. These areas of exotic vegetation have limited habitat value for native plants, particularly threatened species, given the highly modified soil profile across much of the project site resulting from historical earthworks and rehabilitation. Vegetation clearing would remove a small number of individuals of non-threatened native plants and noxious and environmental weeds. Provided the weed management measures proposed in Section 6.2 are adopted, the proposal may result in positive impacts on retained native vegetation adjoining the site by reducing the amount of weeds within the site.

Impacts on Blue Gum High Forest

A total of 0.74 hectares of Blue Gum High Forest would be removed by the project as a result of stabilisation and geotechnical safety management works required for the development of the community parkland. The areas to be removed comprise the disturbed and heavily modified edges of larger patches of vegetation, and much of this vegetation has been planted as part of previous rehabilitation activities. Patches to be impacted are already exposed to the influences of edge effects, weed invasion and track/access maintenance.

As outlined in Section 4.2.2, Blue Gum High Forest within the project site occurs as a highly modified and poor condition form of the community, and does not meet the condition criteria for inclusion as the EPBC Act-listed CEEC.

There are occurrences of better condition Blue Gum High Forest outside of the project site boundary, as well as elsewhere in the locality within the reserve network. Kleinfelder (2017) mapped 15.63 ha of Blue Gum High Forest at Hornsby Quarry, of which 4.35 ha was in good condition. Northconnex impacted 0.06 ha of this community (Ecological 2015), and 0.74 ha would be impacted by the reprofiling of the quarry for the current project. As such 14.83 ha of Blue Gum High Forest would be retained at Hornsby Quarry. Given the small area of impact on disturbed and heavily modified areas of Blue Gum High Forest, and the comparatively larger area to be retained, impacts associated with the project are unlikely to threaten the viability or persistence of Blue Gum High Forest within the locality.

Section 5.4.2 and Appendix C provide a detailed assessment of significance of impacts on Blue Gum High Forest.

Removal of habitat resources

The 2.5 ha of native vegetation that would be removed provides foraging, breeding, roosting and nesting resources for a range of fauna species, including threatened species. However, the magnitude of impact is likely to be low given the historic and recent modification of the site and the presence of extensive areas of similar habitat in surrounding protected areas.

The clearing of native canopy species would result in the loss of nectar resources as well as foraging substrate for a diverse range of arboreal species, such as birds, reptiles (varanids), arboreal mammals and bats. Large areas of better quality habitat occur in surrounding areas. In

addition, rehabilitation of the site in the future would replace many of these resources in the long time.

The project would remove five hollow-bearing trees containing small hollows (<10 cm diameter). These may be utilised by mammal species such as the common Sugar Glider and some microbat species, as well as parrots and tree frogs. The removal of these trees within the construction footprint is unlikely to comprise the removal of a significant proportion of the total resource, such that any local populations of fauna would experience significant negative impacts, given the expansive tracts of vegetation containing hollow-bearing trees that are present in the locality.

The project would remove fallen logs and rock outcrops, which represent potential den habitat for the Spotted-tailed Quoll. No evidence of use of termite mounds by Rosenberg's Goanna was observed, however the loss of three termite mounds reduces the availability of this resource in the area. The removal of vegetation would also lead to the loss of potential foraging habitat for these and other ground-dwelling species.

The project would also involve the removal of 3.39 ha of low condition grassland, which provides foraging habitat for common birds and mammals, as well as shelter and foraging habitat for reptiles and frogs.

There would be no removal of natural creeklines, rather artificial drains and culverts would be extended. Culverts represent potential roosting habitat for microbat species. These are likely to be used as temporary roosts only for species such as the Eastern Bentwing Bat. The lack of large areas of water limits their value for the Southern Myotis. Extension of these culverts could provide additional roost habitat in the future, if used by these species.

Fauna injury and mortality

Construction is likely to result in the injury or mortality of some individuals of these less mobile fauna species and other small terrestrial fauna that may be sheltering in vegetation within the project site during clearing activities. This may include species such as the Common Ringtail Possum, and frogs and lizards. There are few hollow-bearing trees in the project site, and hollows are generally small, which reduces the risk of injury or mortality of larger hollow-nesting birds. The potential injury or mortality of individuals within a maximum of 5.89 hectares of habitat (including 3.39 ha of low condition grassland), is highly unlikely to affect an ecologically significant proportion of any local populations. More mobile native fauna such as native birds, bats, terrestrial and arboreal mammals that may be sheltering in vegetation in the project site are likely to evade injury during construction activities by moving into adjacent areas of habitat. However, displaced individuals may suffer stress, increased energy costs or increased risk of predation.

Recommendations have been made in Section 6.2 to minimise the risk of vegetation clearing activities resulting in the injury or mortality of resident fauna.

Fragmentation or isolation of habitat

The removal of native vegetation would occur around the edges of the existing quarry. There would be no isolation of habitat as a result of the project. Native vegetation surrounds the project site and would continue to provide connectivity for fauna and flora. Revegetation in later phases of the project would improve habitat connectivity over the longer term.

Aquatic habitats

Aquatic habitats in the project area are limited. The project would remove small areas of low quality aquatic habitat associated with drainage structures and small depressions. Aquatic habitats would provide breeding and shelter resources for common frog and reptile species.

These do not provide potential habitat for threatened fish. There would be no loss of key fish habitat or impacts on fish passage.

5.1.2 Indirect and operational impacts

Weed invasion and edge effects

'Edge effects' refers to factors including increased noise and light, weed invasion, tree failure or erosion and sedimentation at the interface of intact vegetation and cleared areas. Edge effects may result in impacts such as changes to vegetation type and structure, increased growth of exotic plants, increased predation of native fauna or avoidance of habitat by native fauna. Edge effects would result from construction activities.

Altered environmental conditions along new edges can allow invasion by pest animals specialising in edge habitats and/or change the behaviour of resident animals. Edge zones can be subject to higher levels of predation by introduced mammalian predators and native avian predators. Edge generally occur up to 50 metres away from the vegetation edge (Bali 2005) but have been recorded up to 1000 metres from a vegetated edge (Forman et al 2000).

The impacts of edge effects are visible across much of the project site due to the presence of existing clearings for the quarry, access tracks and other ancillary areas. The project would create a new edge in some areas. Revegetation in later phases of the project would reduce edge effects in the long term.

Given the level of existing disturbance, the proposal would have a minor impact on the degree of weed infestation and other edge effects in the study area. Recommendations have been made in Section 6.2 to minimise the spread of weeds.

Surface water

The following pathways exist for potential impact on surface water quality by extracting water from the void (supplied by groundwater) and dewatering to the surface water system:

- Elevated concentrations of substances naturally in the groundwater system, in excess of the surface water system concentrations.
- Introduction of elevated concentrations of substances through leaching of the material placed under the 2016 approval.
- Introduction of elevated concentrations of substances through the activities associated with the construction and operation of the proposed works.
- Elevation of concentrations of substances through ongoing accumulation in the void through processes such as evaporation.

The water quality of water discharged from the void is anticipated to be generally similar to that of the receiving environment. This is supported by existing void water quality monitoring data, assessment of the impacts of emplacing material undertaken for the NorthConnex project, and water balance results showing no increasing accumulation of concentrations of water quality constituents (GHD 2018).

Prior to Hornsby Shire Council commencing pumping, a creek vegetation assessment was conducted on the Old Mans Creek down to the West Hornsby Treatment Plant. A survey one year later noted no significant impact from the pumping of the quarry void (C. Clendenning, pers. comm.).

Sedimentation and erosion

The project has the potential to result in sedimentation and erosion within the project site and adjoining areas downstream through soil disturbance and construction activities. Sediment laden runoff to waterways can alter water quality and adversely affect aquatic life. The project has the potential to introduce pollutants and sediments into Old Mans Creek. Water quality impacts would be managed through implementation of management during construction, including the provision of sedimentation basins, silt fences and other structures, and management of chemical storage and spills (see section 6.2).

Discharges associated with the dewatering have the potential to impact on downstream waterways through affecting the patterns of sediment mobilisation and deposition. However, the impact for the proposed works is not anticipated to be significant on the basis of the following:

- Downstream waterways are generally well vegetated, with defined stream patterns and outcrops of bedrock providing control on potential incisions.
- The downstream waterways, immediately downstream of the discharge point are of a significant catchment area where natural flood flows are likely to be of a much larger flow rate, and therefore the governing geomorphological process behind the system.

The dewatering rates under the project will be less than historical dewatering, on the basis of the higher water level in the void, therefore if there are impacts associated with the dewatering, they may have already occurred or be lessened in the future by the project relative to historical conditions (GHD 2018).

Groundwater

Significant volumes of surface water and particularly groundwater are intercepted by the quarry void. This intercepted water is then either evaporated or conveyed to the downstream surface water system. As the groundwater would flow inwards to the void, this would mitigate the risk of discharging lower quality water to the groundwater system in the wider area (noting that this lower quality water is not anticipated) (GHD 2018).

Pathogens

Construction activities within the project site have the potential to introduce or spread pathogens such as Phytophthora (*Phytophthora cinnamomi*), Myrtle Rust (*Uredo rangelii*) and Chytrid fungus (*Batrachochytrium dendrobatidis*) into adjacent native vegetation through vegetation disturbance and increased visitation. There is little available information about the distribution of these pathogens within the locality, and no evidence of these pathogens was observed during surveys. Phytophthora and Myrtle Rust may result in the dieback or modification of native vegetation and damage to fauna habitats. Chytrid fungus affects both tadpoles and adult frogs and can cause 100% mortality in some populations once introduced into an area.

Mitigation measures would be included in the CEMP to minimise the potential for the introduction or spread of disease that could potentially impact threatened biota in the study area (see Section 6.2).

Dust generation

Dust as a result of infilling of the existing quarry, vehicle movement and wind may currently affect native vegetation located adjacent to the project site, however there was little evidence of dust in adjacent vegetation during the field survey. Dust is likely to be generated during clearing and construction activities. High dust levels could reduce habitat quality for flora and fauna species by reducing plant and animal health in areas of adjacent vegetation. Revegetation in later phases of the project would reduce dust effects in the long term.

Mitigation measures would be included in the CEMP to minimise the potential for impacts of dust generation (Section 6.2). Dust is unlikely to substantially impact habitat for any threatened biota due to the mitigation measures proposed.

Noise

There would be noise impacts during the construction and operation phases as a result of vegetation clearing, the movement of vehicles and operation of plant. The project site currently experiences substantial noise impacts from infilling of Hornsby Quarry by NorthConnex, and there is unlikely to be more noise than is currently occurring. There is the potential for individuals that nest in trees that are close to the project site abandoning their nests as a result of noise during construction. Noise may also affect general fauna activity in these areas. Given the existing noise levels in the vicinity of the proposal, any localised and temporary increase in noise levels during the construction activities are unlikely to substantially impact on native biota.

Vibration

Vibration impacts may result from works associated with the project, such as heavy vehicle movement and construction and operational activities. Vibration may deter native fauna from using the area surrounding the source of vibration. This may potentially interrupt dispersal within the locality if an individual is unwilling to travel through an area where vibration is detectable, or may cause some species to abandon an area in search of areas where vibration is not detectable.

Within the project site, some level of vibration is already present as a result of vehicles travelling along access roads, and the dumping of fill into Hornsby Quarry. The project has the potential to increase vibration throughout the project site and adjacent areas during construction. Impacts would be localised and temporary during construction.

5.2 Cumulative impacts

The project would increase the extent of vegetation clearing in the locality, and increase the removal of habitats for flora and fauna species, including threatened species. Recent projects that have impacted Blue Gum High Forest have included the construction of the Epping to Thornleigh Third Track and NorthConnex. Other developments in the locality would also lead to a reduction in vegetation and habitats available. Rehabilitation following reprofiling would minimise the cumulative impacts.

5.3 Key threatening processes

A key threatening process (KTP) is defined under the TSC Act as an action, activity or proposal that:

- Adversely affects two or more threatened species, populations or ecological communities
- Could cause species, populations or ecological communities that are not currently threatened to become threatened.

There are currently 38 KTPs listed under the TSC Act and eight listed under the FM Act. A number of KTPs are listed under more than one Act. Those potentially relevant to this proposal are listed in Table 5.2 below. Mitigation measures to limit the impacts of these KTPs are discussed in Chapter 6.

Table 5.2 Key threatening processes

KTP	Status	Comment
Clearing of native vegetation	TSC Act EPBC Act	The proposal includes the clearing of 5.89 hectares of native vegetation, much of which is disturbed from

KTP	Status	Comment
		previous quarrying activities. Vast areas of intact native vegetation are present in the locality. This minor reduction in extent is highly unlikely to affect the viability of remnant vegetation in the wider area Hornsby Quarry area or locality or reduce the extent of habitat below a minimum size required for any fauna species. The implementation of vegetation management procedures is recommended to limit impacts on vegetation (see Section 6.2). Following reprofiling, revegetation works would be conducted which would improve vegetation in the longer term.
Clearing of hollow-bearing trees	TSC Act	Five trees with suitable hollows for small birds or mammals are likely to be removed by the proposal. No large hollows suitable for species such as cockatoos and forest owls will be removed. The implementation of habitat management procedures is recommended to limit impacts on fauna and their habitats as a result of removal of these hollow-bearing trees (see Section 6.2).
Removal of dead wood and dead trees	TSC Act	The project site contains areas of fallen timber. The proposal will result in the removal of this timber during construction of the proposal. The implementation of habitat management procedures is recommended to limit impacts on fauna and their habitats (see Section 6.2).
Invasion of plant communities by perennial exotic grasses	TSC Act	The project site features large areas of exotic grassland. There is the potential for perennial exotic grasses to invade adjacent native vegetation through disturbance during construction of the proposal and a shift of the disturbed edge into intact native vegetation. The proposal would include environmental management measures, including weed management and specific consideration of potential impacts on soil, water and native vegetation (see Section 6.2).
Infection of native plants by *Phytophthora cinnamomi*	TSC Act; EPBC Act	Proposed activities have the potential to introduce Phytopthora into the study area, through the transport and movement of plant, machinery and vehicles, as well as through any landscaping works following the proposed landform modification works. The proposal would include environmental management measures, including specific consideration of measures to reduce potential impacts on soil, water and native vegetation (see Section 6.2).
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae	TSC Act	Proposed activities have the potential to introduce Myrtle Rust to the study area. The proposal would include environmental management measures, including specific consideration of measures to reduce potential impacts on soil, water and native vegetation (see Section 6.2).
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	TSC Act; EPBC Act	Construction activities have the potential to introduce amphibian chytrid to the study area, which could lead to death of local frogs. The project would include environmental management measures including specific consideration of measures to reduce potential impacts on soil, water and native vegetation (see Section 6.2).
The degradation of native riparian vegetation along NSW water courses	FM Act	Reprofiling and construction activities could have indirect impacts on riparian vegetation downstream of the study area through sedimentation, erosion and pollution. Mitigation measures are recommended to limit the

KTP	Status	Comment
		potential for adverse impacts on riparian vegetation (see Section 6.2).
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands	TSC Act; FM Act	The hydrology of the study area is already substantially modified by the existing quarry. The proposal would further alter the natural landform through placement of fill and modification of surface water flows. Mitigation measures are recommended to limit the potential for adverse impacts on aquatic habitats (see Section 6.2).
Human-caused climate change	TSC Act EPBC Act	Combustion of fuels associated with construction of the project would contribute to anthropogenic emissions of greenhouse gases. The increase in greenhouse gases could impact average temperatures, rainfall patterns and bushfires, which can impact vegetation and habitats for flora and fauna. In the long-term, replanting of forest will help offset carbon.

5.4 Impacts on State-listed threatened biota

5.4.1 Identification of affected biota

The desktop assessment, field surveys and habitat assessments described in this report have been used to identify the threatened flora and fauna species, and ecological communities, that may be affected by the project, through either direct or indirect impacts. The outcome of these assessments is summarised in Appendix A.

The project will have direct impacts on one threatened ecological community listed under the TSC Act. No threatened flora species are considered 'likely' to occur within the project site, and as such, impacts on threatened flora species are unlikely.

A total of 18 threatened fauna species are known or are likely to occur in the project site. Potential impacts on threatened ecological communities, flora and fauna are discussed further in Sections 5.4.2, 5.4.3 and 5.4.4 respectively.

5.4.2 Threatened ecological communities

Up to 0.74 hectares of Blue Gum High Forest would be removed from within the site for stabilisation and geotechnical safety management works. Blue Gum High Forest to be impacted is highly modified and degraded, with significant weed infestations in the midstorey and understorey, and consists of a mix of planted and regenerating vegetation. Indirect impacts of construction activities on adjacent areas of higher quality vegetation are unlikely given the impact amelioration measures presented in Section 6.

The project would remove a relatively minor area of habitat for this CEEC within the project site and would not isolate any area of habitat from presently interconnected areas. An assessment of significance pursuant to s5A of the EP&A Act has been prepared for this CEEC. Based on the consideration of the factors presented in the 7 part test provided in Appendix C, the project is highly unlikely to have a significant adverse effect on the local occurrence of this community as:

- The project has been designed specifically to avoid impacts on good quality patches and to minimise impacts on poor quality patches.
- While up to 0.74 ha of poor condition will be removed, extensive, better condition areas of this community will be retained within the wider Hornsby Quarry site outside of the project footprint and in the adjoining National Park (around 15 hectares).

- The vegetation to be impacted comprises the highly modified and degraded, poor condition edges of larger tracts of vegetation, and the proposal will not substantially increase existing levels of fragmentation and isolation from other areas of habitat
- No critical habitat has been listed for this community and the proposal will not impact any areas of critical habitat.
- Landscaping works following completion of the proposal will focus on revegetating areas of Blue Gum High Forest, and will improve the condition of the community at the site in the long-term.

5.4.3 Threatened flora species

No threatened flora species were recorded during recent and previous surveys at the Hornsby Quarry site. No threatened flora species are considered 'likely' to occur within the project site given a lack of suitable habitat, highly modified vegetation and modified soil profiles and landforms. A total of 18 species have a 'possible' likelihood of occurrence, given the presence of broadly suitable habitat, however given the modified nature of the site, there is little chance that they would actually occur within the project site. As such, no assessments of significance pursuant to s5A of the EP&A Act have been prepared for threatened flora species.

5.4.4 Threatened fauna species

The project would remove up 2.50 hectares of canopied native vegetation and 3.39 hectares of grassland vegetation within the project site. This habitat is highly modified and subject to disturbance including edge effects and noise from the surrounding urban environment. Up to five hollow-bearing trees would be removed. These have small hollows and would not provide breeding habitat for forest owls or cockatoos. Large areas of good quality habitat occur in adjacent areas. Foraging resources for threatened fauna that would be affected by the project are likely to be only a small proportion of the foraging habitat used by these species in the locality. Large areas of forest are present in adjacent areas, including within Berowra Valley National Park.

Table 5.3 outlines the potential impacts the project may have on threatened fauna species recorded or that have potential habitat in the project area. Assessments of significance pursuant to s5A of the EP&A Act have been prepared for species assessed as having a moderate or high level of impact as a result of the project (see Table 5.3). These include species recorded at the Hornsby Quarry site and hollow-dependent microchiropteran bats. These species are discussed in more detail below.

The Powerful Owl was recorded roosting on site by Kleinfelder (2017), and feathers were recorded by GHD. Prey species including Brush-tailed Possums and Ringtail Possums were recorded at the site. These owl species is likely to forage at the site on a regular basis. A small area of roosting habitat is present, however the species is more likely to roost away from disturbed edges. No hollow-bearing trees suitable for breeding were observed at the site, however suitable hollows are likely to occur in adjacent habitat, particularly along drainage lines. The site is likely to be part of the home range of one pair of Powerful Owls. Pairs are known to defend a territory of over 400 ha, and sometimes over 1000 ha. The home range tends to be centres on large patches of bushland, but they do forage in urban areas. The project would remove 2.50 hectares of modified vegetation that is foraging and roosting habitat for this species. This would make up a minor proportion of the home range of the pair. No breeding habitat is likely to be impacted. An assessment of significance pursuant to s5A of the EP&A Act has been prepared for this species. Given the small area of disturbed edge-effected vegetation, and the very large areas of surrounding good quality habitat, and lack of impact on breeding habitat, the project is unlikely to result in a significant impact on this species.

The Varied Sittella was recorded during previous surveys in the study area. The project would remove about 2.50 hectares of habitat for this species. The loss of this vegetation would reduce the total area of habitat for this threatened woodland bird species in the locality. The Varied Sittella requires large patches of intact vegetation for its survival, and may only occur at in the project site on a transient basis given the lower condition of the vegetation compared to surrounding areas. An assessment of significance pursuant to s5A of the EP&A Act has been prepared for this species. Given the small area of disturbed edge-effected vegetation, and the very large areas of surrounding good quality habitat, the project is unlikely to result in a significant impact on this species.

Hollow-dependent microchiropteran bats such as the Eastern Freetail Bat, Greater Broad-nosed Bat and Yellow-bellied Sheathtail Bat may roost in the project site. The project would remove up to five hollow-bearing trees within the project site that may provide roosting habitat for threatened microchiropteran bats. Microchiropteran bats are known to use multiple roost sites, and would likely also use hollows outside the project site. Large areas of forest containing hollow-bearing trees are present in adjacent areas, including within Berowra Valley National Park. There is a risk, however of mortality of any individuals that may be present at the time of vegetation removal. None of these species have been recorded at the site during GHD or other surveys, but there are records in the locality. There are large areas of potential roosting and breeding habitat in the locality for this species, including within the adjacent Berowra Valley National Park. Microchiropteran bats are known to use multiple hollows. These highly mobile species forage across very large areas, and some are known to travel up to 12 km in one night. An assessment of significance pursuant to s5A of the EP&A Act has been prepared for this species. Given the small area of disturbed edge-effected vegetation, lack of records at the project site, and the very large areas of surrounding good quality habitat, the project is unlikely to result in a significant impact on these species.

A range of mitigation measures are proposed to minimise impacts on threatened species that may be present in the proposal area during construction or that occur in surrounding habitats (see Section 6.2).

Table 5.3 Potential impacts on threatened fauna species

Species	TSC Act	EPBC Act	Species Credit species	Potential impact	Level of impact	Assessment of significance prepared	Outcome
Powerful Owl (*Ninox strenua*)	V		No	Known roosting and foraging habitat would be removed. No hollow-bearing trees suitable for breeding were recorded in the project site. Large areas of suitable habitat occur in adjacent areas, including within reserves.	Moderate – loss of known foraging and roosting habitat for a breeding pair.	Yes	No significant impact likely
Barking Owl (*Ninox connivens*)	V		No	Potential roosting and foraging habitat would be removed. No hollow-bearing trees suitable for breeding were recorded in the project site. Large areas of suitable habitat occur in adjacent areas, including within reserves.	Low – loss of a small area of potential foraging habitat	No	
Masked Owl (*Tyto novaehollandiae*)	V		No	Potential roosting and foraging habitat would be removed. No hollow-bearing trees suitable for breeding were recorded in the project site. Large areas of suitable habitat occur in adjacent areas, including within reserves.	Low – loss of a small area of potential foraging habitat	No	
Sooty Owl (*Tyto tenebricosa*)	V		No	Potential roosting and foraging habitat would be removed. No hollow-bearing trees suitable for breeding were recorded in the project site. Large areas of suitable habitat occur in adjacent areas, including within reserves.	Low – loss of a small area of potential foraging habitat	No	
Gang-gang Cockatoo (*Callocephalon fimbriatum*)	V, EP		Yes	Potential roosting and foraging habitat would be removed. No hollow-bearing trees suitable for breeding were recorded in the project site. Large areas of suitable habitat occur in adjacent areas, including within reserves.	Low – loss of a small area of potential foraging habitat	No	
Glossy Black-cockatoo	V		No	Potential roosting and foraging habitat would be removed. No hollow-bearing trees suitable for breeding were recorded	Low – loss of a small area of potential	No	

Species	TSC Act	EPBC Act	Species Credit species	Potential impact	Level of impact	Assessment of significance prepared	Outcome
(*Calyptorhynchus lathami*)				in the project site. Large areas of suitable habitat occur in adjacent areas, including within reserves.	foraging habitat		
Varied Sittella (*Daphoenositta chrysoptera*)	V		No	Area of foraging habitat and potential breeding habitat would be removed. Large areas of suitable habitat occur in adjacent areas, including within reserves.	Moderate – loss of known foraging habitat and potential breeding habitat	Yes	No significant impact likely
Grey-headed Flying-fox (*Pteropus poliocephalus*)	V	V	No	Area of foraging habitat would be removed. No breeding habitat would be impacted. Large areas of suitable habitat occur in adjacent areas, including within reserves.	Low – loss of a small area of potential foraging habitat	No	
Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*)	V		No	Area of foraging habitat would be removed. No breeding habitat would be impacted. Large areas of suitable habitat occur in adjacent areas, including within reserves.	Low – loss of a small area of potential foraging habitat	No	
Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)	V		No	Area of potential foraging habitat would be removed. No breeding habitat would be impacted. Large areas of suitable habitat occur in adjacent areas, including within reserves.	Low – loss of a small area of potential foraging habitat	No	
Eastern Freetail Bat (*Mormopterus norfolkensis*)	V		No	Area of potential foraging habitat and potential breeding habitat would be removed. Large areas of suitable habitat occur in adjacent areas, including within reserves.	Moderate - loss of potential foraging and breeding habitat. Risk of mortality.	Yes	No significant impact likely
Greater Broad-nosed Bat	V		No	Area of potential foraging habitat and potential breeding habitat would be	Moderate - loss of	Yes	No significant impact likely

Species	TSC Act	EPBC Act	Species Credit species	Potential impact	Level of impact	Assessment of significance prepared	Outcome
(*Scoteanax rueppellii*)				removed. Large areas of suitable habitat occur in adjacent areas, including within reserves.	potential foraging and breeding habitat. Risk of mortality.		
Little Bentwing Bat (*Miniopterus australis*)	V		No	Area of foraging habitat would be removed. No breeding habitat would be impacted. Large areas of suitable habitat occur in adjacent areas, including within reserves.	Low – loss of a small area of potential foraging habitat	No	
Yellow-bellied Sheathtailed Bat (*Saccolaimus flaviventris*)	V		No	Area of potential foraging habitat and potential breeding habitat would be removed. Large areas of suitable habitat occur in adjacent areas, including within reserves.	Moderate - loss of potential foraging and breeding habitat. Risk of mortality.	Yes	No significant impact likely
Rosenberg's Goanna (*Varanus rosenbergi*)	V		Yes	Area of low quality potential foraging habitat and potential breeding habitat would be removed. Large areas of suitable habitat occur in adjacent areas, including within reserves.	Low – loss of a small area of potential foraging habitat	No	
Spotted-tailed Quoll (*Dasyurus maculatus*)	V	V	No	Area of low quality potential foraging habitat and potential breeding habitat would be removed. Large areas of suitable habitat occur in adjacent areas, including within reserves.	Low – loss of a small area of potential foraging habitat	No	

5.5 Impacts on Commonwealth-listed threatened biota

5.5.1 Threatened ecological communities

No threatened ecological communities as listed under the EPBC Act occur within the site or would be impacted by the proposal. The Blue Gum High Forest in the site does not meet the condition criteria for inclusion as the EPBC Act-listed form of the community. As such, no assessment of significance in accordance with the MNES *Significant Impact Guidelines 1.1* (DoE, 2013) have been prepared for Blue Gum High Forest.

5.5.2 Threatened flora species

No threatened flora species listed under the EPBC Act are considered 'likely' to occur within the project site given a lack of suitable habitat, highly modified vegetation and modified soil profiles and landforms. A total of 11 species listed under the EPBC Act have a 'possible' likelihood of occurrence, given the presence of broadly suitable habitat, however given the modified nature of the site, there is little chance that they would actually occur within the project site. As such, no assessment of significance in line with the MNES *Significant Impact Guidelines 1.1* (DoE, 2013) have been prepared for threatened flora species.

5.5.3 Threatened species

The project would clear a small area of potential habitat for the Grey-headed Flying-fox and Spotted-tailed Quoll (see Table 5.3). Large areas of better quality habitat are located in nearby areas. No assessments of significance in accordance with the EPBC Act Significant Impact Guidelines 1.1 are therefore considered necessary.

5.5.4 Migratory species

No migratory species were recorded within the site, however a number of migratory birds that occur in forest and woodland habitats have the potential to occur on occasion (see Appendix A). The project will remove up to 2.5 ha of native vegetation within the project site, but is unlikely to substantially modify, destroy or isolate an area of important habitat for any of these species. Large areas of native vegetation are present in the locality. The proposal is unlikely to seriously disrupt the lifecycle of a significant proportion of the population of any of these species. No assessments of significance are considered necessary.

6. Mitigation

6.1 Avoidance of impacts

The project site is located on land which has been previously modified by land clearing for quarrying. Mapping of biodiversity values, in particular threatened ecological communities, early in the project has allowed some avoidance of impacts in the detail design phase. Notably the project has been purposefully designed to minimise direct impacts on areas of good condition Blue Gum High Forest. A number of iterations of the proposal design have been made, each one further minimising impacts on native vegetation and fauna habitat, and increasing impacts on exotic vegetation and/or hardstand or quarry areas. This has allowed impacts on biodiversity values to be substantially reduced. A comparison of the area of vegetation clearing required for three design iterations is provided in Table 6.1.

Table 6.1 Design iterations and changes to vegetation clearing

Veg Zone ID	Veg Zone	Clearing area (ha)		
		February 2018 design	September 2018 design	October 2018 design
1	Blackbutt Gully Forest (HN648, Moderate/good - high)	0.94	0.26	0.26
2	Blackbutt Gully Forest (HN648, Moderate/good - poor)	3.71	1.53	1.50
5	Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest (HN596, Moderate/good-poor) (CEEC TSC Act)	4.65	0.90	0.74
6	Exotic vegetation (Blackbutt Gully Forest (HN648, Low)	2.98	3.41	3.39
8	Hardstand	1.72	0.77	0.90
9	Quarry Void	2.77	1.41	2.28
	Total area	16.77	8.28	9.07
	Native vegetation	9.30	1.79	2.50
	Blue Gum High Forest	4.65	0.90	0.74

6.2 Mitigation of impacts

6.2.1 Construction

In order to address the potential impacts of the project on biodiversity and to reduce the operation of KTPs as discussed in section 5.3, the mitigation measures outlined in Table 6.2 would be implemented.

Table 6.2 Mitigation measures: construction

Impact	Mitigation	Timing	Effectiveness
Seed collection	• Collection of seeds and propagules from areas of Blue Gum High Forest should be considered prior to vegetation clearing occurring. Seeds (if collected) should be planted in Council's community nursery and any individuals grown used for on-site plantings during creation of the parkland.	Pre-construction	Proven - has been used effectively in many projects
General	• Ensure all workers are provided an environmental induction prior to starting work in the project area. This would include information on the ecological values of the study area, protection measures to be implemented to protect biodiversity and penalties for breaches. • Prepare a flora and fauna management plan as part of the Construction Environmental Management Plan (CEMP), incorporating recommendations below, and expanding where necessary.	Pre-construction	Proven - has been used effectively in many projects
Vegetation clearing	• Limit disturbance of vegetation to the minimum necessary to construct works. • Where the project area adjoins native vegetation, mark the limits of clearing and install temporary protective fencing around the vegetated area prior to the commencement of construction activities to avoid unnecessary vegetation and habitat removal. • Restrict equipment storage and stockpiling of resources to designated areas in cleared land.	Construction	Proven - has been used effectively in many projects
Weeds	• Develop weed management actions to manage weeds during the construction phase of the project. This would include the management and disposal of the weeds that were recorded within the project area including the priority weeds listed in section 4.2.3 in accordance with the Biosecurity Act. • Vehicles and other equipment to be used within the project site should be cleaned to prevent the introduction of further exotic plant species or disease.	Construction	Proven - has been used effectively in many projects
Fauna habitat	• An unexpected finds procedure should be developed for any threatened biota or habitat resources detected during pre-clearing or clearing surveys or revealed by other sources.	Construction	Proven - has been used effectively in many projects

	• Protocols to prevent introduction or spread of chytrid fungus should be implemented following OEH Hygiene protocol for the control of disease in frogs (DECC, 2008b). • A trained ecologist should be present during the clearing of native vegetation or removal of potential fauna habitat to avoid impacts on resident fauna and to salvage habitat resources as far as is practicable. Clearing surveys should include: – inspections of native vegetation for resident fauna and/or nests or other signs of fauna occupancy – inspection of culverts proposed for demolition/removal for roosting microbats prior to works commencing – inspection and identification/marking of hollow-bearing trees and termite mounds – protocols for the removal of hollow-bearing trees and termite mounds must be developed prior to removal to minimise mortality or injury of native fauna – capture and relocation or captive rearing of less mobile fauna (such as nestling birds) by a trained fauna handler and with assistance from Wildlife Information Rescue and Education Service (WIRES) as required – salvage of habitat features such as mature tree trunks and woody debris from the project area for future use in the parkland or surrounding areas. • Clearing of mature, native trees should be minimised where possible and exclusion barriers set up to prevent indirect impacts.		
Water Quality	• Erosion and sediment control plans should be prepared in accordance with Volume 2D of Managing Urban Stormwater: Soils and Construction (DECC, 2008c). The erosion and sediment control plans would be established prior to the commencement of construction and be updated and managed throughout as relevant to the activities during the construction phase. • All water discharge into creeks would be guided by the ANZECC Water Quality Guidelines (2000). • Temporary scour protection and energy dissipation measures should be designed to protect receiving environments from erosion. • Erosion and sediment control measures should be established prior to construction.	Construction.	Proven - has been used effectively in many projects

	• Erosion and sediment control measures should be regularly inspected, particularly following rainfall events, to ensure their ongoing functionality. • Stabilised surfaces should be reinstated as quickly as practicable after construction. • All stockpiled material should be stored in bunded areas and kept away from waterways to avoid sediment entering the waterway. • Water should be applied to exposed surfaces that are causing dust generation. Surfaces may include unpaved roads, stockpiles, hardstand areas and other exposed surfaces (for example recently graded areas). • Vehicles must follow appropriate speeds to limit dust generation.		

6.2.2 Operation

The final created landform will be developed into a major parkland generally in accordance with the adopted Hornsby Shire Council (2015) *Hornsby Park Plan of Management (including Hornsby Quarry and Old Mans Valley)*. The future development of the parkland including landscaping and installation of recreational facilities is a separate project and will be subject to a separate approval process. Table 6.3 sets out recommendations for future landscaping and other mitigation measures to minimise indirect impacts on surrounding bushland areas.

Table 6.3 Mitigation measures: operation

Impact	Mitigation	Timing
Flora	• Planting of locally endemic species, characteristic of Blue Gum High Forest and Blackbutt Gully Forest • Use of tube stock grown from seed collected from local sites that support remnant, intact stands of comparable vegetation..	Following groundworks
Fauna	• Reuse of salvaged hollows and logs in the parkland	Following groundworks
Weeds	• Ongoing management of priority weeds according to legislative requirements.	Throughout operation of the parkland
Water quality	• Ongoing water quality management	Throughout operation of the parkland

6.3 Offsetting of impacts

Hornsby Shire Council has developed the Green Offsets Code to manage impacts on native vegetation as a result of developments. The code identifies offset multipliers for different categories of vegetation and habitat. The proponent is required to undertake offset works comprising the restoration of a degraded patch of vegetation or the creation of a complementary patch of vegetation equivalent to the offset area.

An offset package for the project would be developed in accordance with Hornsby Shire Council's Green Offsets Code and with reference to OEH's recommendations (Table 1.2).

6.4 Assessment of maintenance or improvement of biodiversity values

While the project would result in the clearing of 2.5 ha of native vegetation, a substantial revegetation program is proposed following completion of the reprofiling activities. The planting program would target canopy, shrub and groundcover species. Species selected must be representative of Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest (HN596) (Blue Gum High Forest). Plants will be of local provenance. All seed collection and plant supply activities should be in accordance with Florabank Guidelines & Code of Practice (www.florabank.org.au).

A suitable planting medium, including top soil profile, will be installed in areas proposed for revegetation. Soils will be sourced from site during construction activities, stored and then applied to the planting areas once the final landform is achieved. While much of the site is highly disturbed, Sydney Environmental Soil Laboratory (2018) found a 30 year soil profile in the north-eastern section of the Hornsby Quarry site which can be used as a benchmark for developing soil profile and fertility concepts for the revegetation. Council with the assistance of Sydney Environmental Soil Laboratory propose to manufacture a new soil to replicate the natural soils for the Blue Gum High Forest part of the quarry rehabilitation.

The project would result in the clearing of 2.5 ha of highly modified and weed-infested native vegetation. Revegetation would include areas of replantings containing canopy, shrub and groundcover species. The lake, properly designed and managed, would encourage the growth of submerged and emergent aquatic flora, which would in turn provide additional habitats for fauna. The reuse of salvaged hollows and logs in the parkland would further improve fauna habitat values. The restoration of a degraded patch of vegetation or the creation of a complementary patch of vegetation, and the provision of nest boxes, is required by Council's Green Offsets Code to offset impacts of the project on native vegetation and threatened species habitats. Based on these points, the future rehabilitation of the project site and provision of offsets would improve biodiversity values at the site and nearby areas in the long-term.

7. Conclusion

Hornsby Quarry operated from the early 1900s to the 1990s. The quarry was acquired by Hornsby Shire Council in 2002, and the quarry void has been closed to the public as it poses a potential risk to public safety due to its depth and steep exposed sides. About one million cubic metres of spoil from the NorthConnex tunnel has been placed into the quarry void. Additional filling and stabilisation works are still required, which are the subject of the current proposal. Following these bulk earthworks, Hornsby Shire Council will perform landscaping works (which will form a separate project) to create a new reserve named Hornsby Park, which is expected be open to the public in the mid-2020s.

The site is characterised by dramatic topography, which generally falls from the east to the west. The steeper parts of the site has many slopes that exceed a gradient of 25 percent. The majority of the site has been highly modified as a result of historical quarrying and rehabilitation works, and the landform and soil profile has been significantly altered. Vegetation within the site is a mixture of remnant, regrowth, revegetation and rehabilitation.

Field surveys confirmed the presence and distribution of two native PCTs in varying condition at the site:

- Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest (HN596, Moderate/good - poor), which is commensurate with Blue Gum High Forest in the Sydney Basin Bioregion (BGHF), a critically endangered ecological community (CEEC) listed under the TSC Act. This form of the community does not meet the condition criteria for inclusion as the EPBC Act-listed community.
- Blackbutt Gully Forest (HN648) (not a threatened community).

The proposal would remove 0.74 ha of Blue Gum High Forest and 1.76 ha of Blackbutt Gully Forest. This area of clearing has been substantially reduced through various iterations of the design, specifically to minimise impacts on Blue Gum High Forest. No threatened flora species are considered ‘likely’ to occur within the project site given a lack of suitable habitat, highly modified vegetation and modified soil profiles and landforms.

The proposal would impact a small area of disturbed habitat for threatened fauna species. Up to 2.50 ha of native vegetation that is foraging habitat for threatened fauna species such as the Powerful Owl, Varied Sittella and Eastern Bentwing Bat (among others), and up to five hollow-bearing trees that may provide roosting habitat for smaller species would be removed.

Assessments of significance pursuant to s5A of the EP&A Act have been prepared for these threatened biota. Given the small area of impact and large areas of habitat present in the locality and/or immediately adjacent to the study area, the proposal is unlikely to have a significant impact on any threatened biota within the study area. As such, a species impact statement is not required.

A range of mitigation measures have been proposed to ameliorate potential impacts of the proposal on habitat throughout the study area, as well as areas downstream of the proposed works. These include provision of no-go zones to protect native vegetation, fauna management protocols, site-specific erosion and sedimentation management strategies and revegetation following construction. Future revegetation would improve biodiversity values in the long term.

An offset package for the project would be developed in accordance with Hornsby Shire Council’s Green Offsets Code and with reference to OEH’s recommendations. As the proposal is unlikely to have a significant impact on any MNES, no referral is considered necessary and no offset is required for threatened biota listed under the EPBC Act.

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Appendices

Appendix A – Likelihood of occurrence of threatened and migratory biota in the study area

Threatened flora species predicted to occur within the locality of the site

Scientific name	Common name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence
Acacia bynoeana	Bynoe's Wattle	E	V	10 records within 10km (OEH 2017a); Species or species' habitat known to occur within 10km (DoEE 2017a)	Endemic to central eastern NSW, currently known from only 34 locations, many of only 1-5 plants. Grows mainly in heath/ dry sclerophyll forest on sandy soils, prefers open, sometimes slightly disturbed sites such as trail margins, road edges, and in recently burnt open patches. Flowers September to March, and fruit matures in November.	Unlikely. No suitable habitat present on site.
Acacia clunies-rossiae	Kanangra Wattle	V		1 record within 10km (OEH 2017a)	Occurs within the Kowmung and Cox's River areas, entirely within Kanangra-Boyd and Blue Mountains National Parks. Grows on skeletal soils on rocky slopes, or on alluvium along creeks Flowering occurs in spring.	Unlikely. Outside of known range.
Acacia gordonii		E	E	1 record within 10km, last recorded 2003 (OEH 2017a)	Disjunct populations in the lower Blue Mountains and the South Maroota/Glenorie areas, within the Hawkesbury, The Hills and Blue Mountains LGAs. Grows in dry sclerophyll forest and heathlands amongst or within rock platforms on sandstone outcrops.	Unlikely. Outside of known range.
Acacia pubescens	Downy Wattle	V	V	9 records within 10km (OEH 2017a); Species or species' habitat known to occur within 10km (DoEE 2017a)	Occurs mainly in Bankstown-Fairfield-Rookwood and Pitt Town areas, with outliers at Barden Ridge, Oakdale and Mountain Lagoon. Grows on alluviums, shales and shale/sandstone intergrades. Soils characteristically gravely, often with ironstone. Occurs in open woodland and forest, in communities including Cooks River/ Castlereagh Ironbark Forest, Shale/ Gravel Transition Forest and Cumberland Plain Woodland. Flowers August to October.	Unlikely. No suitable habitat present on site.

Scientific name	Common name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence
Allocasuarina glareicola		E	E	Species or species' habitat may occur within 10km (DoEE 2017a)	Primarily restricted to small populations in and around Castlereagh NR (NW Cumberland Plain), but with an outlier population at Voyager Point, Liverpool. Also reported from Holsworthy Military Area. Grows on tertiary alluvial gravels, with yellow clayey subsoil and lateritic soil. Occurs in Castlereagh open woodland.	Unlikely. No suitable habitat present on site.
Ancistrachne maidenii		V		6 records within 10km, last recorded 2005 (OEH 2017a)	Restricted to 2 disjunct areas: Northern Sydney within the St Albans, Mt White to Berowra area and in the Shannon Creek area near Grafton, with only 7 known populations. Occurs in dry sclerophyll forest on sandstone derived soils at the transition between Hawkesbury and Watagan soil landscapes.	Unlikely. Site is not at the transition between Hawkesbury and Watagan soil landscape.
Asterolasia elegans		E	E	Species or species' habitat likely to occur within 10km (DoEE 2017a)	Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby LGAs, may also occur in the western part of Gosford LGA. 7 known populations. Occurs on Hawkesbury sandstone, commonly amongst rocky outcrops and boulders in sheltered forests on mid- to lower slopes and valleys.	Possible. Suitable habitat present on site. Not recorded in Kleinfelder (2017) or Ecological (2015) surveys.
Callistemon linearifolius	Netted Bottle Brush	V		10 records within 10km (OEH 2017a)	Recorded from the Georges to Hawkesbury Rivers in Sydney, and north to Nelson Bay. There is also a recent record from the northern Illawarra. In Sydney, recent records are limited to the Hornsby Plateau area near the Hawkesbury River. Grows in dry sclerophyll forest on the coast and adjacent ranges.	Possible. Suitable habitat present on site. Not recorded in Kleinfelder (2017) or Ecological (2015) surveys.

Scientific name	Common name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence
Cryptostylis hunteriana	Leafless Tongue-orchid	V	V	Species or species' habitat likely to occur within 10km (DoEE 2017a)	Occurs in coastal areas from East Gippsland to southern Queensland. Habitat preferences not well defined. Grows mostly in coastal heathlands, margins of coastal swamps and sedgelands, coastal forest, dry woodland, and lowland forest. Prefers open areas in the understorey and is often found in association with Large Tongue Orchid and the Bonnet Orchid. Soils include moist sands, moist to dry clay loam and occasionally in accumulated eucalypt leaves. Flowers November-February.	Unlikely. No suitable habitat present on site.
Darwinia biflora		V	V	346 records within 10km (OEH 2017a); Species or species' habitat likely to occur within 10km (DoEE 2017a)	Known from north and north-western Sydney, in the Ryde, Baulkham Hills, Hornsby and Ku-Ring-Gai LGAs. Grows on the edges of weathered shale-capped ridges, at the intergrade with Hawkesbury Sandstone. Occurs in woodland, open forest and scrub/heath. Associated overstorey species include Scribbly Gum, Red Bloodwood and/or Scaly Bark.	Possible. Suitable habitat present on site. Not recorded in Kleinfelder (2017) or Ecological (2015) surveys.
Darwinia peduncularis		V		19 records within 10km (OEH 2017a)	Disjunct populations in coastal NSW with isolated populations in the Blue Mountains. Recorded from Brooklyn, Berowra, Galston Gorge, Hornsby, Bargo River, Glen Davis, Mount Boonbourwa and Kings Tableland. Usually grows in dry sclerophyll forest on hillsides and ridges, on or near rocky outcrops on sandy, well drained, low nutrient soil over sandstone.	Possible. Suitable habitat present on site. Not recorded in Kleinfelder (2017) or Ecological (2015) surveys.

Scientific name	Common name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence
Diuris bracteata		E	X	1 record within 10km, last recorded 1999 (OEH 2017a)	Extant populations known only from north-west of Gosford. Historically collected at Gladesville in northern Sydney. Grows in dry sclerophyll forest and woodland with a grassy understorey.	Unlikely. Outside of known range.
Epacris purpurascens var. *purpurascens*		V		249 records within 10km (OEH 2017a)	Occurs from Gosford in the north, Narrabeen in the east, Silverdale in the west and Avon Dam vicinity in the South. Grows in a range of sclerophyll forest, scrubs and swamps, most of which have a strong shale soil influence.	Possible. Suitable habitat present on site. Not recorded in Kleinfelder (2017) or Ecological (2015) surveys.
Eucalyptus camfieldii	Camfield's Stringybark	V	V	14 records within 10km (OEH 2017a); Species or species' habitat likely to occur within 10km (DoEE 2017a)	Occurs from Raymond Terrace to Waterfall, with populations known from Norah Head (Tuggerah Lakes), Peats Ridge, Mt Colah, Elvina Bay Trail (West Head), Terrey Hills, Killara, North Head, Menai and the Royal NP. Occurs in exposed situations on sandstone plateaus, ridges and slopes near the coast, often on the boundary of tall coastal heaths or low open woodland. It grows in shallow sandy soils overlying Hawkesbury sandstone.	Possible. Suitable habitat present on site. Not recorded in Kleinfelder (2017) or Ecological (2015) surveys.
Eucalyptus nicholii	Narrow-leaved Black Peppermint	V	V	7 records within 10km (OEH 2017a)	Naturally occurs only in New England Tablelands from Nundle to north of Tenterfield. Widely planted as urban street tree. Grows in dry grassy woodland, on shallow and infertile soils, mainly on granite.	Nil. Outside of natural range. Any occurrences are planted and not considered threatened for the purposes of this assessment.

Scientific name	Common name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence
Eucalyptus scoparia	Wallangarra White Gum	E	V	3 records within 10km, last recorded 2005 (OEH 2017a)	Occurs mostly in Queensland with only three known occurrences in NSW near Tenterfield. In NSW it is found on well-drained granitic hilltops, slopes and outcrops, often as scattered trees in open forest and woodland.	Nil. Outside of natural range. Any occurrences are planted and not considered threatened for the purposes of this assessment.
Eucalyptus sp. Cattai		CE		2 records within 10km (OEH 2017a)	Occurs between Colo Heights and Castle Hill, in NW Sydney, though it historically extended through to central areas of Sydney. Grows in scrub, heath and low woodland on sandy soils, generally on flat ridge tops.	Unlikely. No suitable habitat present on site.
Galium australe	Tangled Bedstraw	E		7 records within 10km (OEH 2017a)	In NSW currently known from 13 locations between Sydney and Eden, with an outlying record from Byabarra on the north coast. Range of habitats in NSW including a valley floor, alluvial soil beside a creek, heathland in a rocky gully, and the top of an escarpment above a creek. In other states known from a range of near-coastal habitats.	Possible. Suitable habitat present on site. Not recorded in Kleinfelder (2017) or Ecological (2015) surveys.
Genoplesium baueri	Bauer's Midge Orchid	E	E	51 records within 10km (OEH 2017a); Species or species' habitat known to occur within 10km (DoEE 2017a)	Occurs from Ulladulla to Port Stephens, with only 13 known extant populations. Grows in sparse sclerophyll forest and moss gardens over sandstone	Possible. Suitable habitat present on site. Not recorded in Kleinfelder (2017) or Ecological (2015) surveys.

Scientific name	Common name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence
Grammitis stenophylla	Narrow-leaf Finger Fern	E		9 records within 10km (OEH 2017a)	Occurs along the coast of NSW and as far west as Narrabri. Grows in small colonies in moist places, usually near streams, on rocks and in trees in rainforest and moist eucalypt forest.	Possible. Suitable habitat present on site. Not recorded in Kleinfelder (2017) or Ecological (2015) surveys.
Grevillea caleyi	Caley's Grevillea	CE	E	9 records within 10km (OEH 2017a); Species or species' habitat likely to occur within 10km (DoEE 2017a)	Restricted to 8 km square area around Terrey Hills. All remnants occur on ridge tops between elevations of 170 to 240 m, in association with laterite soils and a vegetation community of open forest, usually Silvertop Ash and Red Bloodwood.	Unlikely. Outside of known range.
Grevillea juniperina subsp. *juniperina*	Juniper-leaved Grevillea	V		1 record within 10km, last recorded 2003 (OEH 2017a)	Occurs only within western Sydney in an area bounded by Blacktown, Erskine Park, Londonderry and Windsor. Outlier populations also at Kemps Creek and Pitt Town. Grows on reddish clay to sandy soils derived from Wianamatta Shale and Tertiary alluvium, typically containing lateritic gravels. Occurs in association with Cumberland Plain Woodland, Castlereagh Ironbark Woodland, Castlereagh Scribbly Gum Woodland and Shale/Gravel Transition Forests.	Unlikely. No suitable habitat present on site.
Grevillea parviflora subsp. *parviflora*	Small-flower Grevillea	V	V	1 record within 10km (OEH 2017a)	Occurs between Moss Vale/Bargo and lower Hunter Valley, with most occurrences in Appin, Wedderburn, Picton and Bargo. Broad habitat range including heath, shrubby woodland and open forest on light clay or sandy soils, and often in disturbed areas such as on the fringes of tracks.	Unlikely. No suitable habitat present on site.

Scientific name	Common name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence
Grevillea parviflora subsp. *supplicans*		E		6 records within 10km (OEH 2017a)	Has a very restricted range and is confined to north-west Sydney near Arcadia and the Maroota-Marramarra Creek area in the Hornsby and Baulkim Hills LGA's. Occurs in eathy woodland associations on skeletal sandy soils over sandstone (OEH 2013).Preference for yellow clays with periodically impeded drainage. Affinity wtih disturbance margins such as trail/road verges where soils are suitable and there is available light.	Unlikely. No suitable habitat present on site.
Grevillea shiressii		V	V	Species or species' habitat may occur within 10km (DoEE 2017a)	Known from only 2 populations near Gosford (at Mooney Mooney Creek and Mullet Creek). Grows along creek banks in wet sclerophyll forest with a moist understorey in alluvial sandy or loamy soils.	Unlikely. Outside of known range.
Haloragis exalata subsp. *exalata*	Wingless Raspwort	V	V	Species or species' habitat may occur within 10km (DoEE 2017a)	Occurs in 4 widely scattered localities in eastern NSW, in the central coast, south coast and north-western slopes. Requires protected and shaded damp situations in riparian habitats.	Unlikely. No suitable habitat present on site.
Haloragodendron lucasii		E	E	Species or species' habitat likely to occur within 10km (DoEE 2017a)	Known from 9 sites in a 10km range in the Gordon-Hornsby area. Occurs on Hawkesbury Sandstone in moist sandy loam soil. Prefers sheltered aspects and gentle slopes below cliff lines near creeks in low open woodland or open forest. Distribution correlated with high soil moisture and phosphorus levels.	Possible. Suitable habitat present on site. Not recorded in Kleinfelder (2017) or Ecological (2015) surveys.
Hibbertia spanantha	Julian's Hibbertia	CE	CE	Species or species' habitat known to occur within 10km (DoEE 2017a)	Endemic to NSW where it is restricted to a single population located in the northern Sydney suburb of Turramurra. This species grows in a forest with canopy species including Blackbutt, Red Mahogany, Red Bloodwood and Sydney Red Gum (Toelken	Possible. Suitable habitat present on site. Not recorded in Kleinfelder (2017) or

Scientific name	Common name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence
					in litt. April 2014). The understorey is open with species of Poaceae, Orchidaceae and Fabaceae present.	Ecological (2015) surveys.
Hibbertia superans		E		52 records within 10km (OEH 2017a)	Occurs from Castle Hill to South Maroota, and an isolated population near Kempsey. Grows on sandstone ridgetops often near the shale/sandstone boundary, in open woodland and heathland. Prefers open /disturbed areas, such as tracksides.	Possible. Suitable habitat present on site. Not recorded in Kleinfelder (2017) or Ecological (2015) surveys.
Kunzea rupestris		V	V	1 record within 10km (OEH 2017a)	Restricted, with most locations in the Maroota - Sackville - Glenorie area and one outlier in Ku-ring-gai Chase National Park, all within the Central Coast botanical subdivision of NSW (OEH 2013). Grows in shallow depressions on large flat sandstone rock outcrops - generally found in short to tall shrubland or heathland.	Unlikely. No suitable habitat present on site.
Lasiopetalum joyceae		V	V	37 records within 10km (OEH 2017a); Species or species' habitat likely to occur within 10km (DoEE 2017a)	Occurs on Hornsby Plateau between Berrilee and Duffys Forest, south of the Hawkesbury. Grows on lateritic to shaley ridgetops, in heath on sandstone.	Possible. Suitable habitat present on site. Not recorded in Kleinfelder (2017) or Ecological (2015) surveys.
Leptospermum deanei	Deane's Tea-tree	V	V	Species or species' habitat known to occur within 10km (DoEE 2017a)	Occurs in NW Sydney, in the Hornsby, Warringah, Ku-ring-gai and Ryde LGAs. Grows in woodland on lower hill slopes or near creeks, in sandy alluvial soil or sand over sandstone. Occurs in riparian scrub, woodland and open forest.	Unlikely. No suitable habitat present on site.

Scientific name	Common name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence
Leucopogon fletcheri subsp. *fletcheri*		E		10 records within 10km, last recorded 2002 (OEH 2017a)	Restricted to northwest Sydney between St Albans and Annangrove, within the Hawkesbury, The Hills and Blue Mountains LGAs. Occurs in dry eucalypt woodland or shrubland on clayey lateritic soils, generally on flat to gently sloping terrain along ridges and spurs. Flowers August to September.	Unlikely. Outside of known range.
Melaleuca biconvexa	Biconvex Paperbark	V	V	Species or species' habitat may occur within 10km (DoEE 2017a)	Scattered, disjunct populations in coastal areas from Jervis Bay to Port Macquarie, with most populations in the Gosford-Wyong areas. Grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects.	Unlikely. No suitable habitat present on site.
Melaleuca deanei	Deane's Paperbark	V	V	70 records within 10km (OEH 2017a); Species or species' habitat likely to occur within 10km (DoEE 2017a)	Occurs from Nowra- St Albans and west to the Blue Mountains, with most records in Ku-ring-gai / Berowra and Holsworthy/Wedderburn areas. Mostly grows on broad flat ridgetops, dry ridges and slopes and strongly associated with low nutrient sandy loam soils, sometimes with ironstone. Grows in heath- open forest, often in sandstone ridgetop woodland communities.	Possible. Suitable habitat present on site. Not recorded in Kleinfelder (2017) or Ecological (2015) surveys.
Pelargonium sp. Striatellum	Omeo Stork's-bill	E	E	Species or species' habitat may occur within 10km (DoEE 2017a)	Omeo Storksbill Pelargonium sp. (G.W. Carr 10345), syn. P. striatellum, is a tufted perennial forb known from only 3 locations in NSW, with two on lake-beds on the basalt plains of the Monaro and one at Lake Bathurst. It has a narrow habitat that is usually just above the high-water level of irregularly inundated or ephemeral lakes, in the transition zone between surrounding grasslands or pasture and the wetland or aquatic communities.	Unlikely. Outside of known range.

Scientific name	Common name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence
Persoonia hirsuta	Hairy Geebung	E	E	9 records within 10km (OEH 2017a); Species or species' habitat likely to occur within 10km (DoEE 2017a)	Occurs within the Blue Mountains, Southern Highlands and Sydney coastal regions from Hilltop to Glen Davis and Royal NP to Gosford. Population within the Hills Shire particularly important due to high density of plants. Grows on sandy soils in dry sclerophyll open forest, woodland and heath on sandstone up to 600m above sea level.	Possible. Suitable habitat present on site. Not recorded in Kleinfelder (2017) or Ecological (2015) surveys.
Persoonia mollis subsp. *maxima*		E	E	325 records within 10km (OEH 2017a); Species or species' habitat known to occur within 10km (DoEE 2017a)	Occurs in an approx. 5.75 x 7.5 km area in the Hornsby Heights-Mt Colah area. Grows in sheltered aspects of deep gullies or on the steep upper hillsides of narrow gullies on Hawkesbury Sandstone. These habitats support relatively moist, tall forest vegetation communities, often with mesic influences.	Possible. Suitable habitat present on site. Not recorded in Kleinfelder (2017) or Ecological (2015) surveys.
Pimelea curviflora var. *curviflora*		V	V	34 records within 10km (OEH 2017a); Species or species' habitat known to occur within 10km (DoEE 2017a)	Confined to area between north Sydney in the south and Maroota in the north-west. Former range extended to Parramatta River including Five Dock, Bellevue Hill and Manly. Grows on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Often grows amongst dense grasses and sedges. Flowers October to May.	Possible. Suitable habitat present on site. Not recorded in Kleinfelder (2017) or Ecological (2015) surveys.

Scientific name	Common name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence
Pimelea spicata	Spiked Rice-flower	E	E	Species or species' habitat may occur within 10km (DoEE 2017a)	Disjunct populations within the Cumberland Plain (from Mount Annan and Narellan Vale to Freemans Reach and Penrith to Georges Hall) and Illawarra (from Mt Warrigal to Gerroa) (DEC 2005). In the Cumberland Plain region, restricted to areas which support or historically supported Cumberland Plain Woodland. Grows on well-structured clay soils derived from Wianamatta Shale. In the Illawarra, grows on variable soils in close proximity to the coast on hills or coastal headlands. Inhabits coastal woodland or grassland with emergent shrubs (DEC 2005).	Unlikely. No suitable habitat present on site.
Pomaderris brunnea	Brown Pomaderris	E	V	1 record within 10km (OEH 2017a)	Mainly occurs in SW Sydney (Wollondilly and Camden LGAs), with other populations in the Hawkesbury-Wollemi region, near Walcha in the New England tablelands and Gippsland in VIC. In NSW, grows in moist woodland or open forest on clay and alluvial soils on flood plains and creek lines. Near Sydney occurs in open woodland dominated by Cabbage Gum with Allocasuarina sp. and Bursaria sp. understorey, or on alluvial flats with eucalypts including River Peppermint, Syndey Peppermint and Grey Gum (Sutter 2011).	Unlikely. No suitable habitat present on site.
Prostanthera marifolia	Seaforth Mintbush	CE	CE	Species or species' habitat may occur within 10km (DoEE 2017a)	Only known from a 2 x 2 km area in Seaforth, northern Sydney. Associated with the endangered Duffys Forest ecological community. Grows on deeply weathered clay-loam soils associated with ironstone and scattered shale lenses.	Unlikely. No suitable habitat present on site.

Scientific name	Common name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence
Pterostylis saxicola	Sydney Plains Greenhood	E	E	Species or species' habitat may occur within 10km (DoEE 2017a)	Occurs in western Sydney between Picton and Freemans Reach. Grows in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. Associated vegetation above these rock shelves is sclerophyll forest or woodland on shale or shale/sandstone transition soils.	Unlikely. No suitable habitat present on site.
Syzygium paniculatum	Magenta Lilly Pilly	E	V	31 records within 10km (OEH 2017a); Species or species' habitat known to occur within 10km (DoEE 2017a)	Occurs in narrow coastal strip from Bulahdelah to Conjola State Forest. Grows in rainforest on sandy soils or stabilised Quaternary sand dunes at low altitudes in coastal areas, often in remnant littoral or gallery rainforests.	Unlikely. No suitable habitat present on site.
Tetratheca glandulosa		V		277 records within 10km (OEH 2017a)	Restricted to The Hills, Gosford, Hawkesbury, Hornsby, Ku-ring-gai, Pittwater, Ryde, Warringah, and Wyong LGAs. Associated with shale-sandstone transition habitat (shale-cappings over sandstone). Occupies ridgetops, upper-slopes and to a lesser extent mid-slope sandstone benches. Soils generally shallow, yellow, clayey/sandy loam, commonly with lateritic fragments. Vegetation varies from heath to open forest and is broadly equivalent to Sydney Sandstone Ridgetop Woodland community.	Possible. Suitable habitat present on site. Not recorded in Kleinfelder (2017) or Ecological (2015) surveys.
Thesium australe	Austral Toadflax	V	V	Species or species' habitat may occur within 10km (DoEE 2017a)	Found in small, scattered populations along the east coast, northern and southern tablelands. Occurs in grassland or grassy woodland, and is often found in association with Kangaroo Grass.	Unlikely. No suitable habitat present on site.

Threatened fauna species predicted to occur within the locality of the site

Scientific name	Common name	TSC Act Status	EPBC Act Status	Source	Habitat association	Likelihood of occurrence
Botaurus poiciloptilus	Australasian Bittern	E	E	Species or species' habitat known to occur within 10km (DoEE 2017a)	Widespread but uncommon over most NSW except the northwest. Favours permanent freshwater wetlands with tall dense reedbeds particularly *Typha* spp. and *Eleocharis* spp., with adjacent shallow, open water for foraging. Roosts during the day amongst dense reeds or rushes and feeds mainly at night on frogs, fish, yabbies, spiders, insects and snails.	Nil. No freshwater wetland habitat present.
Rostratula australis	Australian Painted Snipe	E	E	Species or species' habitat likely to occur within 10km (DoEE 2017a)	Normally found in permanent or ephemeral shallow inland wetlands, either freshwater or brackish. Nests on the ground amongst tall reed-like vegetation near water. Feeds on mudflats and the water's edge taking insects, worm and seeds. Prefers fringes of swamps, dams and nearby marshy areas with cover of grasses, lignum, low scrub or open timber.	Nil. No freshwater wetland habitat present.
Ninox connivens	Barking Owl	V		8 records within 10km (OEH 2017a)	Occurs from coast to inland slopes and plains, though is rare in dense, wet forests east of the Great Dividing Range. Inhabits eucalypt woodlands, open forest, swamp woodlands, and, especially in inland areas, timber along watercourses. Roosts along creek lines in dense, tall understorey foliage or dense eucalypt canopy. Nests in hollows of large, old eucalypts. Birds and mammals are important prey during breeding. Territories range from 30 to 200 hectares.	Likely. Potential foraging habitat present. Breeding habitat unlikely to be present as few suitable large hollows are present.

Scientific name	Common name	TSC Act Status	EPBC Act Status	Source	Habitat association	Likelihood of occurrence
Ixobrychus flavicollis	Black Bittern	V		1 record within 10km, last recorded 2004 (OEH 2017a)	Occurs from southern NSW to Cape York and the Kimberley, and southwest WA. Inhabits terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. May occur in flooded grassland, forest, woodland, rainforest and mangroves as long as there is permanent water. Roosts by day in trees or within reeds on the ground. Nests in branches overhanging water and breeds from December to March.	Nil. No freshwater wetland habitat present.
Artamus cyanopterus	Dusky Woodswallow	V		3 records within 10km (OEH 2017a)	The Dusky Woodswallow is often recorded in woodlands and dry open sclerophyll forests, and has also been recorded in shrublands, heathlands regenerating forests and very occasionally in moist forests or rainforests. The understorey is typically open with sparse eucalypt saplings, acacias and other shrubs, often with coarse woody debris. It is also recorded in farmland, usually at the edges of forest or woodland or in roadside remnants or wind breaks with dead timber. Dusky Woodswallows prefer larger remnants over smaller remnants. Competitive exclusion by Noisy Miners (Manorina melanocephala) is a significant threat to this species.	Unlikely. Suitable woodland habitat not present.
Dasyornis brachypterus	Eastern Bristlebird	E	E	Species or species' habitat likely to occur within 10km (DoEE 2017a)	Occurs in three disjunct areas of south-eastern Australia: southern Queensland/northern NSW, the Illawarra Region and in the vicinity of the NSW/Victorian border. Habitat is characterised by dense, low vegetation including heath and open woodland with a heathy understorey.	Nil. No habitat present. Outside known distribution.

Scientific name	Common name	TSC Act Status	EPBC Act Status	Source	Habitat association	Likelihood of occurrence
Callocephalon fimbriatum	Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai Local Government Areas	EP		35 records within 10km (OEH 2017a)	Largely confined to the area bounded by Thornleigh and Wahroonga in the north, Epping and North Epping in the south, Beecroft and Cheltenham in the west and Turramurra/ South Turramurra to the east. It is known to inhabit areas of Lane Cove National Park, Pennant Hills Park and other forested gullies in the area. Inhabits eucalypt open forests and woodlands with an acacia understorey. In summer it lives in moist highland forest types, and in winter it moves to more open types at lower elevations. The Gang-Gang Cockatoo nests in hollows in the trunks, limbs or dead spouts of tall living trees, especially eucalypts, often near water. It feeds on seeds obtained in trees and shrubs, mostly from eucalypts and wattles.	Likely. Potential foraging habitat present. Minimal suitable breeding habitat present.
Calyptorhynchus lathami	Glossy Black-Cockatoo	V		68 records within 10km (OEH 2017a)	Widespread but uncommon from coast to southern tablelands and central western plains. Feeds almost exclusively on the seeds of Allocasuarina species. Prefers woodland and open forests, rarely away from Allocasuarina. Roost in leafy canopy trees, preferably eucalypts, usually <1km from feeding site. Nests in large (approx. 20cm) hollows in trees, stumps or limbs, usually in Eucalypts (Higgins 1999).	Possible. Some potential foraging habitat present, however the site is dominated by planted *Casuarina* rather than *Allocasuarina* species. Breeding habitat unlikely to be present.
Hieraaetus morphnoides	Little Eagle	V		7 records within 10km (OEH 2017a)	Occurs throughout NSW except most densely forested parts of the Dividing Range escarpment. Occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. For nest sites it requires a tall living tree within a remnant patch, where	Unlikely. Suitable woodland habitat not present.

Scientific name	Common name	TSC Act Status	EPBC Act Status	Source	Habitat association	Likelihood of occurrence
					pairs build a large stick nest in winter and lay in early spring.	
Glossopsitta pusilla	Little Lorikeet	V		5 records within 10km (OEH 2017a)	Occurs from coast to western slopes of the Great Dividing Range. Inhabits dry, open eucalypt forests and woodlands. Occurrence is positively associated with patch size, and with components of habitat complexity including canopy cover, shrub cover, ground cover, logs, fallen branches and litter. Mostly nests in small (opening approx. 3cm) hollows in living, smooth-barked eucalypts. Most breeding records are from the western slopes.	Unlikely. Suitable woodland habitat not present.
Tyto novaehollandiae	Masked Owl	V		1 record within 10km (OEH 2017a)	Occurs across NSW except NW corner. Most common on the coast. Inhabits dry eucalypt woodlands from sea level to 1100 m. Roosts and breeds in large (>40cm) hollows and sometime caves in moist eucalypt forested gullies. Hunts along the edges of forests and roadsides. Home range between 500 ha and 1000 ha. Prey mostly terrestrial mammals but arboreal species may also be taken.	Possible. Potential foraging habitat present. Breeding habitat unlikely to be present as few suitable large hollows are present.
Grantiella picta	Painted Honeyeater	V	V	Species or species' habitat may occur within 10km (DoEE 2017a)	Nomadic, occurring in low densities across most of NSW. Highest concentrations and almost all breeding occur on inland slopes of the Great Dividing Range. Inhabits Boree, Brigalow and Box Gum woodlands and Box-Ironbark forests. Specialist forager on the fruits of mistletoes, preferably of the Amyema genus. Nests in outer tree canopy.	Nil. No suitable habitat present. Outside usual range.

Scientific name	Common name	TSC Act Status	EPBC Act Status	Source	Habitat association	Likelihood of occurrence
Ninox strenua	Powerful Owl	V		381 records within 10km (OEH 2017a)	Occurs from the coast to the western slopes. Solitary and sedentary species. Inhabits a range of habitats from woodland and open sclerophyll forest to tall open wet forest and rainforest. Prefers large tracts of vegetation. Nests in large tree hollows (> 0.5 m deep), in large eucalypts (dbh 80-240 cm) that are at least 150 years old. Pairs have high fidelity to a small number of hollow-bearing nest trees and defend a large home range of 400 - 1,450 ha. Forages within open and closed woodlands as well as open areas.	Present. Foraging and roosting habitat present. Breeding habitat unlikely to be present as few suitable large hollows are present.
Anthochaera phrygia	Regent Honeyeater	CE	CE	1 record within 10km, last recorded 1998 (OEH 2017a); Species or species' habitat known to occur within 10km (DoEE 2017a)	In NSW confined to two known breeding areas: the Capertee Valley and Bundarra-Barraba region. Non-breeding flocks occasionally seen in coastal areas foraging in flowering Spotted Gum and Swamp Mahogany forests, presumably in response to drought. Inhabits dry open forest and woodlands, particularly Box-Ironbark woodland and riparian forests of River Sheoak, with an abundance of mature trees, high canopy cover and abundance of mistletoes.	Nil. No suitable foraging habitat present. Does not breed in the area.
Petroica boodang	Scarlet Robin	V		2 records within 10km, last recorded 2001 (OEH 2017a)	In NSW occurs from coast to inland slopes. Breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within open understorey of shrubs and grasses and sometimes in open areas. In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees. Abundant logs and coarse woody debris are important habitat components.	Unlikely. Suitable woodland habitat not present.

Scientific name	Common name	TSC Act Status	EPBC Act Status	Source	Habitat association	Likelihood of occurrence
Tyto tenebricosa	Sooty Owl	V		1 record within 10km (OEH 2017a)	Occurs in the coastal, escarpment and tablelands regions of NSW. More common in the north and absent from the western tablelands and further west. Inhabits tall, moist eucalypt forests and rainforests, and are strongly associated with sheltered gullies, particularly those with tall rainforest understorey. Roosts in tree hollows, amongst dense foliage in gullies or in caves, recesses or ledges of cliffs or banks. Nest in large (>40cm wide, 100cm deep) tree hollows in unlogged/unburnt gullies within 100m of streams or in caves.	Possible. Potential foraging habitat present. Breeding habitat unlikely to be present as few suitable large hollows are present. Few local records.
Lophoictinia isura	Square-tailed Kite	V		12 records within 10km (OEH 2017a)	Occurs across NSW, resident in North, northeast and along west-flowing rivers. Summer breeding migrant to southeast of state. Inhabits a variety of habitats including woodlands and open forests, with preference for timbered watercourses. Favours productive forests on the coastal plain. In Sydney area nests in mature living trees within 100m of ephemeral/permanent watercourse. Large home range > 100 km^2.	Unlikely. Suitable woodland habitat not present.
Lathamus discolor	Swift Parrot	E	CE	3 records within 10km (OEH 2017a); Species or species' habitat known to occur within 10km (DoEE 2017a)	Migratory, travelling to the mainland from March to October. Breeds in Tasmania from September to January. On the mainland, it mostly occurs in the southeast foraging on winter flowering eucalypts and lerps, with records of the species between Adelaide and Brisbane. Principal over-winter habitat is box-ironbark communities on the inland slopes and plains. *Eucalyptus robusta, Corymbia maculata* and *C. gummifera* dominated coastal forests are also important habitat.	Unlikely. Limited potential foraging habitat present (only occasional C. gummifera in the site)

Scientific name	Common name	TSC Act Status	EPBC Act Status	Source	Habitat association	Likelihood of occurrence
Daphoenositta chrysoptera	Varied Sittella	V		5 records within 10km (OEH 2017a)	Sedentary, occurs across NSW from the coast to the far west. Inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Sensitive to habitat isolation and loss of structural complexity, and adversely affected by dominance of Noisy Miners. Cleared agricultural land is potentially a barrier to movement. Builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.	Present. Previously recorded at the site (OEH 2017a).
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	C	8 records within 10km (OEH 2017a)	Primarily coastal but may extend inland over major river systems. Breeds close to water, mainly in tall open forest/woodland but also in dense forest, rainforest, closed scrub or remnant trees. Usually forages over large expanses of open water, but also over open terrestrial habitats (e.g. grasslands).	Nil. No suitable habitat present.
Heleioporus australiacus	Giant Burrowing Frog	V	V	22 records within 10km (OEH 2017a); Species or species' habitat known to occur within 10km (DoEE 2017a)	Occurs along the coast and eastern slopes of the Great Dividing Range south from Wollemi National Park. Occurs on sandy soils supporting heath, woodland or open forest. Breeds in ephemeral to intermittent streams with persistent pools. Only infrequently moves to breeding sites, most commonly found on ridges away from creeks, several hundred metres from water.	Unlikely. Areas of dry sclerophyll forest occur along edges of roads or are in a highly disturbed condition. No suitable seepage areas or pools for breeding are present.

Scientific name	Common name	TSC Act Status	EPBC Act Status	Source	Habitat association	Likelihood of occurrence
Litoria aurea	Green and Golden Bell Frog	E	V	4 records within 10km (OEH 2017a); Species or species' habitat known to occur within 10km (DoEE 2017a)	Formerly occurred from Brunswick Heads to Victoria, but >80% populations now extinct. Inhabits marshes, natural and artificial freshwater to brackish wetlands, dams and in stream wetlands. Prefers sites containing cumbungi (*Typha* spp.) or spike rushes (*Eleocharis* spp.), which are unshaded and have a grassy area and/or rubble as shelter/refuge habitat nearby. Gambusia holbrooki is a key threat as they feed on green and Golden Bell Frog eggs and tadpoles.	Nil. No wetland habitat present.
Litoria littlejohni	Littlejohn's Tree Frog	V	V	Species or species' habitat may occur within 10km (DoEE 2017a)	Occurs on plateaus and eastern slopes of the Great Dividing Range south from Watagan State Forest. Occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops, hunting either in shrubs or on the ground.	Nil. No suitable stream habitat present. Outside known distribution.
Pseudophryne australis	Red-crowned Toadlet	V		259 records within 10km (OEH 2017a)	Restricted to Sydney Basin, from Nowra to Pokolbin and west to Mt Victoria. Inhabits heathland and open woodland on Hawkesbury and Narrabeen Sandstones, within 100m of ridgelines. Breeds in ephemeral feeder creeks or flooded depressions, requiring unpolluted water between 5.5 and 6.5 pH. Shelters under rocks, amongst masses of dense vegetation or leaf litter. Populations restricted to immediate vicinity of breeding areas.	Unlikely. Highly disturbed site. Likely pollution from nearby residential areas and previous quarrying activities. Topography not suitable, as most of the site is well below the ridges. Areas of dry sclerophyll forest occur along edges of roads or are in a highly disturbed condition.

Scientific name	Common name	TSC Act Status	EPBC Act Status	Source	Habitat association	Likelihood of occurrence
Mixophyes balbus	Stuttering Frog	E	V	Species or species' habitat likely to occur within 10km (DoEE 2017a)	The Stuttering Frog is typically found in association with permanent streams through rainforest and wet sclerophyll forest, rarely in dry open tableland riparian vegetation, and also in moist gullies in dry forest. They shelter in deep leaf litter and thick understorey vegetation on the forest floor. The species does not occur in areas where the riparian vegetation has been disturbed or where there have been significant upstream human impacts).	Nil. No suitable stream habitat present. Outside known distribution.
Meridolum corneovirens	Cumberland Plain Land Snail	E		1 record within 10km (OEH 2017a)	Occurs within a small area of the Cumberland Plain, from Richmond and Windsor to Picton.Found primarily under litter of bark, leaves and logs, or in loose soil around grass clumps within Cumberland Plain Woodland. Has also been found under rubbish. Feeds on fungus. During periods of drought can burrow into the soil to escape the dry conditions.	Nil. No shale habitat present.
Pommerhelix duralensis	Dural Woodland Snail	E	E	15 records within 10km (OEH 2017a); Species or species' habitat known to occur within 10km (DoEE 2017a)	This species is a shale-influenced habitat specialist, which occurs in low densities along the northwest fringes of the Cumberland Plain on shale-sandstone transitional landscapes. The majority of confirmed records for the species occur within The Hills Shire Local Government Area. The species is also found within the Local Government Areas of Blue Mountains City, Penrith City, Hornsby Shire and Parramatta City	Nil. No shale/sandstone transitional habitat present.

Scientific name	Common name	TSC Act Status	EPBC Act Status	Source	Habitat association	Likelihood of occurrence
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	Species or species' habitat may occur within 10km (DoEE 2017a)	Occurs from the Shoalhaven north to the Queensland border. Occurs on rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north.	Nil. No rocky escarpment habitat present.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V		103 records within 10km (OEH 2017a)	Generally occurs east of the Great Dividing Range along NSW coast. Inhabits various habitats from open grasslands to woodlands, wet and dry sclerophyll forests and rainforest. Essentially a cave bat but may also roost in road culverts, stormwater tunnels and other man-made structures. Only 4 known maternity caves in NSW, near Wee Jasper, Bungonia, Kempsey and Texas. Females may travel hundreds of kilometres to the nearest maternal colony.	Present. Recorded previously on site. Could forage in the site. No roost habitat present at the site. Roosting habitat in adjacent areas includes culverts, pipes and disused buildings.
Pseudomys gracilicaudatus	Eastern Chestnut Mouse	V		2 records within 10km, last recorded 2000 (OEH 2017a)	Mainly occurs north from the Hawkesbury from the coast to the eastern slopes of the Great Dividing Range. Isolated records from Jervis Bay. Typically inhabits heathland in dense wet heaths and swamps. Optimal habitat is young regenerating heathland (e.g. after fire), with dense understorey the most important characteristic. May nest above ground or in hollows.	Nil. No suitable habitat present.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		14 records within 10km (OEH 2017a)	Occurs on southeast coast and ranges. Prefers tall (>20m) and wet forest with dense understorey. Absent from small remnants, preferring continuous forest but can move through cleared landscapes and may forage in open areas. Roosts in hollow trunks of Eucalypts, underneath bark or in buildings. Forages in gaps and spaces within forest,	Possible. Potential foraging habitat present. Minimal suitable breeding habitat present. More likely to occur in better quality forest in the adjacent reserves.

Scientific name	Common name	TSC Act Status	EPBC Act Status	Source	Habitat association	Likelihood of occurrence
					with large foraging range (12km foraging movements recorded).	
Mormopterus norfolkensis	Eastern Freetail-bat	V		33 records within 10km (OEH 2017a)	Occurs in dry sclerophyll forest and woodland east of the Great Dividing Range. Forages in natural and artificial openings in vegetation, typically within a few kilometres of its roost. Roosts primarily in tree hollows but also recorded from man-made structures or under bark.	Likely. Potential foraging habitat present. Minimal suitable breeding habitat present.
Cercartetus nanus	Eastern Pygmy-possum	V		88 records within 10km (OEH 2017a)	Inhabits range of habitats from coastal heath and woodland though open and closed forests, subalpine heath and rainforest. Inhabits rainforest, sclerophyll forests and heath. *Banksia* spp. and myrtaceous shrubs and trees are favoured food sources and nesting subject sites in drier habitats. Diet mostly pollen and nectar from *Banksia* spp., *Eucalyptus* spp., *Callistemon* spp. and insects. Nests in hollows in trees, under the bark of Eucalypts, forks of tea-trees, abandoned bird nests and Xanthorrhoea bases.	Unlikely. Areas of dry sclerophyll forest present occur on the edges of roads and are in generally degraded condition with little suitable understory present.

Scientific name	Common name	TSC Act Status	EPBC Act Status	Source	Habitat association	Likelihood of occurrence
Scoteanax rueppellii	Greater Broad-nosed Bat	V		13 records within 10km (OEH 2017a)	Occurs on the east coast and Great Dividing Range. Inhabits a variety of habitats from woodland to wet and dry sclerophyll forests and rainforest, also remnant paddock trees and timber-lined creeks, typically below 500m asl. Forages in relatively uncluttered areas, using natural or man-made openings in denser habitats. Usually roosts in tree hollows or fissures but also under exfoliating bark or in the roofs of old buildings. Females congregate in maternal roosts in suitable hollow trees.	Likely. Potential foraging habitat present. Minimal suitable breeding habitat present.
Petauroides volans	Greater Glider		V	3 records within 10km, last recorded 2004 (OEH 2017a); Species or species' habitat known to occur within 10km (DoEE 2017a)	The greater glider is restricted to eastern Australia, with an elevational range from sea level to 1200 m above sea level. It prefers taller montane, moist eucalypt forest with relatively old trees and abundant hollows.	Unlikely. Few suitable hollow-bearing trees present. May forage on site on occasion if denning in nearby areas.
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	598 records within 10km (OEH 2017a); Roosting known to occur within 10km (DoEE 2017a)	Roosts in camps within 20 km of a regular food source, typically in gullies, close to water and in vegetation with a dense canopy. Forages in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths, swamps and street trees, particularly in eucalypts, melaleucas and banksias. Highly mobile with movements largely determined by food availability. Will also forage in urban gardens and cultivated fruit crops.	Likely. Potential foraging habitat present. No breeding habitat present. Observed flying above the site during surveys.

Scientific name	Common name	TSC Act Status	EPBC Act Status	Source	Habitat association	Likelihood of occurrence
Phascolarctos cinereus	Koala	V	V	3 records within 10km (OEH 2017a); Species or species' habitat known to occur within 10km (DoEE 2017a)	Occurs from coast to inland slopes and plains. Restricted to areas of preferred feed trees in eucalypt woodlands and forests. Home range varies depending on habitat quality, from < 2 to several hundred hectares.	Unlikely. No preferred feed trees present.
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Species or species' habitat known to occur within 10km (DoEE 2017a)	Occurs from the coast to the western slopes of the divide. Largest numbers of records from sandstone escarpment country in the Sydney Basin and Hunter Valley. Roosts in caves and mines and most commonly recorded from dry sclerophyll forests and woodlands. An insectivorous species that flies over the canopy or along creek beds. In southern Sydney appears to be largely restricted to the interface between sandstone escarpments and fertile valleys.	Unlikely. No appropriate breeding habitat present. Could forage on occasion in the area.
Miniopterus australis	Little Bentwing-bat	V		22 records within 10km (OEH 2017a)	Occurs from Cape York to Sydney. Inhabits rainforests, wet and dry sclerophyll forests, paperbark swamps and vine thickets. Only one maternity cave known in NSW, near Kempsey. Outside breeding season roosts in caves, tunnels and mines and has been recorded in a tree hollow on one occasion. Forages for insects beneath the canopy of well-timbered habitats.	Likely. Could forage in the site. No roost habitat present at the site. Roosting habitat in adjacent areas includes culverts, pipes and disused buildings.

Scientific name	Common name	TSC Act Status	EPBC Act Status	Source	Habitat association	Likelihood of occurrence
Pseudomys novaehollandiae	New Holland Mouse		V	4 records within 10km, last recorded 2003 (OEH 2017a); Species or species' habitat known to occur within 10km (DoEE 2017a)	Occurs in disjunct, coastal populations from Tasmania to Queensland. In NSW inhabits a variety of coastal habitats including heathland, woodland, dry sclerophyll forest with a dense shrub layer and vegetated sand dunes. Populations may recolonise/ increase in size in regenerating native vegetation after wildfire, clearing and sandmining. Presence strongly correlated with understorey vegetation density, and high floristic diversity in regenerating heath.	Nil. No suitable habitat present.
Isoodon obesulus obesulus	Southern Brown Bandicoot	E	E	Species or species' habitat known to occur within 10km (DoEE 2017a); 298 records within 10km (OEH 2017a)	Occurs mainly in 2 areas: Ku-ring-gai Chase and Garigal National Parks N of Sydney, and far SE NSW, but also occurs between these areas. Inhabits scrubby vegetation, including heath, shrubland, and heathy forest and woodland. Often associated with well-drained soils and dry heathland communities, and prefers periodically burnt areas as this increases insect abundance.	Unlikely. Majority of the site is disturbed or vegetated with wet sclerophyll forests.
Myotis macropus	Southern Myotis	V		8 records within 10km (OEH 2017a)	Mainly coastal but may occur inland along large river systems. Usually associated with permanent waterways at low elevations in flat/undulating country, usually in vegetated areas. Forages over streams and watercourses feeding on fish and insects from the water surface. Roosts in a variety of habitats including caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage, typically in close proximity to water (Campbell 2011). Breeds November or December (Churchill 2008).	Unlikely. No suitable foraging habitat present. Creeklines near the site were dry at the time of survey.

Scientific name	Common name	TSC Act Status	EPBC Act Status	Source	Habitat association	Likelihood of occurrence
Dasyurus maculatus	Spotted-tailed Quoll	V	E	11 records within 10km (OEH 2017a); Species or species' habitat known to occur within 10km (DoEE 2017a)	Inhabits a range of environments including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Den sites are in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces. Females occupy home ranges of up to 750 ha and males up to 3,500 ha, usually traversed along densely vegetated creek lines.	Possible. Suitable den sites present around the site. Site connected with large expanses of vegetation.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V		16 records within 10km (OEH 2017a)	Migrates from tropics to SE Aus in summer. Forages across a range of habitats including those with and without trees, from wet and dry sclerophyll forest, open woodland, Acacia shrubland, mallee, grasslands and desert. Roosts communally in large tree hollows and buildings (Churchill 2008).	Likely. Potential foraging habitat present. Minimal suitable breeding habitat present. Disused buildings in adjacent areas.
Hoplocephalus bungaroides	Broad-headed Snake	E	V	Species or species' habitat likely to occur within 10km (DoEE 2017a)	Nocturnal, sheltering in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter, and spring, moving to shelters in hollows of large trees within 200m of escarpments in summer. Feeds mostly on geckos and small skinks, and occasionally on frogs and small mammals.	Nil. No rocky escarpment habitat present.

Scientific name	Common name	TSC Act Status	EPBC Act Status	Source	Habitat association	Likelihood of occurrence
Varanus rosenbergi	Rosenberg's Goanna	V		53 records within 10km (OEH 2017a)	In NSW mainly occurs on the mid coast region from Wollemi NP to Nowra; the ACT and Goulburn regions and the South-west Slopes. Inhabits coastal heathlands, wet and dry sclerophyll forests, woodlands and mallee communities. Termite mounds are an important habitat feature: eggs are laid in the mounds in summer and incubate till spring, when the young dig themselves out. Young may return to the mound as a refuge for some months, while adults shelter in burrows dug under rocks or logs, or in rock crevices, hollow logs or even rabbit burrows (Sass 2008).	Likely. Could forage at the site. Occasional termite mounds present on the southern side of the site, although no signs of nesting were observed.

Appendix B – Field results

Flora species recorded within the site

Family	Scientific Name	Common Name	Exotic	TSC Status	EPBC Status	Vegetation zone			
						1; Blackbutt Gully Forest (HN648, Moderate/good - high)	2; Blackbutt Gully Forest (HN648, Moderate/good - poor)	3; Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest (HN596, Moderate/good - poor) (CEEC)	4; Blackbutt Gully Forest (HN648, Low)
Apiaceae	*Cyclospermum leptophyllum*	Slender Celery	*	0	0			1	1
Apocynaceae	*Araujia sericifera*	Moth Vine	*	0	0			1	
Arecaceae	*Phoenix canariensis*	Canary Island Date Palm	*	0	0	1			
Asparagaceae	*Asparagus aethiopicus*	Asparagus Fern	*	0	0	1	1	1	
Asteraceae	*Ageratina adenophora*	Crofton Weed	*	0	0		3.5	3.5	5
	Ageratina riparia	Mistflower	*	0	0			2	
	Bidens pilosa	Cobbler's Pegs	*	0	0	1	1	3	1
	Cirsium vulgare	Spear Thistle	*	0	0				2
	Conyza bonariensis	Flaxleaf Fleabane	*	0	0		1	1	
	Delairea odorata	Cape Ivy	*	0	0			6	2
	Sonchus oleraceus	Common Sowthistle	*	0	0			1	
Bignoniaceae	*Jacaranda mimosifolia*	Jacaranda	*	0	0			2	
Caprifoliaceae	*Lonicera japonica*	Japanese Honeysuckle	*	0	0		1	1	
Casuarinaceae	*Allocasuarina littoralis*	Black She-Oak		0	0	5		3.5	
	Casuarina cunninghamiana subsp. *cunninghamiana*	River Oak		P	0		12.5	20	
Commelinaceae	*Commelina cyanea*	Native Wandering Jew		0	0	1		1	
	Tradescantia fluminensis	Wandering Jew	*	0	0			10	
Cyperaceae	*Cyperus gracilis*	Slender Flat-sedge		0	0			1	
Davalliaceae	*Nephrolepis cordifolia*	Fishbone Fern		0	0			20	
Dennstaedtiaceae	*Pteridium esculentum*	Bracken		0	0	5			
Fabaceae (Faboideae)	*Glycine tabacina*	Variable Glycine		0	0			1	1

Family	Scientific Name	Common Name	Exotic	TSC Status	EPBC Status	Vegetation zone			
						1; Blackbutt Gully Forest (HN648, Moderate/good - high)	2; Blackbutt Gully Forest (HN648, Moderate/good - poor)	3; Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest (HN596, Moderate/good - poor) (CEEC)	4; Blackbutt Gully Forest (HN648, Low)
	Trifolium repens	White Clover	*	0	0		1		
	Vicia sativa	Common vetch	*	0	0		1		1
Fabaceae (Mimosoideae)	*Acacia longifolia*			0	0	2			
Gentianaceae	*Centaurium erythraea*	Common Centaury	*	0	0				1
Geraniaceae	*Geranium solanderi*	Native Geranium		0	0				1
Juncaceae	*Juncus usitatus*			0	0				2
Lauraceae	*Cinnamomum camphora*	Camphor Laurel	*	0	0		2		
Lomandraceae	*Lomandra cylindrica*			0	0	2			
	Lomandra longifolia	Spiny-headed Mat-rush		0	0		1	2	
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry		0	0	2			
Malvaceae	*Malva parviflora*	Small-flowered Mallow	*	0	0			1	
	Sida rhombifolia	Paddy's Lucerne	*	0	0	1		1.5	
Menispermaceae	*Stephania japonica*	Snake vine		0	0		1		
Myrsinaceae	*Anagallis arvensis*	Scarlet Pimpernel	*	0	0			2	2
Myrtaceae	*Angophora bakeri*	Narrow-leaved Apple		0	0		2		
	Angophora costata	Sydney Red Gum		0	0	5	5		
	Angophora floribunda	Rough-barked Apple		0	0			5	
	Callistemon salignus	Willow Bottlebrush		0	0		5		
	Corymbia gummifera	Red Bloodwood		0	0	5		2	
	Eucalyptus botryoides	Bangalay		0	0		10		
	Eucalyptus pilularis	Blackbutt		0	0	25	5	7.5	
	Eucalyptus resinifera	Red Mahogany		0	0	2			
	Eucalyptus saligna	Sydney Blue Gum		0	0		15	23.3	

Family	Scientific Name	Common Name	Exotic	TSC Status	EPBC Status	Vegetation zone			
						1; Blackbutt Gully Forest (HN648, Moderate/good - high)	2; Blackbutt Gully Forest (HN648, Moderate/good - poor)	3; Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest (HN596, Moderate/good - poor) (CEEC)	4; Blackbutt Gully Forest (HN648, Low)
	Syncarpia glomulifera	Turpentine		0	0	25	5		
Ochnaceae	*Ochna serrulata*	Mickey Mouse Plant	*	0	0			1	
Oleaceae	*Ligustrum lucidum*	Large-leaved Privet	*	0	0	1	30	40	1
	Ligustrum sinense	Small-leaved Privet	*	0	0	1	25	6.6	1
Orchidaceae	*Dipodium variegatum*			P	0	1			
Passifloraceae	*Passiflora edulis*	Common Passionfruit	*	0	0			1	
Phormiaceae	*Dianella caerulea*	Blue Flax-lily		0	0	1			
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush		0	0	2	1		
	Glochidion ferdinandi	Cheese Tree		0	0			10	
	Phyllanthus hirtellus	Thyme Spurge		0	0	1			
Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry		0	0	1			
	Pittosporum undulatum	Sweet Pittosporum		0	0	5	16	15	
Plantaginaceae	*Plantago debilis*	Shade Plantain		0	0			1	
Poaceae	*Avena* sp.	Oats	*	0	0				30
	Briza maxima	Quaking Grass	*	0	0				1
	Briza subaristata		*	0	0				5
	Bromus catharticus	Praire Grass	*	0	0				5
	Chloris gayana	Rhodes Grass	*	0	0	2			10
	Cortaderia selloana	Pampas Grass	*	0	0		10	20	5
	Cynodon dactylon	Common Couch		0	0			2	50
	Ehrharta erecta	Panic Veldtgrass	*	0	0		2	5	
	Entolasia stricta	Wiry Panic		0	0	5		1	
	Eragrostis curvula	African Lovegrass	*	0	0			5	

Family	Scientific Name	Common Name	Exotic	TSC Status	EPBC Status	Vegetation zone			
						1; Blackbutt Gully Forest (HN648, Moderate/good - high)	2; Blackbutt Gully Forest (HN648, Moderate/good - poor)	3; Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest (HN596, Moderate/good - poor) (CEEC)	4; Blackbutt Gully Forest (HN648, Low)
	Imperata cylindrica	Blady Grass		0	0	40	10		
	Microlaena stipoides	Weeping Grass		0	0		1.5	1.5	
	Oplismenus aemulus			0	0		2	2	
	Paspalum dilatatum	Paspalum	*	0	0				2
	Poa affinis			0	0		2		
	Poa sp.		*	0	0			1	
Proteaceae	*Grevillea robusta*	Silky Oak		0	0			10	
	Lomatia silaifolia	Crinkle Bush		P	0	2			
Ranunculaceae	*Clematis aristata*	Old Man's Beard		0	0	1			
	Ranunculus sp.			0	0				1
Sapindaceae	*Dodonaea triquetra*	Large-leaf Hop-bush		0	0	1			
Solanaceae	*Solanum nigrum*	Black-berry Nightshade	*	0	0			2	
Ulmaceae	*Celtis sinensis*	Japanese Hackberry	*	0	0			1	
Verbenaceae	*Lantana camara*	Lantana	*	0	0		1	1.5	
	Verbena bonariensis	Purpletop	*	0	0				2

* Values provided in these columns are an average of percent cover within the zone

Fauna species recorded in the study area

Common Name	Scientific Name	Exotic	TSC Act	EPBC Act	GHD (2017)	Eco Aus (2015)	PB (2004)	Kleinfelder (2017)
BIRDS								
Australian Brush-Turkey	*Alectura lathami*				O, E	O		
Australian Magpie	*Cracticus tibicen*				W	O	O	
Australian Pipit	*Anthus novaeseelandiae*						O	
Australian Raven	*Corvus coronoides*					O	O	
Bell Miner	*Manorina melanophrys*					W		
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*				O	O	O	
Brown Cuckoo-dove	*Macropygia amboinensis*				O			
Brown Gerygone	*Gerygone mouki*				W, E			
Brown Thornbill	*Acanthiza pusilla*						O	
Buff-rumped Thornbill	*Acanthiza reguloides*						O	
Channel-billed Cuckoo	*Scythrops novaehollandiae*				O	O		
Crested Pigeon	*Ocyphaps lophotes*							
Crimson Rosella	*Platycercus elegans*						O	
Dollarbird	*Eurystomus orientalis*				O			
Eastern Rosella	*Platycercus eximius*						O	
Eastern Spinebill	*Acanthorhynchus tenuirostris*				O			
Eastern Whipbird	*Psophodes olivaceus*						O	
Eastern Yellow Robin	*Eopsaltria australis*				O		O	
Fan-tailed Cuckoo	*Cacomantis flabelliformis*				W			
Galah	*Eolophus roseicapillus*						O	
Golden Whistler	*Pachycephala pectoralis*				W		O	
Grey Butcherbird	*Cracticus torquatus*					W		
Grey Fantail	*Rhipidura albiscapa*				O		O	
Grey Shrike-thrush	*Colluricincla harmonica*				O			

Common Name	Scientific Name	Exotic	TSC Act	EPBC Act	GHD (2017)	Eco Aus (2015)	PB (2004)	Kleinfelder (2017)
Jacky Winter	*Microeca fascinans*						O	
Laughing Kookaburra	*Dacelo novaeguineae*				O	W	O	
Lewin's Honeyeater	*Meliphaga lewinii*				O			
Little Corella	*Cacatua sanguinea*				O			
Magpie-lark	*Grallina cyanoleuca*						O	
Noisy Friarbird	*Philemon corniculatus*						O	
Noisy Miner	*Manorina melanocephala*				O		O	
Pacific Black Duck	*Anas superciliosa*				O	O		
Pied Currawong	*Strepera graculina*					W		
Powerful Owl	*Ninox strenua*		V		H			O
Rainbow Lorikeet	*Trichoglossus haematodus*				W		O	
Red Wattlebird	*Anthochaera carunculata*				O		O	
Red-browed Finch	*Neochmia temporalis*						O	
Red-whiskered Bulbul	*Pycnonotus jocosus*	*			O		O	
Sacred Kingfisher	*Todiramphus sanctus*				O			
Scarlet Honeyeater	*Myzomela sanguinolenta*				O			
Silvereye	*Zosterops lateralis*						O	
Southern Boobook	*Ninox novaeseelandiae*				OW		O	
Striated Thornbill	*Acanthiza lineata*				O			
Sulphur-crested Cockatoo	*Cacatua galerita*				O		O	
Superb Fairy-wren	*Malurus cyaneus*				O	O		
Superb Lyrebird	*Menura novaehollandiae*				O			
Varied Sittella	*Daphoenositta chrysoptera*		V				O	
Variegated Fairy-wren	*Malurus lamberti*				O		O	
Welcome Swallow	*Hirundo neoxena*						O	
White-browed Scrubwren	*Sericornis frontalis*				O			

Common Name	Scientific Name	Exotic	TSC Act	EPBC Act	GHD (2017)	Eco Aus (2015)	PB (2004)	Kleinfelder (2017)
White-throated Gerygone	*Gerygone olivacea*						O	
Wonga Pigeon	*Leucosarcia picata*				W			
Yellow Thornbill	*Acanthiza nana*						O	
MAMMALS								
a forest bat	*Vespadelus sp.*				U			
Eastern Bentwing Bat	*Miniopterus schreibersii oceanensis*		V		U[ł]			
Gould's Wattled bat	*Chalinolobus gouldii*					U		
Grey-headed Flying-fox	*Pteropus poliocephalus*		V				O	
Little Forest Bat	*Vespadelus vulturnus*					U		
White-striped Freetail-bat	*Tadarida australis*					U		
Brown Antechinus	*Antechinus stuartii*						O	
Bush Rat	*Rattus fuscipes*						O	
Common Brushtail Possum	*Trichosurus vulpecula*						O	
Common Ringtail Possum	*Pseudocheirus peregrinus*				O		O	
Fox	*Vulpes vulpes*	*			O, P			
Short-beaked Echidna	*Tachyglossus aculeatus*				F, X			
Swamp Wallaby	*Wallabia bicolor*				O	O	O	
REPTILES								
Dark-flecked Garden Sunskink	*Lampropholis delicata*				O			
Eastern Water Dragon	*Intellagama lesueurii*					O	O	
Red-bellied Black Snake	*Pseudechis porphyriacus*					O		
FROGS								
Common Eastern Froglet	*Crinia signifera*				W		O	
Peron's Tree Frog	*Litoria peronii*				W			

Key: V – vulnerable, Observation codes: E – nest, F – tracks/traces, H – feathers, O - observed, P – scats, U – anabat recording, W – heard, X – in scat, Ł possible identification from Anabat recording

Appendix C – Assessments of significance

Legislative context

Section 5A of the EP&A Act lists seven factors that must be taken into account in the determination of the significance of potential impacts of an activity on 'threatened species, populations or ecological communities (or their habitats)' listed under the TSC Act. The '7 part test' is used to determine whether an activity is 'likely' to impose 'a significant effect' on threatened biota and thus whether a species impact statement (SIS) is required. Should the 7 part test conclude that a significant effect is likely, an SIS must be prepared.

An assessments of the likely significance of impacts has been prepared for the following biota listed under the TSC Act:

- Threatened ecological communities
  - – Blue Gum High Forest
- Threatened fauna species
  - – Powerful Owl
  - – Varied Sittella
  - – Eastern Freetail Bat
  - – Greater Broad-nosed Bat
  - – Yellow-bellied Sheathtail Bat

Blue Gum High Forest – CEEC TSC Act
a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction
N/A
b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction
N/A
c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction**
The proposal would involve the removal of up to 0.74 ha of poor condition Blue Gum High Forest vegetation from within a highly modified landscape as a result of stabilisation of quarry walls to make the site safe and to assist development into a community parkland. The vegetation to be impacted comprises a mixture of regrowth and vegetation planted as part of rehabilitation and soil stabilisation works that is broadly characteristic of the community. Vegetation occurs on highly modified landforms, which have been altered through the historical placement of fill and spoil from the quarry, and now support unnatural soil profiles. Vegetation that will be impacted by the proposal is subject to existing pressures such as edge effects, established and extensive weed invasion, changes or increases to stormwater and nutrient levels, and ongoing disturbances resulting from activities associated with the quarry void. Vegetation to be removed forms part of a larger patch of Blue Gum High Forest that extends outside of the site boundary. Around 15 ha of Blue Gum High Forest would be retained within the wider site or is protected in the adjacent Berowra Valley National Park. The vegetation to be impacted by the project is the poorest condition form of this vegetation within the wider Hornsby Quarry area. The topography of the site combined with recommended mitigation measures makes any impact to adjacent vegetation as a

Blue Gum High Forest – CEEC TSC Act
result of the proposal unlikely, as better quality stands tend to occur upslope of those being impacted. Following the proposed landform rehabilitation works, there are extensive revegetation activities planned that will utilise species characteristic of the Blue Gum High Forest CEEC and of local provenance, potentially improving the genetic stock in the Hornsby Quarry area. Given that vegetation to be impacted is highly modified and weed infested, and only a small area (0.74 ha) is to be removed, the project is unlikely to place the local occurrence of the ecological community at risk of extinction.
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction
The proposal would require removal of up to 0.74 ha of highly modified and degraded vegetation from within a larger patch, most of which is broadly characteristic of Blue Gum High Forest. The vegetation to be impacted does not include high quality remnant Blue Gum High Forest, rather a mixture of regrowth and vegetation planted as part of rehabilitation and soil stabilisation works that is broadly characteristic of the community. 14.83 ha of better quality Blue Gum High Forest would be retained at the site, and a small area (0.12 ha) is protected in the adjacent national park. Vegetation occurs on highly modified landforms, which have been altered through the historical placement of fill and spoil from the quarry, and now support unnatural soil profiles. There is no intact native midstorey or understorey, and the canopy comprises a mixture of native and exotic. As outlined above, vegetation that will be impacted by the proposal is subject to existing pressures such as edge effects, established and extensive weed invasion, changes or increases to stormwater and nutrient levels, and ongoing disturbances resulting from activities associated with the quarry void. The vegetation zone lacks native species in all stratum and supports an extensive and established weed infestation. The vegetation within the study area would be unlikely to significantly contribute to the floristic or genetic composition or variability of other stands of vegetation within the locality due to its topographically isolated and modified nature at the project site. Local populations of species that make up the CEEC would persist elsewhere within the locality, including within the reserve network, irrespective of impacts within the project site. Removal of 0.74 ha would not substantially or adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.
d) in relation to the habitat of a threatened species, population or ecological community: **(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed**
The proposal would result in the temporary removal of up to 0.74 ha of poor condition Blue Gum High Forest from within a larger patch of vegetation that extends outside of the site. About 15 ha of better quality Blue Gum High Forest would be retained in the wider Hornsby Quarry site and is protected in the adjacent Berowra Valley National Park. Vegetation to be impacted would be removed and the landform rehabilitated, and then extensive revegetation works would be undertaken to restore a vegetation type characteristic of Blue Gum High Forest. The proposal is unlikely to modify habitat or areas of retained Blue Gum High Forest adjoining the proposal disturbance footprint through edge effects and other secondary impacts due to the topographic landscape of the site. Notwithstanding, mitigation measures are recommended to reduce the potential of any risk to adjacent vegetation.
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action
Vegetation to be impacted is topographically restricted by the existing quarry landform and comprises the highly disturbed edges of a larger tract of vegetation, and is already exposed to extensive edge effects, as discussed previously. The extreme topography of the site and surrounding residential and infrastructure development (e.g. NorthConnex works) means that much of the vegetation within the project site is effectively isolated from adjacent or nearby vegetation. The site requires rehabilitation by partial filling and

Blue Gum High Forest – CEEC TSC Act
stabilisation of specific areas to make the site safe and develop the land into a community parkland Removal of vegetation from the disturbed edges of a larger tract of vegetation will result in a temporary reduction in available habitat for this community and would partially increase the degree of fragmentation of habitat within the locality by reducing the total amount of vegetation cover present, but will not result in any additional fragmentation or isolation of this vegetation from other areas of habitat. The proposal would not result in the fragmentation of the existing patch into smaller patches, but would temporarily reduce the area of available habitat for this community.
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality
The proposal would result in the removal of up to 0.74 ha of highly modified and degraded Blue Gum High Forest vegetation from the disturbed edges of a larger patch of vegetation. About 15 ha of better quality Blue Gum High Forest would be retained in the wider Hornsby Quarry site and is protected in the adjacent Berowra Valley National Park. Vegetation to be impacted would play a minimal role in the long-term survival of the community in the locality, given it lacks a native midstorey or understorey. Blue Gum High Forest within the site is in poor condition and has been exposed to ongoing and historical modifications resulting from quarry rehabilitation and revegetation actions, as well as the influences of edge effects, stormwater run-off, and significant weed invasion. There is generally low species richness within areas to be removed. The site has moderate value as a fauna movement corridor due to its modified vegetation structure, and proximity to large-scale and constant disturbance resulting from earth works associated with the NorthConnex project. Notwithstanding, it does contain habitat suitable for a number of threatened fauna species as well as common native species. Its value to local flora populations is low as a result of the existing degree of degradation.
e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)
There is no critical habitat listed for this ecological community on either the OEH or DEE registers of critical habitat.
f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan
To date, no formal recovery plan has been prepared for this community. A targeted strategy for managing this community is being developed by OEH under the Saving Our Species program. Management actions include securing protection and undertaking management of priority sites, as well as general management actions such as weed management, rehabilitation, and encouraging protection of stands on private land. The removal of up to 0.74 ha of vegetation commensurate with Blue Gum High Forest is not consistent with the management actions, but is unlikely to interfere with the recovery of the community, given the retention of about 15 ha of better quality Blue Gum High Forest in the wider Hornsby Quarry site and adjoining national park. Given the highly modified and degraded nature of the Blue Gum High Forest within the site and the historical and ongoing disturbance and modification actions, the vegetation present is unlikely to be a priority site. Retained areas of Blue Gum High Forest outside of the site would be protected by the mitigation measures recommended in this report.
g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process
The proposal may contribute to the action of the following key threatening processes (KTPs) relevant to this community at the site: *Clearance of native vegetation* The proposal would involve the removal of up to 0.74 ha of highly modified and degraded vegetation from the edges of a larger patch of better condition vegetation. Vegetation to be impacted includes regrowth and revegetated canopy species, and a midstorey and understorey dominated by exotic species with overall low native species diversity and abundance. Much of this is located in areas that require stabilisation to make the site safe and develop the community parkland.

Blue Gum High Forest – CEEC TSC Act
Removal of dead wood and dead trees The proposal will result in the removal of low to moderate quantities of dead wood and dead trees. The amount of fallen timber present within the vegetation zone was well below benchmark values for the community, based on the three plot/transects sampled. The Blue Gum High Forest within the project site would contain a very minor proportion of these habitat resources within the wider quarry site and locality. *Infection of native plants by Phytophthora cinnamomi* There is a minor risk that *Phytophthora cinnamomi* would infect native plants within the Blue Gum High Forest within the remainder of the Hornsby Quarry site. However, given the small disturbance footprint and its position at the edge of the local occurrence of Blue Gum High Forest, and existing levels of disturbance throughout the vegetation type, the risk is considered to be low. This risk would be further reduced through the management measures that would be implemented.
Conclusion of Assessment of Significance
On consideration of the above criteria, the proposal is unlikely to have a significant negative effect on the local occurrence of Blue Gum High Forest for the following reasons: • While up to 0.74 ha of poor condition vegetation will be removed, about 15 ha of this community will be retained within the wider Hornsby Quarry site outside of the project site and the adjacent national park, including areas in better condition. • The proposal is unlikely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction • The proposal is unlikely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction • The extent to which habitat is likely to be removed or modified as a result of the action proposed is not considered to be significant to the community • The vegetation to be impacted comprises the highly modified and degraded, poor condition edges of larger tracts of vegetation, and the proposal will not substantially increase existing levels of fragmentation and isolation from other areas of habitat • No critical habitat has been listed for this community and the proposal will not impact any areas of critical habitat. • Landscaping works following completion of the proposal will focus on revegetating areas of Blue Gum High Forest, and will improve the condition of the community at the site in the long-term.

Powerful Owl

The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation.

Powerful Owls are monogamous and mate for life. Nesting occurs from late autumn to mid-winter.

Section 5A Assessment: Powerful Owl
a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction
The Powerful Owl has been recorded roosting on site and would forage in forest patches in the study area. The project site would make up a small proportion of the home range of a breeding pair. Large areas of better quality habitat are present in adjacent areas including within Berowra Valley National Park. The proposal would remove a negligible area of foraging habitat for this species. The proposal would remove up to five hollow bearing trees within the project site, however none appeared to be suitable for this species to breed in as it requires very large hollows. The proposal would not prevent these this mobile species from travelling between foraging and roosting or breeding habitat. Given the mobility of the species, the negligible impact on potential foraging habitat, the proposal is unlikely to have an adverse effect on the life cycle of the species such that a viable local population is likely to be placed at risk of extinction.
b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction
Not relevant to this threatened species.
c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction**
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Not relevant to this threatened species.
d) in relation to the habitat of a threatened species, population or ecological community: **(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed**
The proposal would remove up to 2.5 ha of native vegetation and five hollow-bearing trees within the project site, although no hollow-bearing trees appear suitable for this species to breed in. Extensive areas of native vegetation containing hollow-bearing trees are present in the locality. The removal of disturbed vegetation from around the quarry would create new edges and may result in additional edge effects which may modify the vegetation along the new edge. Given the existing edge effects, these additional impacts are likely to be minor.
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action
Fragmentation from the existing quarry, existing roads, and residential areas is already present. The proposal comprises removal of vegetation from around the existing quarry. No areas of vegetation would become isolated as a result of the proposal, however the proposal would increase fragmentation in the locality to a small degree. The proposal would widen the gap between stands of vegetation. This would not prevent this highly mobile species from travelling

Section 5A Assessment: Powerful Owl
between foraging and roosting habitat. These additional gaps in the tree canopy are not likely to affect the viability of the local population of any of this species.
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,
Up to 2.50 hectares of foraging habitat for this species is present in forested areas of the project site and it is likely that the owl would feed regularly in the project site, but would not depend solely on these foraging habitats. No hollows suitable for breeding for this species were observed in the project site, although it is known to roost on site on occasion. Large areas of better quality habitat are present in adjacent areas including within Berowra National Park. Given the presence of large areas of intact forest habitat in surrounding areas, and that habitat to be removed within the project site is already highly modified, the habitat to be removed is not considered important for this species in the locality.
e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)
There is no critical habitat listed for this threatened species.
f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan
The overall objective of the NSW Large Forest Owl recovery plan is to ensure that viable populations of the three species continue in the wild in NSW in each region where they presently occur. Recovery actions generally relate to further research on habitat in national parks and state forests, as well as undertaking suitable surveys for impact assessments. While the proposal would remove potential foraging and roosting habitat for the Powerful Owl within the project site, the loss of a very small area of highly disturbed potential habitat is not likely to interfere with the recovery of this species. Mitigation measures have been proposed to minimise impacts on fauna habitat. These include retention of hollow-bearing trees where possible and removal and control of weeds. The project has been designed to minimise clearing as far as possible. Large expanses of protected habitat are located in adjacent areas. While the clearing of habitat is not consistent with the recovery plan, the proposal is unlikely to interfere with the recovery of the species.
g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process
The REF proposal would result in the operation of the following KTPs: • Clearing of native vegetation – up to 2.5 ha of native vegetation would be removed within the project site, which is foraging habitat for this species. • Loss of hollow-bearing trees – up to five hollow-bearing trees would be removed within the project site, however none appear suitable for breeding for this species. • Loss of dead wood and dead trees – the proposal is likely to remove dead wood and dead trees. Mitigation measures to minimise direct impacts on fauna habitat would be included in the CEMP (see section 6.2). The proposal has the potential to introduce or increase the operation of the following KTPs within this community through soil disturbance and increased visitation to the area: • Infection of native plants by *Phytophthora cinnamomi*. • Invasion and establishment of weeds. Native vegetation is already subject to weed invasion. The proposal is unlikely to influence the introduction or further spread of exotic species, given their dominance throughout the study area in the understorey of most occurrences of native vegetation. Mitigation measures to minimise indirect impacts would be included in the CEMP (see section 6.2).
Conclusion of Assessment of Significance
The REF proposal is highly unlikely to result in a significant impact the Powerful Owl pursuant to s.5A of the EP&A Act given: • Up to 2.50 ha of native vegetation that represents potential foraging habitat for this species would be removed within the project site • No hollow-bearing trees suitable for this species would be removed within the project site. • Large areas of habitat including many hollow-bearing trees occur in the locality • No areas of habitat would become isolated

Section 5A Assessment: Powerful Owl
• Indirect impacts would occur along already modified and disturbed edges.

Varied Sittella

The Varied Sittella occurs in eucalypt forests and woodlands, nesting in the tree canopy. The Varied Sittella's nest is a deep open cup of bark and spider web, decorated on the outside with long pieces of bark to look like the fork or branch where it is placed. This species usually breeds cooperatively, with the breeding pair having several helpers. They will sometimes also breed in single pairs. Only the breeding female incubates the eggs and broods the young, although all help to feed the young (Higgins and Peter, 2002).

The Varied Sittella inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland. The Varied Sittella feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy.

Section 5A Assessment: Varied Sittella
a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,
The Varied Sittella has been recorded roosting on site and would forage in forest patches in the study area. Large areas of better quality habitat are present in adjacent areas including within Berowra Valley National Park. The proposal would remove a negligible area of habitat for this species. Given the mobility of the species, the negligible impact on potential foraging habitat, the proposal is unlikely to have an adverse effect on the life cycle of the species such that a viable local population is likely to be placed at risk of extinction.
b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,
Not applicable to this threatened fauna species.
c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
Not applicable to this threatened fauna species.
d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
The proposal would remove up to 2.5 ha of native vegetation within the project site, which represents potential habitat for this species. Extensive areas of native vegetation are present in the locality. The removal of disturbed vegetation from around the quarry would create new edges and may result in additional edge effects which may modify the vegetation along the new edge. Given the existing edge effects, these additional impacts are likely to be minor.
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action
Fragmentation from the existing quarry, existing roads, and residential areas is already present. The proposal comprises removal of vegetation from around the existing quarry. No areas of vegetation would become isolated as a result of the proposal, however the proposal would increase fragmentation in the locality to a small degree. The proposal would widen the gap between stands of vegetation. This would not prevent this highly mobile species from

Section 5A Assessment: Varied Sittella
travelling between foraging and roosting habitat. These additional gaps in the tree canopy are not likely to affect the viability of the local population of any of this species.
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,
Foraging habitat for Varied Sittellas is present in forested areas of the project site and it is likely that Varied Sittellas feed regularly in the project site, but would not depend solely on these foraging habitats. It is also possible that individuals could breed in the project site and in the surrounding areas. Large areas of better quality habitat are present in adjacent areas including within Berowra Valley National Park. Given the presence of large areas of intact forest habitat in surrounding areas, and that habitat to be removed within the project site is disturbed and already subject to edge effects, the habitat to be removed is not considered important for this species in the locality.
e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),
There is no critical habitat listed for this threatened species.
f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,
No recovery plan has been prepared for this species. A targeted strategy for managing this species has been developed under the Saving Our Species program. Relevant actions include: • Raise public awareness of the importance of large old trees and undertaking restoration and revegetation to replace cohorts of trees where they have been removed from the landscape, particularly in areas adjacent to and connecting woodland remnants • Encourage landholders to protect ground layer and midstorey vegetation • Target removal of weeds significantly compromising habitat values (e.g. invasive perennial grasses) and restore native vegetation • Undertake revegetation, using a diverse mix of locally appropriate native species, focussing on expanding areas of existing habitat, connecting isolated habitat patches or establishing additional habitat patches in landscapes with already existing, although insufficient, patches of suitable habitat. While the proposal would remove up to 2.50 ha of foraging habitat and potential nesting habitat for this species within the project site, the loss of this vegetation is not likely to interfere with the recovery of the species. The proposed revegetation works are consistent with the recovery actions.
g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.
The proposal would directly contribute to the operation of the following KTPs : • Clearing of native vegetation – the proposal would remove up to 2.50 ha of potential foraging and nesting habitat for this species (canopied eucalypt forest) within the project site. • Loss of dead wood and dead trees - dead wood and dead trees would be removed as a result of the proposal. The proposal has the potential to introduce or increase the operation of the following KTPs within potential habitat through soil disturbance and increased visitation to the area: • Infection of native plants by *Phytophthora cinnamomi*. • Invasion and spread of weeds. Native vegetation is already subject to weed invasion from previous land uses. The proposal is unlikely to influence the introduction or further spread of exotic species, given their dominance throughout the study area in the understorey of most occurrences of native vegetation. Mitigation measures to minimise indirect impacts would be included in the CEMP (see section 6.2).
Conclusion of Assessment of Significance
On consideration of the above criteria, the REF proposal is unlikely to have a significant effect on the Varied Sittella pursuant to s5A of the EP&A Act as: • Only 2.50 ha of foraging and nesting habitat for this species (canopied eucalypt forest) within the project site

Section 5A Assessment: Varied Sittella
• Large areas of habitat occur in the locality • No areas of habitat would become isolated. • Revegetation works would improve habitat for this species in the long-term.

Hollow-dependent bats

The Greater Broad-nosed Bat inhabits tall, wet forests and roosts in hollow trunks of eucalypts, and occasionally in caves and buildings. It inhabits tall wet forests with a dense understorey. The species prefers continuous forest, and is generally absent from small patches of remnant forest (Churchill, 2008).

The Eastern Freetail Bat roosts in tree hollows (generally spouts of large mature trees). They have also been recorded roosting in buildings and under exfoliating bark. This species occurs in dry forests and woodlands where it shows a preference for foraging in open spaces in these habitats, as well as over waterways (Churchill, 2008).

The Yellow-bellied Sheathtail-bat roosts singly or in small group, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. This species forages in most habitats across its very wide range, with and without trees. It forages above the canopy, or lower in more open country (OEH 2016b).

Hollow-dependent bats are likely to require multiple roost trees, generally in close proximity. Roost sites used on consecutive nights are typically within a few hundred metres of one another (Parnaby and Hamilton-Smith, 2004).

Section 5A Assessment: Hollow-dependant bats
a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction
The Eastern Freetail Bat, Greater Broad-nosed Bat and Yellow-bellied Sheathtail Bat may forage in forest patches in the study area, as well as in more open areas. Many of the threatened microbats rely on large areas intact vegetation for foraging. Large areas of better quality habitat are present in adjacent areas including within Berowra Valley National Park. The proposal would remove a negligible area of foraging habitat for these species. The proposal would remove up to five hollow bearing trees within the project site. These occur near the existing quarry and have been subject to high levels or disturbance, potentially making them less suitable for these species. The proposal would not prevent these highly mobile species from travelling between foraging and roosting habitat. Given the mobility of the species, the negligible impact on potential foraging habitat, the proposal is unlikely to have an adverse effect on the life cycle of these species such that a viable local population of these species is likely to be placed at risk of extinction.
b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction
Not relevant to these threatened species.
c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction**
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Not relevant to these threatened species.
d) in relation to the habitat of a threatened species, population or ecological community:

Section 5A Assessment: Hollow-dependant bats
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed
The proposal would remove up to 5.89 ha of vegetation and five hollow-bearing trees within the project site. Extensive areas of native vegetation containing hollow-bearing trees are present in the locality. The removal of disturbed vegetation from around the quarry would create new edges and may result in additional edge effects which may modify the vegetation along the new edge. Given the existing edge effects, these additional impacts are likely to be minor.
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action
Fragmentation from the existing quarry, existing roads, and residential areas is already present. The proposal comprises removal of vegetation from around the existing quarry. No areas of vegetation would become isolated as a result of the proposal, however the proposal would increase fragmentation in the locality to a small degree. The proposal would widen the gap between stands of vegetation. This would not prevent this highly mobile species from travelling between foraging and roosting habitat. These additional gaps in the tree canopy are not likely to affect the viability of the local population of any of these bat species.
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,
Foraging habitat for many microbat species is present in forested areas (and cleared areas) of the project site and it is likely that they would feed regularly in the project site, but would not depend solely on these foraging habitats. It is also possible that microbats could roost and breed in hollows in the project site and in the surrounding areas. Large areas of better quality habitat are present in adjacent areas including within Berowra National Park. Given the presence of large areas of intact forest habitat in surrounding areas, and that habitat to be removed within the project site is already highly modified, the habitat to be removed is not considered important for these species in the locality.
e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)
There is no critical habitat listed for these threatened species.
f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan
There are no recovery plans for any of these microbat species. Recovery strategies have been developed for microbat species under the Save our Species program (OEH 2018b). Relevant strategies include: • Promote strategies for retaining hollow-bearing trees in the landscape • Bush regeneration including the removal of weeds in habitat patches. • Protection and restoration of riparian habitat. While the proposal would remove potential habitat for microbat species including hollow-bearing trees within the project site, the loss of a very small area of highly disturbed potential habitat is not likely to interfere with the recovery of these specie. Mitigation measures have been proposed to minimise impacts on fauna habitat. These include retention of hollow-bearing trees where possible and removal and control of weeds.
g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process
The REF proposal would result in the operation of the following KTPs: • Clearing of native vegetation – up to 5.89 ha of vegetation would be removed within the project site. • Loss of hollow-bearing trees – up to five hollow-bearing trees would be removed within the project site. • Loss of dead wood and dead trees – the proposal is likely to remove dead wood and dead trees. Mitigation measures to minimise direct impacts on fauna habitat would be included in the CEMP (see section 6.2). The proposal has the potential to introduce or increase the operation of the following KTPs within this community through soil disturbance and increased visitation to the area: • Infection of native plants by *Phytophthora cinnamomi*. • Invasion and establishment of weeds.

Section 5A Assessment: Hollow-dependant bats
Native vegetation is already subject to weed invasion. The proposal is unlikely to influence the introduction or further spread of exotic species, given their dominance throughout the study area in the understorey of most occurrences of native vegetation. Mitigation measures to minimise indirect impacts would be included in the CEMP (see section 6.2).
Conclusion of Assessment of Significance
The REF proposal is highly unlikely to result in a significant impact on any hollow-dependent microbat species pursuant to s.5A of the EP&A Act given: • Up to 5.89 ha of vegetation that represents potential foraging habitat for these species would be removed within the project site • Up to five hollow-bearing trees would be removed within the project site. • Large areas of habitat including many hollow-bearing trees occur in the locality • No areas of habitat would become isolated • Indirect impacts would occur along already modified and disturbed edges.

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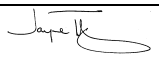
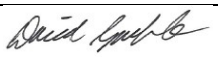
		Name	Signature	Name	Signature	Date
0	K. Crosby	J. Tipping		D. Gamble		22/11/2018
1	K. Crosby	J. Tipping		D. Gamble		18/12/2018

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